

Effects of Motivational Interviewing on Adherence to Treatment Regimens Among Patients With Type 1 Diabetes: A Systematic Review

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■ ABSTRACT

Background. Motivational interviewing (MI) is a strategy for promoting adherence to treatment regimens among patients with diabetes. However, limited evidence exists regarding its effectiveness in reducing A1C.

Objective. To identify and synthesize evidence about the effectiveness of patient, provider, and health system interventions to improve diabetes care among patients with type 1 diabetes.

Design. This was a systematic review of randomized controlled trials.

Methods. A search was conducted of the scientific databases MEDLINE, Elsevier, CINAHL, Google Scholar, ProQuest, Ovid, and PubMed without imposing any time limit. Only four documents met the inclusion criteria and were included in the final analysis. The methodological quality of these four articles was reviewed by three reviewers using the Jadad Scale. The main intervention and the primary outcome in this study were MI or motivational enhancement therapy and A1C, respectively.

Results. The retrieved studies reported that MI promotes self-monitoring of blood glucose and reduces A1C.

Conclusion. MI is effective in enhancing patients' adherence to the treatment regimen and thereby decreasing A1C. Given the fact that the reviewed studies had not eliminated the effects of confounding factors, further studies are needed to assess the pure effects of MI on adherence to treatment regimens and A1C levels.

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<https://doi.org/10.2337/ds18-0038>

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Type 1 diabetes is a metabolic disorder caused by inadequate production of insulin in the body. Accordingly, patients with this disorder need daily insulin injections. Despite considerable scientific advances, the etiology of this disorder remains unknown (1). Epidemiological studies have demonstrated that the prevalence of type 1 diabetes has increased by 2–5% worldwide (2). In the United States, the prevalence of type 1 diabetes has been reported to be 1 per 300 Americans >18 years of age (1). The incidence of this disorder in our country, Iran, was 0.7 cases per 100,000 Iranians in 2010 (3).

Uncontrolled type 1 diabetes is associated with microvascular and macrovascular complications such as cardiovascular diseases, neuropathy, nephropathy, and retinopathy (4). Accordingly, rapid and proper management of diabetes is essential to the prevention of these complications. The primary aims of diabetes management are optimal blood glucose control and prevention of diabetes-associated complications (5). Poor blood glucose control and nonadherence to treatment regimens can cause diabetes-associated complications, reduce patients' quality of life (1), and increase health care costs (6).

Many pharmacological therapies and nonpharmacological techniques have been developed for preventing the complications of diabetes, the latter of which include regular physical exercise, dietary regimens, stress management, smoking cessation, and motivational interviewing (MI). However, the effectiveness of these techniques and the success of diabetes management strategies depend largely on their accordance with patients' preferences and values, as well as patients' adherence to them (7–9). The process of diabetes management is lengthy and laborious, and, hence, patients have low motivation for adhering to their prescribed dietary and treatment regimens (5). Accordingly, they need to be supported and motivated throughout the process of treatment.

MI is one nonpharmacological strategy for diabetes management and, particularly, for motivating patients to closely adhere to prescribed regimens (10). MI helps patients accept their disease, modify their lifestyle, correct their misconceptions, and overcome psychological problems such as depression (11–14). MI interventionists are generally trained as health psychologists. The MI interviewing intervention uses a “menu of strategies” approach (15), eliciting patient views and then exploring discrepancies between beliefs and behavior.

Although no two MI sessions will be the same because they are patient driven, they are likely to include the following aspects. The clinician's role is to help patients articulate their simultaneously held but conflicting beliefs about behavioral change. In making decisions about changing behavior, individuals weigh the benefits of making a change against the personal costs, which may be social, emotional, or financial; their ambivalence about making the change reflects the balance of the benefits and costs. The clinician's role is to elicit benefits and costs and increase patients' awareness of them. Once patients are more aware of the costs

and benefits of their behaviors, alternatives to their current behaviors can be considered. Having identified alternative behaviors, the costs and benefits of the alternative options are then discussed. The choice of which alternative behavior to adopt rests with the patient. Once an alternative behavior has been selected, the clinician and patient set a goal that is realistic and achievable in the time between appointments.

