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Motivational Interviewing Delivered by Diabetes Educators: Does It Improve Blood Glucose Control Among Poorly Controlled Type 2 Diabetes Patients?

Garry Welch, PhD,

Department of Behavioral Medicine Research, Baystate Medical Center, 140 High Street, Room 2104, Springfield, MA 01105; Phone: (413) 794-2012; Fax: (413) 794-3890

Sofija E. Zagarins, PhD,

Department of Behavioral Medicine Research, Baystate Medical Center, 140 High Street, Room 298, Springfield, MA 01105

Rebecca G. Feinberg, MPH, and

Department of Behavioral Medicine Research, Baystate Medical Center, 140 High Street, Room 2102, Springfield, MA 01105

Jane L. Garb, MS

Department of Academic Affairs, Baystate Medical Center, 280 Chestnut Street, 3rd Floor, Springfield, MA 01104

Garry Welch: garry.welch@bhs.org

Abstract

Aims—To determine whether glycemic control is improved when Motivational Interviewing (MI), a patient-centered behavior change strategy, is used with Diabetes Self Management Education (DSME) as compared to DSME alone.

Methods—Poorly controlled type 2 diabetes (T2DM) patients (n=234) were randomized into 4 groups: MI+DSME or DSME alone, with or without use of a computerized summary of patient self management barriers. We compared HbA1c changes between groups at 6 months and investigated mediators of HbA1c change.

Results—Study patients attended the majority of intervention visits (mean 3.4/4), but drop-out rate was high at follow-up research visits (35%). Multiple regression showed that groups receiving MI had a mean change in HbA1c that was significantly lower (less improved) than those not receiving MI ($t=2.10$; $p=0.037$). Mediators of HbA1c change for the total group were diabetes self-care behaviors and diabetes distress; no between-group differences were found.

Conclusions—DSME improved blood glucose control, underlining its benefit for T2DM management. However, MI+DSME was less effective than DSME alone. Overall, weak support

Correspondence to: Garry Welch, garry.welch@bhs.org.

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was found for the clinical utility of MI in the management of T2DM delivered by diabetes educators.

Keywords

Type 2 Diabetes; Diabetes Self Management Education; DSME; Motivational Interviewing; Blood Glucose Control; HbA1c

Introduction

Diabetes self-management education (DSME) is critical in type 2 diabetes (T2DM) treatment planning. DSME focuses on diabetes knowledge and skills training and fosters behavior change for targeted self-management behaviors. These include following an appropriate diet, consistent use of (often multiple) medications, regular monitoring of blood glucose levels to inform decision making, regular physical activity, practical problem solving and communication skills, and psychosocial adaptation skills [1].

Diabetes specialists, including 30,000 diabetes educators of whom approximately half are certified diabetes educators (CDEs), are working on the front line of diabetes care and are well positioned to help behavioral researchers translate innovative educational and behavioral strategies into workable and sustainable patient programs [2]. Current control rates for blood glucose are suboptimal and innovative new treatment approaches are needed to help reduce the devastating effects of diabetes complications on patients and the healthcare system [3]. While appropriate evidence-based medical care is critical to good diabetes control, effective DSME and patient support are also key factors in T2DM treatment. One recent theoretical advance in the delivery of DSME has been an emphasis on patient-centered or collaborative approaches to care and education [4–6], although these have not been well studied in terms of clinical outcomes and theoretical mechanisms [7].

Motivational interviewing (MI), a patient-centered behavior change strategy, has proven valuable in the treatment of addictions and other chronic medical conditions [8]. MI aims to identify and reduce patient ambivalence regarding health behavior change and to improve patient perceptions of the importance of behavior change and confidence (self-efficacy). MI is traditionally delivered by mental health counselors such as clinical psychologists or social workers. These counselors are typically not trained in diabetes treatment or integrated into primary care settings where 80–95% of diabetes care is delivered [9]. By contrast, CDEs have specialized knowledge in diabetes pathophysiology and treatment approaches and are trained in patient-centered behavior change strategies [2]. Therefore, it may be beneficial to adopt scaleable MI strategies into DSME, utilizing the expertise of CDEs.

