Original Article

Effect of motivational interviewing on self-management in patients with type 2 diabetes mellitus: A meta-analysis

Dan Song a, Tu-Zhen Xu b, Qiu-Hua Sun a,*

a School of Nursing, Zhejiang Chinese Medical University, Hangzhou, China
b Nursing Department, The Second Affiliated Hospital of Zhejiang Chinese Medical University, Hangzhou, China

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Abstract

Objective: The objective of this meta-analysis was to evaluate the effect of motivational interviewing (MI) on self-management in patients with type 2 diabetes.

Methods: Randomised controlled trials that assessed the effects of MI on self-management and HbA1c levels in patients with type 2 diabetes were systematically reviewed using multiple electronic databases. Weighted mean differences with 95% confidence intervals were calculated for continuous data.

Results: Ten trials were included in this meta-analysis. The self-management ability of patients with type 2 diabetes who underwent MI was significantly better than that of patients in the control group (WMD, 2.37; 95% CI, 1.77–2.98; p < 0.00001). Subgroup analysis showed that short-term MI (<6 months) resulted in a significant decrease in the HbA1c level (p < 0.05) but that this advantage was not present for relatively long-term MI (>6 months) (p > 0.05).

Conclusions: MI was associated with improved self-management abilities among patients with type 2 diabetes, and short-term MI (<6 months) effectively decreased the HbA1c level. The effect of long-term MI (>6 months) on the HbA1c level remains uncertain. Large-scale, higher-quality randomised controlled trials are needed to confirm the present findings.

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1. Introduction

The prevalence of type 2 diabetes is rapidly increasing due to population ageing and lifestyle changes [1]. Self-management is the basis for treatment of type 2 diabetes and is critical in the prevention of complications. Nurse-led health education has been one of the most important methods of helping these patients to strengthen their self-management abilities [2]. However, a previous study showed that health education programmes that provide traditional advice have a success rate of only 5%–10% [3]. Therefore, effective new approaches to helping patients improve their self-management abilities are urgently needed. Motivational interviewing (MI) is a patient-centred behaviour-changing strategy that aims to identify and reduce patient ambivalence regarding health behaviour changes and improve patients’ perceptions of the importance of behaviour changes [4,5]. MI is valuable in the
treatment of addictions and other chronic medical conditions, including type 2 diabetes [6]. Recent studies have shown that MI can contribute to improvements in self-management abilities in patients with type 2 diabetes [7,8]. However, many professionals remain concerned about the applicability of these results because of the great variation in interventional designs and questionable evaluation indices. Therefore, we conducted the present meta-analysis to assess the effects of MI on the self-management ability of patients with type 2 diabetes and to provide evidence for the use of MI in nursing practice.

2. Design and method

2.1. Inclusion and exclusion criteria

2.1.1. Study type
Randomised controlled trials (RCTs) in both Chinese and English were eligible for inclusion in this meta-analysis.

2.1.2. Study objective
Patients with type 2 diabetes aged >18 years who were able to independently care for themselves were eligible for inclusion in this study. Patients with other severe medical conditions or complications such as stroke, malignant tumours, ketoacidosis, or critical diabetic nephropathy were excluded.

2.1.3. Study intervention
MI was provided to patients in the study group. Trained and qualified professionals acted as the interviewers. The intervention plan was formulated by the interviewer and generally comprised two steps. First, the patients were assisted in strengthening their internal motive for behaviour changes. Second, the patients were assisted in consolidating their commitment to and carrying out the plan for these behaviour changes. Self-management–related knowledge was introduced to the patients in the control group using traditional health education methods, such as collective classes.

2.1.4. Outcome measures
The primary outcomes were the HbA1c level (%) and the self-management ability. The measurement tools used to evaluate the self-management ability included the Summary of Diabetes Self-Care Activities (SDSCA) and the Type 2 Diabetes Self-Care Scale (2-DSCS).

2.2. Search strategy

Medline, PubMed, JBI Library, CINAHL, EMBASE, the Cochrane Library, CNKI, VIP, Wanfang, Google, and Google Scholar were electronically searched up to January 2014 using combinations of the following search terms: “diabetes,” “motivational interviewing,” “self-care,” “self-management,” and “behavior change.” The titles, abstracts, and reference lists of all identified reports were independently examined by D.S. and T-Z X.. Disagreements were resolved by discussion or consensus with Q-H. S..

2.3. Assessment of methodological quality

The methodological quality of all RCTs was graded with the Cochrane Handbook, version 5.1.0, which assesses studies according to the method of randomisation, adequacy of allocation concealment, blinding of outcome assessment, proportion of patients lost to follow-up, performance of intention-to-treat analysis, and comparability of baseline data. The risk of bias in each RCT was graded from A to C, where A, B, and C indicated low, medium, and high risk, respectively. All disagreements were resolved by discussion.