One of the central tenets of MI is avoidance of confrontation to reduce resistance and argumentation (16). Instead, the conversational style is one of eliciting by asking open-ended questions to encourage participants to articulate their concerns and goals.

Previous studies have shown that MI has positive effects on adherence to treatment regimens among adolescents with type 1 diabetes (16). However, considerable controversies exist concerning the effectiveness of MI and motivational enhancement therapies (METs) in decreasing A1C. Previous studies in this area differ from each other in terms of sampling method, length of intervention, and follow-up care. Accordingly, this systematic review study was conducted to provide clear evidence regarding the effects of MI on adherence to treatment regimens among patients with type 1 diabetes.

Methods

The Preferred Reporting Items for Systematic Reviews (PRISMA) guidelines were used to standardize the conduct and reporting of the research.

Data Collection

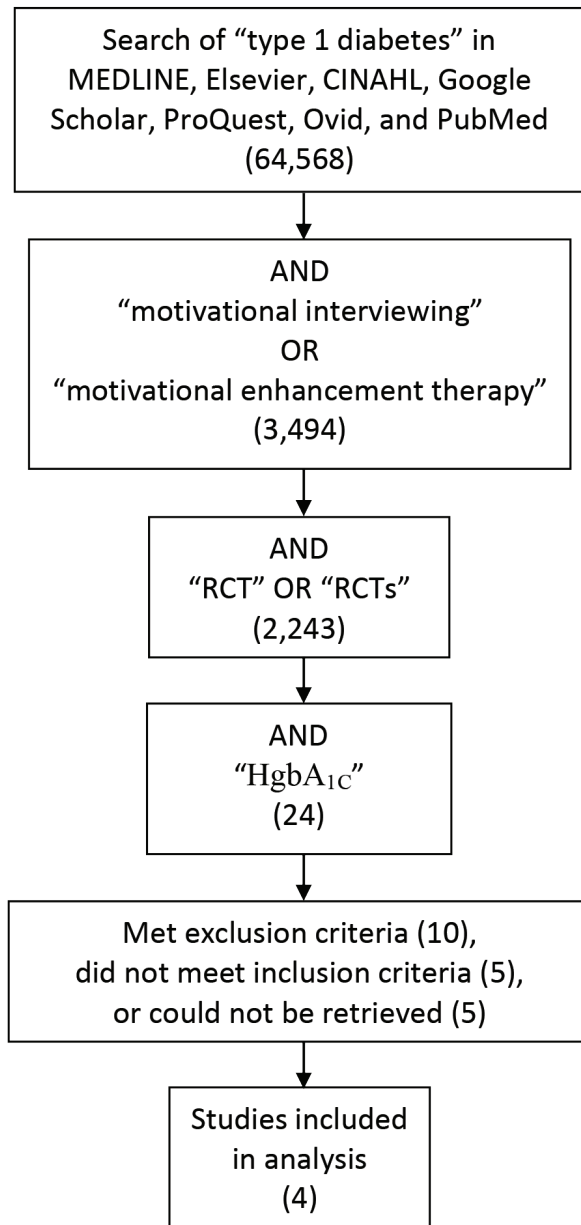
We searched the online scientific databases MEDLINE, Elsevier, CINAHL, Google Scholar, ProQuest, Ovid, and PubMed. Moreover, a paper-based search was performed simultaneously on accessible library records. No time limit was defined. The initial search term “type 1 diabetes” produced 64,568 articles. After limiting the search protocol by using additional search terms such as “motivational interviewing” and “motivational en-