No study to date has reported on the use of MI in the context of DSME provided by diabetes educators. The goal of this study was to create a brief DSME intervention that blended a MI counseling approach with the practical teaching of diabetes knowledge and skills training (e.g., help patients identify barriers, facilitate problem solving, and develop coping skills to effectively manage their diabetes) [1]. We compared the clinical benefit of a six month MI-based DSME intervention with standard DSME. Our primary clinical outcome was blood glucose control (HbA1c). To advance our theoretical knowledge in this area, we also examined a range of salient psychosocial and behavioral mediators expected to influence blood glucose control outcome over the course of the MI-based DSME intervention.

Subjects, Materials and Methods

Patients were recruited from the adult T2DM patient population of a large hospital medical center following chart review and physician approval for patient participation. Patients were recruited from a variety of sources within the hospital network including the diabetes clinic and hospital laboratory database. Study patients were aged 30–70 years, had poorly controlled blood glucose ($HbA1c \geq 7.5\%$), and were able to speak and write in English. Exclusion criteria included the presence of major diabetes complications (i.e., proliferative retinopathy, cardiovascular conditions including stroke or myocardial infarction within 12 months or have congestive heart failure, renal disease [microalbumin $>300\mu\text{g}/\text{mg}$], severe autonomic neuropathy, lower limb amputations), pregnancy, any severe psychiatric disorders or mental retardation, or visual, literacy, or comprehension barriers that would prevent completion of study questionnaires.

Patients were randomized following completion of patient consent forms to receive either diabetes education with MI (with or without use of a one page patient self management assessment report generated by a web tool, described below) or standard DSME (with or without the summary report from the web tool). Thus, the four experimental groups were: MI alone, MI with report, DSME alone, DSME with report.

Four CDEs (certified by the American Association of Diabetes Educators Diabetes Education Accreditation Program) from the hospital diabetes program took part in the study. Study patients were seen in the diabetes clinic for both research and intervention activities. Two diabetes educators were randomized to receive MI training from two experienced MI trainers, both of whom are members of the Motivational Interviewing Network of Trainers [10]. No specific training was provided to the educators in the non-MI conditions. Study educators delivered four diabetes education sessions to each randomized study patient over a six month period. For each intervention, patients received an initial DSME session for one hour followed by three 30 minute sessions at one month, three months, and six months. Patients completed a baseline research visit and a second research visit following the final (six month) intervention visit during which the baseline assessments were repeated. The patients were paid a stipend for their participation. The study was approved by the hospital's Internal Review Board committee.

Motivational Interviewing Training

MI training focused on the exploration of patient ambivalence around behavior change, eliciting patient goals and self-motivational statements, problem solving barriers to change, and exploring discrepancies between the patient's current self management behavior and diabetes control by highlighting the benefits of change and the costs of making no changes. Patient-centered techniques taught included open-ended questioning, reflective listening, summarization, and avoidance of direct confrontation to improve rapport and empathy and to limit argumentation and resistance to change. The educators were taught to use tools we developed based on typical MI counseling strategies, including a pictorial menu of four behavioral options (i.e., self-management of blood glucose [SMBG], diet, exercise, or medication adherence), a "readiness ruler" to assess importance and confidence (self-efficacy) related to behavior change for the selected topic, and a decision matrix to explore the pros and cons of behavior change for the selected topic. These tools were used to foster exploration of patient ambivalence around behavior change and to clarify behavioral goal setting. Realistic and objective self management goals were developed collaboratively to improve SMBG, diet, medication taking, or physical activity that could benefit HbA1c level (primary endpoint). The MI intervention protocol integrated these basic MI counseling skills with traditional diabetes education techniques (e.g., providing diabetes knowledge; teaching

self-management skills such as carbohydrate counting, how to start an exercise program, or managing medications).