2.4. Data extraction

We independently extracted data from all studies using standardised forms. These data included the study design, sample size, type of procedure, numbers and reasons for withdrawals and dropouts, and all aforementioned outcome variables. All disagreements regarding values or analysis were resolved by discussion.

2.5. Statistical analysis

This meta-analysis was conducted using RevMan 5.2.0 software (Cochrane Collaboration, Oxford, UK). Data were evaluated by means of weighted mean differences (WMDs) and 95% confidence intervals (CIs). Heterogeneity was explored by the I² test. If $I^2 < 50\%$, a fixed-effects model was employed; otherwise, a random-effects model was used. Subgroup analysis was performed according to the heterogeneous factors considered. A narrative overview was conducted when synthesis was inappropriate.

3. Results

3.1. Study selection

The initial search strategy generated 427 studies. After screening all titles and abstracts, we identified 23 potentially eligible trials. On further assessment, 13 trials were excluded because they either did not meet the inclusion criteria or met the exclusion criteria. Finally, 10 trials [7–16] involving 2947 patients were included in this meta-analysis. The details of the included trials are summarised in Table 1.

3.2. Methodological quality

The results of the methodological quality assessment of all included trials are shown in Table 2.

3.3. Primary outcomes

3.3.1. Effects of MI on HbA1c level

All 10 trials [7–16] reported assessment of the effects of MI on the HbA1c level. One trial [15] was excluded because it did not mention the intervention time. A subgroup analysis was performed according to the intervention period (3, 6, 12, 14, 18, or 24 months). The heterogeneity test result revealed an $I^2$ of >50%; thus, a random-effects model was used.
### Table 1 – Characteristics of studies included in the present meta-analysis.

<table>
<thead>
<tr>
<th>Study</th>
<th>Participants, n (intervention/control)</th>
<th>Period</th>
<th>Intervention</th>
<th>Control</th>
<th>Time of assessment</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>West 2007 [7]</td>
<td>217 (109/108)</td>
<td>18 months</td>
<td>Frequency: 5 MI sessions, 45 min/session Interviewer: trained psychologist</td>
<td>Traditional diabetes health education</td>
<td>6, 12, and 18 months of intervention</td>
<td>HbA1c</td>
</tr>
<tr>
<td>Welch 2011 [8]</td>
<td>115 (57/58)</td>
<td>6 months</td>
<td>Frequency: 3 MI sessions, 30 min/session Interviewer: trained nursing staff</td>
<td>Traditional diabetes health education</td>
<td>End of intervention</td>
<td>HbA1c</td>
</tr>
<tr>
<td>Gabbay 2013 [9]</td>
<td>545 (232/313)</td>
<td>18 months</td>
<td>Frequency: 8 MI sessions, 1 h/session Interviewer: trained nursing staff</td>
<td>Traditional diabetes health education</td>
<td>12 and 24 months of intervention</td>
<td>HbA1c</td>
</tr>
<tr>
<td>Rubak 2011 [10]</td>
<td>628 (307/321)</td>
<td>12 months</td>
<td>Frequency: 3 MI sessions, 45 min/session Interviewer: trained nursing staff</td>
<td>Traditional diabetes health education</td>
<td>End of intervention</td>
<td>HbA1c</td>
</tr>
<tr>
<td>Jansink 2013 [12]</td>
<td>940 (422/518)</td>
<td>14 months</td>
<td>Frequency: not mentioned Interviewer: trained nursing staff</td>
<td>Traditional diabetes health education</td>
<td>End of intervention</td>
<td>HbA1c</td>
</tr>
<tr>
<td>Zhang 2012 [13]</td>
<td>80 (40/40)</td>
<td>6 months</td>
<td>Frequent MI sessions in the first 2 months, 6 personal MI sessions in the next 3 months, 1 phone and 1 personal MI session in the last month; 30–45 min/session of personal MI, 10 min/session of phone MI Interviewer: trained nursing staff</td>
<td>Traditional diabetes health education</td>
<td>3 and 6 months of intervention</td>
<td>1. HbA1c 2. Self-management ability (2-DSCS)</td>
</tr>
<tr>
<td>Wang 2011 [14]</td>
<td>80 (40/40)</td>
<td>6 months</td>
<td>Frequency: 4 personal MI sessions in the first month, 5 phone MI and 5 personal MI sessions in the next 5 months; 30 min/session of personal MI, 20 min/session of phone MI Interviewer: trained nursing staff</td>
<td>Traditional diabetes health education</td>
<td>End of intervention</td>
<td>1. HbA1c 2. Self-management ability (2-DSCS)</td>
</tr>
<tr>
<td>Zou 2013 [16]</td>
<td>80 (40/40)</td>
<td>6 months</td>
<td>Frequency: 2–3 sessions of personal MI in hospital, 2 phone MI sessions after discharge; 30 min/session of personal MI, 20 min/session of phone MI Interviewer: trained nursing staff</td>
<td>Traditional diabetes health education</td>
<td>3 and 6 months of intervention</td>
<td>1. HbA1c 2. Self-management ability (SDSCA)</td>
</tr>
</tbody>
</table>