hancement therapy,” and “randomized controlled trial,” the number of documents was decreased to 2,243. Then the term “HgbA1c” was added, and the total number of articles decreased to 24, which were then anonymized and given to three independent reviewers to be evaluated. Inclusion criteria were that the articles had to have been published in English and had to address the effects of MI on adherence to treatment regimens among patients with type 1 diabetes. Articles were excluded if they dealt with investigating the effects of MI on other parameters or other patient populations, focused on A1C assessment in patients with either type 1 or type 2 diabetes without differentiating between them, or had a score of <3 on the Jadad Scale, a valid tool for evaluating the methodological quality of randomized, controlled trials (RCTs) (17). The three reviewers separately evaluated the documents using the Jadad Scale, which rates RCTs based on randomization, blinding, and dropout rate. The maximum possible Jadad score is 5. Only articles that had a Jadad score of ≥ 3 were included. Of the 24 articles, 10 were rejected for meeting exclusion criteria, 5 were rejected for not meeting inclusion criteria, and 5 could not be retrieved; thus, only 4 articles were included in the final analysis (Figure 1).

A data sheet was developed for retrieving the relevant information from these four articles. The data sheet included details about the type of study, sample size, mean age of participants, main and follow-up interventions, and primary outcomes. The main intervention was either MI or MET, both of which are defined as treatment techniques for enhancing individuals' motivation or readiness to modify their behavior (12,18,19). The main outcome was A1C. Table 1 summarizes the data extracted from the analyzed studies.

Ethical Considerations

This project was registered at the Nursing and Midwifery Care Research Center of Tehran University



■ FIGURE 1. Flow diagram of literature search.

of Medical Sciences, registration number of 25353. Rules regarding ethical issues (including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancy) were fully followed by the authors.

Results

The four studies included in the analysis are described in the paragraphs below.

In 2003, Channon et al. (18) conducted a pilot study in the United Kingdom to investigate the effects of MI as a behavior-change counseling approach to blood glucose control, well-being, and self-care among adolescents with type 1 diabetes. They found a significant decrease in A1C from 10.8 to 9.7% after the intervention. In addition, they found that their intervention alleviated adolescents' fear of developing hypo-

glycemia ($P = 0.03$) and made living with diabetes easier for them ($P = 0.03$). Their findings also showed that MI could be useful in helping adolescents monitor their blood glucose more effectively. Most of the participating adolescents reported that they experienced at least one change in their self-care behavior during the course of the study.

After completing their pilot study, Channon et al. designed and conducted an RCT, which they reported in 2007 (19). The results of this study revealed that, after 12 and 24 months, mean A1C in the experimental group ($8.7 \pm 1.84\%$ and $8.7 \pm 1.88\%$, respectively) were significantly lower than in the control group ($9.2 \pm 1.78\%$ and $9.1 \pm 1.51\%$, respectively; $P = 0.04$ and $P = 0.003$, respectively).

The third study was a three-group RCT conducted by Ismail et al. and reported in 2008 (20) on 344 adult patients who had had type 1 diabetes for at least 2 years. Before implementing the intervention, participants' A1C ranged from 8.2 to 15.0%, and patients had not developed any diabetes-related complications. Patients in the first experimental group received a four-session nurse-implemented MET program over 2 months, and those in the second experimental group received both cognitive behavior therapy (CBT) and MET, which were delivered in 12 sessions over 6 months. Patients in the control group were treated with routine care, which did not include CBT or MET. Twelve months after the intervention ended, A1C levels were re-tested, and the A1C levels of the two experimental groups differed significantly from each other ($P = 0.01$) so that A1C levels in the group that received both MET and CBT were significantly less than in the group that received only MET and also than the control group ($P < 0.05$).