CDEs received two days of initial workshop training followed by regular in-person and group conference call sessions (twice a month in Year 1 and then monthly thereafter) over the three year intervention phase of the study. This training provided individual phone-based feedback and coaching (two to four hours per month) on MI skills and was supplemented by full day coaching sessions in person with the trainer twice a year. Coaching and feedback was based on audio-taping and expert coding and analysis of education sessions using patient sessions that were challenging or otherwise of interest to the educators.

The brief Motivational Interviewing Treatment Integrity (MITI) code (2.0 Version) was used to assess MI skills in the training phase [10]. MITI is a one-pass behavioral coding system designed to measure treatment fidelity for MI and uses one coding pass for a 20-minute segment of each counseling session. Treatment fidelity assessments during the intervention phase involved a random sample of 24 sessions from each CDE chosen at mid-point of the intervention phase by an independent coder and using the Motivational Interviewing Skills Code (MISC, versions 1.0 and 2.0), a more in-depth research tool than the MITI used in the training phase.

Computerized Self Management Assessment Tool

The Diabetes Self Care Profile (DSCP) was used in approximately half the sessions by the two MI-trained educators and for all sessions provided by one of the non-MI trained educators randomized to this condition. The DSCP is a web-based patient assessment tool that evolved from a CD-ROM version found to improve patient-doctor communication [11–12]. The DSCP has been associated with significant improvement in blood glucose control when used within a diabetes case management intervention for poorly controlled T2DM patients [13]. The DSCP assessment was completed by patients with the support of a research assistant if needed and the one page summary report was printed off prior to the education sessions to structure the DSME discussions.

Study Measures

Glycosylated hemoglobin (HbA1c) was measured in random blood samples analyzed at the Baystate Medical Center reference laboratory. The Baystate Medical Center laboratory uses the HPLC ion capture method (Tosh Medics Inc., San Francisco, CA).

Mediators of HbA1c change were measured by self-report on validated questionnaires. Diabetes distress was measured using the Problem Areas in Diabetes (PAID) scale [14]. Diabetes self-care behaviors were measured using the Self Care Inventory-Revised (SCI-R) [15], which assesses patient perceptions of SMBG, diet, exercise, and medication adherence. The Diabetes Treatment Satisfaction Questionnaire Change version (DTSQ-C) [16] was used to assess change in patient satisfaction at the end of a treatment intervention. Depression was measured using the Center for Epidemiologic Studies Depression Scale (CES-D) [17]. Self efficacy regarding diabetes self management behaviors was assessed using the Diabetes Self-Care Questionnaire (DSCQ), an eight-item scale developed for the present study (two items each for SMBG, diet, medications, exercise) that assessed how important diabetes self management behaviors were to the patient and how confident they felt in carrying out each behavior. Internal reliability of this scale was $\alpha=0.72$ based on the current population.

Statistical Analyses

We calculated the target sample size for this analysis based on existing data from a four-month pilot of an MI intervention. Smith et al. (1997) reported a 50% standard deviation difference between the MI intervention and control conditions in patients with T2DM [18]. Therefore, based on a 50% standard deviation difference, setting power at 0.80, we calculated that a sample size of $n=64$ patients per group would be sufficient to detect our hypothesized effects.

Study Groups were compared at baseline on demographic and treatment variables (age, gender, race/ethnicity, education level, marital status, diabetes duration, HbA1c, questionnaire scores, medication use). ANOVA was used for continuous variables and the chi-square test was used for categorical variables. A model for change in HbA1c from baseline to six-month follow-up was developed using multiple regression analysis of variance with Stata version 10.3 (Stata Corp, 2009). Demographic and treatment variables on which the treatment groups differed at baseline ($p<0.2$) were included as covariates to control for possible confounding. Change in scores on psychological and behavioral measures between baseline and six months were assessed as mediators in the relationship of treatment and HbA1c change using the Sobel-Goodman mediation tests [19–21].