MI = motivational interviewing; 2-DSCS = Type 2 Diabetes Self-Care Scale; SDSCA = Summary of Diabetes Self-Care Activities.
3.3.1. Effect of 3 months of MI on HbA1c level. Two trials [13,16] assessed the effect of 3 months of MI on the HbA1c level. After 3 months of MI, the HbA1c level was significantly lower in the intervention group than in the control group (WMD, 0.10; 95% CI, −1.02 to −0.30; p = 0.0003) (Fig. 1).

3.3.1.2. Effect of 6 months of MI on HbA1c level. Six trials [7,8,11,13,14,16] assessed the effect of 6 months of MI on the HbA1c level. After 6 months of MI, the HbA1c level was significantly lower in the intervention group than in the control group (WMD, −0.44; 95% CI, −0.73 to −0.15; p = 0.003) (Fig. 1).

3.3.1.3. Effect of 12 months of MI on HbA1c level. Two trials [7,10] assessed the effect of 12 months of MI on the HbA1c level. After 12 months of MI, no significant difference in the reduction of the HbA1c level was observed between the intervention and control groups (WMD, 0.10; 95% CI, −0.04 to −0.23; p = 0.16) (Fig. 1).

3.3.1.4. Effect of 14 months of MI on HbA1c level. One trial [12] assessed the effect of 14 months of MI on the HbA1c level. After 14 months of MI, no significant difference in the reduction of the HbA1c level was observed between the intervention and control groups (WMD, −0.10; 95% CI, −0.25 to 0.05; p = 0.19) (Fig. 1).

3.3.1.5. Effect of 18 months of MI on HbA1c level. One trial [7] assessed the effect of 18 months of MI on the HbA1c level. After 18 months of MI, no significant difference in the reduction of the HbA1c level was observed between the two groups (WMD, 0.00; 95% CI, −0.28 to 0.28; p = 1.00) (Fig. 1).

3.3.1.6. Effect of 24 months of MI on HbA1c level. One trial [9] assessed the effect of 24 months of MI on the HbA1c level. After 24 months of MI, no significant difference in the reduction of the HbA1c level was observed between the intervention and control groups (WMD, −0.20; 95% CI, 0.50, 0.10; p = 0.19) (Fig. 1).

3.3.2. Effect of MI on self-management ability

Four trials [13–16] assessed the effect of MI on patients’ self-management ability, which comprises six aspects: control of diet, regular exercise, adherence to medications, glucose monitoring, foot care, and prevention and treatment of hyperglycaemia and hypoglycaemia. One study [16] performed measurements using the SDSCA, developed by Toobert et al. [17]; the other three studies [13–15] performed measurements using the 2-DSCS. Therefore, a meta-analysis was performed for these three trials, and the other one was described separately. The heterogeneity test result showed an I² of >50%; thus, a random-effects model was employed. According to the results, the MI intervention resulted in a significantly greater improvement in all aspects of the self-management ability in the intervention group than in the control group (WMD, 2.37; 95% CI, 1.77–2.98; p < 0.00001) with the exception of adherence to medications (WMD, 1.53; 95% CI, −0.1 to 3.16; p = 0.07) (Fig. 2). Likewise, the one study [16] that performed measurements using the SDSCA reported that 3 and 6 months of MI significantly improved all six aspects of patients’ self-management ability (p < 0.05).

4. Discussion

4.1. Methodological quality

The 10 studies included in this meta-analysis varied in research quality; only three [7,9,11] were considered to be high-quality studies. This result was caused by a lack of preciseness in the research design: one trial [12] did not describe the randomisation method, and one trial [12] did not report the number of patients lost to follow-up. The three high-quality trials [7,9,11] adopted blinding, allocation concealment, and intention-to-treat analysis.

4.2. Short-term MI can reduce the HbA1c level

The findings of the present meta-analysis indicate that short-term MI (<6 months) more effectively reduced the HbA1c level than did the control interventions; however, this advantage disappeared with relatively longer-term MI (12–24 months). Two possible reasons for these findings may be considered. First, as found by a previous study [18], the positive effects of diabetes education may gradually weaken with time. Second, a limited number of studies were included in this meta-analysis, and most did not last more than 1 year; thus, only a few studies were included in the combined analysis.