The final study was a 2013 pilot study by Stanger et al. (21), involving 17 adolescents with type 1 diabetes who were 12–17 years of age. The adolescents and their parents received a multicomponent intervention con-

TABLE 1. Characteristics of Studies Included in the Analysis

First Author (Year)	Study Design	Population (Sample Size)	Interventions	Follow-Up, months	Outcomes
Channon et al. (2003) (18)	Pilot study RCT	Individuals ages 14–18 years ($n = 22$)	The initial training in MI for researchers took place over a 3-month period using a combination of workshop, training videos, role play, and individual supervision	6	Mean A1C decreased from 10.8 to 9.7%
Channon et al. (2007) (19)	RCT	Individuals ages 14–17 years (total $n = 66$; intervention group $n = 38$; control group $n = 28$)	MI, through which patients' views were elicited and discrepancies between beliefs and behavior were explored	12–24	At the end of the intervention (12 months), the mean A1C in the MI group was significantly lower than in the control group ($P = 0.04$), after adjusting for baseline values. At 24 months (when $n = 47$), this difference in A1C was maintained ($P = 0.003$).
Ismail et al. (2008) (20)	RCT	Adults ($n = 344$)	Four sessions of MET over 2 months; 12 sessions of MET plus CBT over 6 months	12	The mean 12-month A1C was 0.45% lower in those treated with MET plus CBT than for those receiving usual care; 0.16% lower in those treated with MET than for those receiving usual care; and 0.30% lower with MET plus CBT than with MET alone.
Stanger et al. (2013) (21)	Pilot study	Individuals ages 12–17 years ($n = 17$)	14 weeks of MI and CBT, clinic-based CM, and parent-directed CM targeting increased blood glucose monitoring	3	A1C was significantly lower at the end of treatment compared with before treatment (before-treatment least square mean [LSM] 11.62% [95% CI 10.75–12.48%]; post-treatment LSM 9.11% [95% CI 8.25–9.98%]; $t(29) = 5.15$, adjusted $P < 0.0001$, $d_{rm} = 1.25$).

sisting of MI, CBT, parent-directed contingency management (CM), and clinic-based CM over 14 weeks. MI and CBT included education about self-care behaviors, the basics of establishing effective communications, and the antecedents and consequences of poor blood glucose control, as well as problem-solving, mood control, and anger management skills. This education was provided through interviews. CM consisted of education to reinforce adolescents' glucose monitoring behavior to gradually increase the number of glucose monitoring tests to 6 times/day, 5 days/week. Parent-directed CM included parental support to reinforce adolescents' glucose monitoring behavior. In addition to offering support, the parents were educated and required to

directly supervise their adolescents' glucose monitoring behavior. The aim of all these interventions was to promote better blood glucose control among the adolescents. The findings revealed that the number of glucose monitoring tests increased significantly from 4 to 6 times/day ($P < 0.001$). Moreover, the adolescents' mean A1C decreased significantly from 11.6 to 9.11% ($P < 0.0001$).

Discussion

Four RCTs met the inclusion criteria and were included in our analysis. All four investigated the effects of MI or MET on A1C among patients with type 1 diabetes, and all of their findings indicated the effectiveness of MI or MET in reducing A1C. However, these four studies differed significant-

ly from each other with regard to the degree to which their interventions changed A1C. Given the heterogeneity of the types and the lengths of the interventions, we did not perform statistical analysis on the differences among these studies.

Channon et al. (18) noted that their findings need to be interpreted cautiously because their study was a short-term, small-scale, uncontrolled pilot experiment. Accordingly, the experimental group was not compared to a control group or a placebo condition. In this study, a slight change in adolescents' self-care behaviors significantly reduced A1C. Given the small sample size of this study, however, controlling for adolescents' psychological stress, psychosocial status, and

treatment regimens was not possible. Moreover, the instrument used to measure adolescents' self-care activities might have not been sensitive enough to detect probable behavioral changes. Accordingly, if the researchers had employed a more sensitive instrument and evaluated the behavioral outcomes of MI in shorter time intervals, they might have acquired different results.

In their second study (19), Channon et al. matched the two groups with regard to demographic characteristics such as age, duration of diabetes, ethnicity, sex, and socioeconomic status. Although they tried to match demographic variables, the observed outcomes could have been the result of not only the intervention, but also the effects of the researchers. Most dropouts (10 from the experimental group and 4 from the control group) occurred in the first 6 months of the intervention. However, the two groups did not differ significantly with regard to the total number of dropouts ($P = 0.24$), indicating that the characteristics of the groups remained unchanged after the dropouts.