Results

Two hundred and thirty four patients were randomized to the four study conditions, with $n=118$ receiving MI and $n=116$ not receiving MI. Mean $\pm$ SD age in the study population was 55.7 ± 10.2 years, and 59% of participants were women. The majority (84%) of participants were white, 12% were black, 1% were Asian, and 3% were another race or mixed race; 12% of participants self-identified as Hispanic. Sixty four percent of participants reported at least some college education. Duration of diabetes was 8.2 ± 7.0 years and baseline HbA1c was $8.9\pm1.2\%$. Treatment groups differed at baseline in terms of education status ($p=0.02$) and insulin use ($p=0.04$) (Table 1).

The mean number of CDE visits was 3.3 (of a maximum of four) within the six-month intervention period. The drop out rate at the six-month research visit did not differ between groups (range: 32.8–43.1%; $p=0.61$). Analysis of HbA1c findings obtained from hospital records within two months of participant drop out showed no significant difference in metabolic control, such that the mean change in HbA1c was $-0.44\pm1.50\%$ for participants who dropped out and $-0.62\pm1.29\%$ for participants who completed the six-month follow-up visit ($p=0.46$). While there were small but statistically significant differences between these groups for age ($p=0.01$) and importance of diabetes self management ($p<0.01$), no other covariates differed by drop-out status.

Results from the MISC coding showed a significant difference between MI-trained educators and those not trained in MI on almost every MISC dimension for which satisfactory inter-rater reliability was achieved (Table 2). The results showed that MI trained educators: 1) integrated more reflective listening into the intervention; 2) reduced their MI-inconsistent responses; and 3) their patients produced more “change talk” (i.e., Desire, Ability, Reasons, Need for change) than Non-MI trained educators. While over half of the DSME+MI sessions had ratings of “MI Spirit” (overall adherence to the MI approach) at threshold proficiency, the results showed that integrating all aspects of the “MI Spirit” was a challenge. While the MI-trained educators had significantly more open-ended questions than those not trained in MI, they were unable to meet the MI proficiency target level (a score of 5 or higher on a 1–7 scale) for MI Spirit. In addition, the MI trained educators had fewer instances of giving information (22 responses vs. 33 in the DSME alone interventions) and fewer responses overall (mean of 152 vs. 174). This indicates that the nature of the DSME

sessions conversation was more of a dialogue in the DSME+MI condition, with less advising or educating, but more listening skills being used.

Mean change in our primary outcome (HbA1c) over the intervention for the total sample was $-0.58 \pm 1.33\%$ ($p < 0.01$) showing that statistically and clinically significant improvement occurred in blood glucose control overall (Table 3). Mean change in HbA1c within both the MI group ($-0.37 \pm 1.35\%$, $p = 0.01$) and non-MI group ($-0.78 \pm 1.29\%$, $p < 0.01$) were also significant.

Multiple regression showed a significant negative effect of MI on change in HbA1c, such that groups receiving MI had a mean change in HbA1c that was significantly lower than those not receiving MI ($\beta \pm SE$: 0.41 ± 0.19 ; $t = 2.10$, $p = 0.037$). Analysis of behavioral and psychosocial mediators of change showed that diabetes distress ($p < 0.001$) and self care behavior ($p = 0.015$) change scores were significantly associated with HbA1c change for the total group analysis. However, these factors did not act as mediators in the effect of treatment group on HbA1c, such that there were no differences in diabetes distress or self care behaviors between MI and non-MI groups. No significant changes were found for either the total group or MI and non-MI comparisons for depression, treatment satisfaction, or perceptions of importance and self efficacy regarding target self care behaviors that were also examined as potential mediators of HbA1c change.