Table 2 – Evaluation of the methodological quality of included studies included.

<table>
<thead>
<tr>
<th>Study</th>
<th>Random effect</th>
<th>Blinding</th>
<th>Allocation concealment</th>
<th>Dropout and loss</th>
<th>Intention-to-treat analysis</th>
<th>Baseline</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>West 2007 [7]</td>
<td>Random number table</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No difference</td>
<td>A</td>
</tr>
<tr>
<td>Welch 2011 [8]</td>
<td>Random number table</td>
<td>Not clear</td>
<td>Not clear</td>
<td>Yes</td>
<td>No</td>
<td>No difference</td>
<td>B</td>
</tr>
<tr>
<td>Gabbay 2013 [9]</td>
<td>Random number table</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No difference</td>
<td>A</td>
</tr>
<tr>
<td>Rubak 2011 [10]</td>
<td>Random number table</td>
<td>Not clear</td>
<td>Not clear</td>
<td>Yes</td>
<td>No</td>
<td>No difference</td>
<td>B</td>
</tr>
<tr>
<td>Brug 2007 [11]</td>
<td>Random number table</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No difference</td>
<td>A</td>
</tr>
<tr>
<td>Jansink 2013 [12]</td>
<td>Mentioned, not described</td>
<td>Not clear</td>
<td>Not clear</td>
<td>No</td>
<td>No</td>
<td>No difference</td>
<td>B</td>
</tr>
<tr>
<td>Zhang 2012 [13]</td>
<td>Random number table</td>
<td>Not clear</td>
<td>Not clear</td>
<td>No</td>
<td>No</td>
<td>No difference</td>
<td>B</td>
</tr>
<tr>
<td>Wang 2011 [14]</td>
<td>Random number table</td>
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<td>Not clear</td>
<td>No</td>
<td>No</td>
<td>No difference</td>
<td>B</td>
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<tr>
<td>Ye 2012 [15]</td>
<td>Random number table</td>
<td>Not clear</td>
<td>Not clear</td>
<td>No</td>
<td>No</td>
<td>No difference</td>
<td>B</td>
</tr>
<tr>
<td>Zou 2013 [16]</td>
<td>Random number table</td>
<td>Not clear</td>
<td>Not clear</td>
<td>No</td>
<td>No</td>
<td>No difference</td>
<td>B</td>
</tr>
</tbody>
</table>
4.3. MI can improve self-management ability

The present study assessed six aspects of the self-management ability among patients with type 2 diabetes: diet control, regular exercise, adherence to medications, glucose monitoring, foot care, and prevention and treatment of hyperglycaemia and hypoglycaemia. Compared with the control group, MI resulted in a significantly greater improvement in the patients’ level of self-management ability in all aspects with the exception of adherence to medication. We separately evaluated the three studies [13–15] that assessed all six aspects of self-management ability. In two of these studies [13,14], MI resulted in a significantly greater improvement in adherence to medication in the MI group than in the control group (p < 0.05); the remaining study [15] showed no difference between the two groups. One study [16] that performed measurements using the SDSCA but that was not included in the meta-analysis also indicated that MI can significantly improve patients’ adherence to medications (p < 0.05). Therefore, the effects of MI on adherence to medications require confirmation by additional high-quality studies.

4.4. Limitations

Only reports written in English and Chinese were included because of language limitations. Additionally, a relatively
inadequate number of studies was included for each different index because of the variation in the evaluation indices and measurement tools used among the studies. However, the measurement tools of the included studies exhibited high reliability and fair validity, and the sample of the combined analysis was very large (n = 2947); both of these factors contributed to the reliability and accuracy of our study.

### 4.5. Implications for Further Study

The results of the present study indicate that MI is superior to traditional interventions in improving the self-management abilities of patients with type 2 diabetes. The study also showed that short-term MI (≤6 months) is more effective than control interventions for reduction of the HbA1c level, but that...
the effect of relatively longer-term MI (>6 months) on reduction of the HbA1c level requires further research. High-quality RCTs with large samples are required to increase the evidence in support of the advantages of MI. The intervention period is relatively short in previous studies on this subject and should be lengthened in future studies. Such longitudinal studies will allow the effects of MI at different intervention phases to be studied in more detail. Finally, although qualitative materials are very important in nursing research, very few such studies were found on this subject. Qualitative studies are needed to ascertain the benefits of MI over traditional intervention and provide higher-quality study content with more accurate results.

Conflict of interest

The authors declare that they have no conflicts of interest.

REFERENCES