The findings of this study revealed that MI can facilitate behavior change, promote blood glucose control, and improve mental health and quality of life among adolescents with type 1 diabetes. Because of the long-term course of the intervention (24 months), the results of this study are more reliable. However, the findings may have been affected not only by MI, but also by changes in adolescents' behaviors and self-care practices. Moreover, adolescents' insulin regimens, which might have affected their A1C, were not evaluated.

The results of the second study by Channon et al. (19) showed an increase, albeit a statistically nonsignificant one, in A1C in the control group during the first 6 months, with a return to baseline A1C levels after 1 year. The mean A1C concentrations between the two groups were signifi-

cantly different ($F = 4.276$, $P = 0.04$) at the end of the year-long interventions, after adjusting for baseline. A possible explanation for this increase is a seasonal effect given that this data period coincided with winter, when glycemic control is known to deteriorate in children, presumably because of decreased levels of physical activity. Changes in certain psychological variables such as well-being, quality of life, and personal models of illness as secondary outcomes were found between groups after 12 months (all $P < 0.001$). Changes on key psychosocial measures were related to improvements in A1C. Although cause and effect cannot be assumed, if psychological factors were to affect A1C, it might be anticipated that such psychological changes would precede changes in self-care, which consequently led to changes in A1C. Our analysis suggests that MI might highlight concerns but also facilitate patients' perception that they have the capacity to make changes, which in turn could lead to reductions in A1C. The MI method incorporates the principle of "deploying discrepancy," which means contrasting through empathic listening the patients' core values and personal aspirations with the behavioral problem under discussion. It is hypothesized that this experience of discrepancy could trigger the motivation to change behavior.

In the third study, conducted by Ismail et al. (20), a nurse-implemented MET program facilitated improved control of serum glucose and A1C. Moreover, the authors reported that their MET program exerted more powerful effects on blood glucose and A1C when combined with CBT.

The fourth study, by Stanger et al. (21), was also a pilot without a control group. Six months after the end of the intervention, there was no significant difference in A1C between teens receiving the intervention and those getting usual care. Despite the limited change in A1C, the intervention condition showed significant reductions in hospitalization for ketoacidosis,

although the confounding effects of variables such as age, sex, ethnicity, socioeconomic status, and baseline A1C were not evaluated or removed.

A1C values should be obtained using the same measure. However, because this pilot study relied on clinical testing, this was not possible for all tests; for 4 of 48 tests, a laboratory blood test was used instead. In addition, the intervention was intensive, requiring weekly clinic visits over an extended period of time. Finally, A1C did not reach the American Diabetes Association target, and it will be important to demonstrate maintenance of positive effects over time.

Conclusion

This systematic review adds to the evidence regarding the effectiveness of interventions that target people with type 1 diabetes in community settings. Study findings suggest that MI is effective in promoting adherence to treatment regimens and decreasing A1C among patients with type 1 diabetes. Moreover, it can facilitate the modification of self-care and self-management behaviors among adolescents with the disease.

This evidence shows the positive effects of psychosocial interventions such as MI. It is noteworthy that the reviewed studies did not take into account factors such as patients' mood, psychological state, treatment regimen, support system, and stress levels that could have confounding effects on A1C. Accordingly, further studies are needed to assess the pure effects of MI on adherence to treatment regimens and A1C. A meta-analysis of individual patient data may answer further questions that could not be addressed in this review.

Funding

The preparation of this article was supported in part by a grant from the Tehran University of Medical Sciences in Tehran, Iran.

Duality of Interest

No potential conflicts of interest relevant to this article were reported.

Author Contributions

N.D.-N. contributed to discussion and reviewed/edited the manuscript. F.G. wrote the manuscript and researched data. T.S. researched data. N.M. researched data and contributed to discussion. F.G. is the guarantor of this work and, as such, had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

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