Discussion

We compared a four-session, six-month MI-based DSME intervention to traditional patient-centered DSME and focused on blood glucose control as the primary outcome. Despite successful MI training findings and the high professional satisfaction with using MI reported informally by our study CDEs receiving MI training, the MI intervention itself was not found to be associated with improvement in blood glucose control when compared to the non-MI condition. In fact, mean HbA1c change for the non-MI condition was significantly greater (i.e., more improved) than that found for the MI condition.

We also examined psychosocial and behavioral mechanisms of blood glucose change following the interventions and found that this change was mediated by patient-reported diabetes self care behaviors as well as perceptions of diabetes distress based on total group data, but no specific differences were found between MI and non-MI groups. Thus, daily self management behaviors and the emotional burden of living with diabetes and its treatment were important mechanisms of change in metabolic control in this study.

Interestingly, despite the fact that MI theory and practice focuses on the role of patient perceptions of importance and self-efficacy regarding behavior change (and the fact that MI interventions focus on manipulating these factors), we found that these factors did not mediate HbA1c. Our MI-trained diabetes educators were taught to apply several visual teaching aids (e.g., a readiness ruler, a decisional balance matrix) to improve patient perceptions of importance and self-efficacy in diabetes self management, but levels for these improved only a few percentage points over the diabetes education sessions. This null finding for the importance and self-efficacy perceptions for both the MI and non-MI conditions could reflect an inability of the educators to modify these perceptions, problems with the responsiveness of the criterion measure we developed for this study, or a lack of salience of the importance and self-efficacy constructs to change in metabolic control in T2DM.

Two prior studies have examined the potential benefit of MI counseling to diabetes management. In a US study of female T2DM patients, a two session MI intervention was delivered by mental health counselors working within an 18-month, multidisciplinary

behavioral weight loss program [22]. Participants showed clinically and statistically significant improvement in glycemic control at six month follow-up compared to an attention control condition, such that HbA1c had dropped -0.8% for the MI treated group compared to -0.5% for the attention control condition. However, mean HbA1c returned to baseline levels at the 12-month follow-up time point and remained so at the end of the 18-month intervention. In a study involving Danish T1DM patients, no difference was found in HbA1c reduction at 12-month follow-up between MI and usual care conditions when delivered by primary care providers, although both showed strong mean HbA1c reductions (-0.9%) [23]. Patient retention rates and data quality were excellent in these two studies, but interventionist MI skills were not independently coded using validated MI research tools (such as the MISC) and MI interventionists were designated as competent by a supervising MI trainer, but this was not independently corroborated. Thus, the level of MI skills and consistency of MI delivery over time were potential confounding factors in these studies, as were differences in diabetes type and background characteristics of the patients studied. Importantly, both studies showed that both MI and control conditions were associated with significant short term clinical benefit, confirming the clinical utility (and likely cost-effectiveness) of diabetes-specific educational and behavioral interventions that target poorly controlled diabetes patients. To place these study findings in context, the landmark UKPDS trial showed that a 1% reduction in HbA1c was associated with a 35% reduction in microvascular complications and that there was a continuous reduction in these complications as glycemic levels approached the normal range [24].

It is important to discuss not only the empirical findings of the present study, but also the feasibility and sustainability of providing MI training to diabetes educators working in busy clinical settings if MI is to be considered as a widely-adopted public health strategy. There currently exists a flourishing network of over 300 MI certified trainers in the US [11]. However, MI training is a highly specialized clinical domain and is often delivered with a consultant training model in healthcare settings. Thus, additional resources are needed to develop and sustain an MI-based DSME program. Notably, the MI training and coding costs were approximately \$57,000 over three years, compared to the \$22,500 needed for software development associated with the computerized self management assessment tool, and no training costs for standard DSME.

Strengths of this study included our highly experienced MI trainers, the significant “dose” of MI training delivered to the educators, and the use of the MISC research tool to make a formal assessment of the MI skills acquired by the CDEs. We demonstrated that our MI-trained CDEs showed significantly improved MI skills as compared to non-trained educators, and the MI-trained CDEs maintained these skills over time. However, the MI-trained CDEs did not reach formal threshold criteria on all MI skills designated by the Motivational Interviewing Network of Trainers (MINT). For example, they achieved a 4.4 on a 1–7 scale of overall MI skills (“MI Spirit”), where a score of 5 indicates MINT proficiency. Feedback from our MI trainers at the conclusion of the study indicated that our MI-trained CDEs did not use complex reflection skills or consistently explore patient ambivalence around behavior change, as would likely have been seen if the sessions were delivered by similarly trained mental health counselors. Thus, there were limits to the depth of MI counseling skills acquired or applied in brief DSME interventions by CDEs. However, MI-trained educators scored significantly higher than the non-MI trained educators in terms of “MI Spirit,” and MI-trained educators showed greater use of open-ended questions, simple reflective listening, and conversation summaries that aim to stimulate patient behavior change talk. In addition, MI-trained CDEs showed increased levels of coded patient “change talk,” a key goal of MI counseling. Furthermore, counseling strategies considered counterproductive according to MI theory, such as advice giving without permission, were markedly lower among MI compared to non-MI educators.

This study was associated with a range of translational research challenges that impacted study quality and the generalizability of our findings, including early loss of our physician champion, recruitment competition from a hospital quality improvement program, low provider and specialist interest in study recruitment, and strong patient resistance to research activities (i.e., returning for a follow-up blood test and questionnaire completion). While there was a high level of patient engagement in the DSME intervention sessions, participation in the follow-up research visits was around 65% despite maximal research efforts to engage the study patients. Following IRB patient consent criteria, patients received a minimum of two letters and three phone calls before being designated lost to follow-up. However, these problems did not negatively impact our power to examine the primary aim of this study (i.e., HbA1c change in MI versus non-MI) that is the focus of this paper. Rather, the fact that our main finding was statistically significant despite the small sample size strengthens the conclusion that there is in fact a difference in HbA1c change between the two groups (i.e., HbA1c is less improved in the MI group).

The current study demonstrated that both MI and non-MI based DSME significantly improved blood glucose control, stressing the potential benefit of DSME in meeting the public health challenge of T2DM. However, DSME with MI was unexpectedly less effective than DSME not involving MI. Also, important constructs applied in MI theory and practice did not mediate blood glucose change as expected. Overall, weak support was found in this study for the clinical utility of MI in the management of T2DM when delivered by diabetes educators and blended with traditional diabetes knowledge and skills training.

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Figure 1.
Flowchart of Patient Recruitment and Retention: Motivational Interviewing in Diabetes Study, 2004–2009.
Note: CDE = Certified Diabetes Educator

Table 1

Characteristics of the study population at baseline by treatment group: Motivational Interviewing in Diabetes Study, 2004–2009.

Continuous measures	Standard Education (n=58) Mean (SD)	Computer Alone (n=58) Mean (SD)	MI Alone (n=57) Mean (SD)	MI with Computer (n=61) Mean (SD)	p-value ^b
Age (years)	54.4 (10.3)	57.2 (10.9)	54.9 (9.3)	56.1 (10.4)	0.46
Duration of diabetes (years)	7.1 (5.8)	7.0 (6.5)	9.0 (7.3)	9.8 (8.0)	0.07
Body mass index (kg/m ²)	34.9 (6.7)	34.4 (6.6)	34.1 (5.6)	34.6 (6.6)	0.92
Hemoglobin A1c	8.8 (1.3)	8.9 (1.2)	9.1 (1.5)	8.8 (1.0)	0.50
PAID score	43.4 (25.0)	42.5 (23.6)	40.5 (23.3)	41.9 (22.4)	0.93
SCI score	56.9 (17.1)	58.0 (16.9)	56.8 (14.9)	57.6 (16.7)	0.98
CES-D score	19.9 (9.3)	18.6 (10.9)	19.1 (9.0)	18.9 (8.7)	0.89
DSCQ importance score	74.6 (20.8)	73.5 (23.9)	73.2 (21.2)	70.5 (19.7)	0.75
DSCQ confidence score	66.2 (21.0)	70.3 (22.8)	68.5 (21.3)	69.5 (22.8)	0.76
Number of CDE visits by R2	3.2 (1.0)	3.5 (0.8)	3.3 (1.0)	3.4 (1.0)	0.28
Categorical Measures					
Female	62.1%	63.8%	57.9%	52.5%	0.60
White race	79.0%	81.0%	86.0%	81.7%	0.80
Hispanic ethnicity	12.8%	12.8%	10.0%	13.0%	0.96
> High school education	74.1%	47.4%	63.2%	69.5%	0.02
Married	66.7%	72.3%	59.2%	71.2%	0.50
Use insulin	40.4%	22.4%	31.6%	45.9%	0.04
Use diabetes pills	84.2%	84.5%	75.4%	86.9%	0.38

Note: PAID = Problem Areas in Diabetes; SCI = Self-Care Inventory; CES-D = Center for Epidemiologic Studies Depression Scale; DSCQ = Diabetes Self-Care Questionnaire; SSS = Social Support Scale; CDE = Certified Diabetes Educator; R2 = research visit 2

^b p-value for overall difference between groups; based on ANOVA for continuous variables, Chisquare for categorical variables

Table 2

Motivational Interviewing Training Scores for MI versus Non-MI Trained Educators: Motivational Interviewing in Diabetes Study, 2004–2009.

MISC variable	ICC	MI Threshold Proficiency	MI Trained Educators	Non-MI Trained Educators	T-test, Significance
Mean MI Spirit rating ^a	0.77	≥5	4.43	2.65	t= -11.26, p<0.001
Ratio of reflections to questions ^b	0.65	1:1	1.92	0.32	t= -6.59, p<0.001
Percentage of open questions ^b	0.93	50%	0.27	0.06	t= -7.37, p<0.001
Mean count of MI- inconsistent responses ^c	0.75	n/a	3.27	12.19	t= 9.38, p<0.001
Mean count of client change talk ^d	0.66	n/a	13.88	9.02	t= -2.93, p=0.004

Note: MI = Motivational Interviewing; ICC = Intraclass correlation coefficient; CDE = Certified Diabetes Educator; MISC = Motivational Interviewing Skills Code

^a Global rating measured on a 1–7 Likert scale; educators high on this scale manifest a directive, client-centered style of facilitating, coaching, and negotiating, and value the patient's perspective

^b Based on frequency count of educator behaviors

^c Behavior count of giving advice to patient without permission, confronting, directing, or warning

^d Count of client responses indicating problem recognition, concern, desire to change, or optimism regarding change

Table 3

Within Group Changes in HbA1c Following a Six Month Diabetes Self Management Education Intervention Using Motivational Interviewing and/or a Computerized Self Management Assessment Report: Motivational Interviewing in Diabetes Study, 2004–2009.

Study Conditions	N	Mean Change (%)	SD	p-value *
DSME alone	44	−0.59	1.24	<0.01
DSME with report [†]	50	−0.95	1.32	<0.01
MI alone	46	−0.41	1.29	0.04
MI with report [†]	44	−0.32	1.42	0.14
DMSE not using MI	94	−0.78	1.29	<0.01
DMSE using MI	90	−0.37	1.35	<0.01
Total	184	−0.58	1.33	<0.01

Note: DSME = Diabetes Self Management Education; MI = Motivational Interviewing

* Significance level for each within-group comparison

[†] The report is a one page summary of diabetes self management barriers generated by the computerized Diabetes Self Care Profile assessment (web-based tool)