GLYCEMIC REGULATION IN PATIENTS WITH TYPE 2 DIABETES MELLITUS: EFFECTS OF MOTIVATIONAL INTERVIEWING

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Abstract

Objectives: Motivational interviewing (MI) is a convenient and effective counseling technique with positive effects on patients with Type 2 Diabetes Mellitus (T2DM), which provides a positive influence on their treatments/follow-up and help them to adopt health-enhancing behaviors. This study investigates whether MI has an effect on improving glycemic control in T2DM patients.

Materials and Methods: This is a retrospective study enrolling 76 follow-up T2DM patients at a family health center who received MI. As a control group, age- and gender-matched 33 T2DM patients who were followed at the same family health center and did not receive MI were recruited. All patients were compared for their age, gender, marital status, education status, duration of diabetes, and HbA1c levels.

Results: In the MI group, T2DM patients had a mean follow-up duration of 22.63±11.93 (3-38) months vs. 24.33±11.29 (3-36) months in the non-MI group (p=0.489). At the end of this follow-up period, the HbA1c level dropped from 8.30±2.10% to 7.68±1.48% (p=0.006) in the MI group, whereas the decrease in the non-MI group was from 8.12±2.14% to 7.93±1.16% which was not statistically significant (p=0.504).

Conclusion: In this study, it was shown that MI provided a significant decrease in HbA1c levels in T2DM patients. MI helps blood sugar regulation by creating lifestyle changes in T2DM patients. MI is a method that can be applied in clinical practice by family physicians working in primary care, who play an important role in the follow-up and treatment of T2DM patients.

Keywords: Motivational interviewing, diabetes mellitus, family physician, blood glucose regulation.

Introduction

In Turkey, as in the entire world, the incidence of type-2 diabetes mellitus (T2DM) is ever-growing, making it a major public health problem. According to The Turkish Epidemiology Survey of Diabetes, Hypertension, Obesity and Endocrine Disease (TURDEP) 1 and 2 studies which were conducted in 1998 and 2010, respectively, within the elapsed time period rate of increase in Diabetes Mellitus (DM) was 90% and in obesity was 44% (The incidence of DM was 7.2% and 13.7% in TURDEP 1 and 2, respectively).[1] The data from the International Diabetes Federation (IDF) Diabetes Atlas 9th Edition suggests that by 2025, Turkey will be among the top 10 countries with the highest number of DM patients having an estimated 10.4 million DM patients.[2] Fighting with T2DM shall incorporate an integrative approach entailing decelerating the rate of disease development along with promoting the "health behavior change" in DM patients during their follow-up and treatment. At the early and advanced stages of T2DM, health-enhancing behaviors include adopting an adequate and balanced diet, regular exercise, self-monitoring of blood glucose, and timely and accurate dosing of medication. When effectively applied, such behavior changes help increase the quality of life and decrease macro- and micro-vascular complications in patients.[3]

Studies on health behavior change have documented a number of models, of which the Transtheoretical Model (TTM) is the most common one, readily applicable to many aspects of health behavior.[4,5] For patients with T2DM, motivational interviewing (MI) has been shown as a convenient and effective TTM-based counseling technique with a beneficial impact on follow-up and treatment of DM patients.[6] Such positive impact arises from the favorable effect of MI on lifestyle change as well as on psychological conditions, including emotional stress and depression, which are of utmost importance in DM.[7]

TTM is composed of 6 stages called pre-contemplation, contemplation, preparation, action, maintenance and termination. The ultimate aim at the end of these stages is to have the patient adopt health behavior changes that include gaining habits such as proper use of medication, adequate and balanced diet, and regular exercise. This study was conducted at a primary family care center where TTM was used to administer MI to T2DM patients aiming to investigate whether it is effective in blood sugar regulation.

Materials and Methods

This study was carried out at a family health center in patients who were diagnosed with T2DM and followed up between July 2015 and October 2018. This study was ethically and scientifically approved by the local Non-Interventional Clinical Research Ethics Committee with decision number 14 on 17th March 2020. In addition, necessary permissions were obtained from the Provincial Health Directorate for the study.

Patients and Control group

This is a retrospective case-control study of T2DM patients with and without MI. Patient age, gender, medication history, education status, marital status, duration of DM, ongoing medication, and glycated hemoglobin (HbA1c) levels were retrieved through the hospital automation system, and patient records were available to the family health center. In the MI group (76 patients), follow-up duration was calculated as the time elapsed from the date of the first interview to the date of study data cut-off. The inclusion and exclusion criteria of the study were as follows.

Inclusion criteria: (a) Being aged over 18 (b) Patients with a diagnosis of T2DM (c) Having a motivational interview for at least three months (d) Presence of HbA1c values at the time of enrollment and at the end of the study.

Exclusion criteria: (a) Patients with a diagnosis of type 1 DM (b) Patients younger than 18 years old (c) Absence of HbA1c value (d) Patients who did not comply with follow-up.

The control group was composed of age- and gender-matched 33 T2DM patients who did not undergo MI but were followed and treated at the same family health center.

The follow-up period of the patients included in the study was calculated as the time between the start of the MI and the date the study data were collected. In terms of HbA1c values, the initial HbA1c value was taken as the value at the beginning of the MI interview, and the final HbA1c value was taken as the value at the end of the study.

Motivational interview method

Patient interviews were implemented with a technique developed by Miller and Rollnick at the usual outpatient clinic setting as sessions over an average of 15 minutes. MI was conducted in 4 phases, namely, engagement, focusing, evocation, and planning, which may occasionally be intertwined or follow a different sequence of occurrence. [8]

During the *engagement* stage, a common language and a collaborative environment were built. Face-to-face interviews were held in an environment without a barrier in between, e.g., a table. A rapport relying on mutual reliance and respect was sought.[8]

Focusing involved open-ended questions such as "What do you know about diabetes? "What is bothering you at most, lately?" and patients were given information based on their replies. The information given was predominantly about the topic the patient was willing to talk about. Thus, patient autonomy was respected.[8]

In the *evocation* stage, the interviewer has taken an attitude in line with the type of talk (change and sustain talk) arising during the interview. The more the patient makes change talk, the closer she or he is to the change. Therefore, the patients were encouraged toward change talk and questions were directed to elicit change talk. During the conversation, various methods were followed, such as looking at the past (I see here you had a low HbA1c 2 years ago, how did you manage that?), looking at the future (Can you please list three reasons why to take your blood sugar under control?) eliciting a reason for the change (What do you think will happen in the future, if things keep going like this?), questioning extreme cases (What can happen in the future at worst?), drawing out goals and values (What is important to you in this life?) and exploring ambivalence.[8]

At the stage of *planning,* the patient is more engaged in change talk, with a lesser amount of sustain-talk. We have discussed what obstacles may hinder the patient from achieving the change and how to overcome them.[8]

All these stages were implemented at varying weights and durations considering the progress attained by the patient and were all recorded. In this study, the data extracted from such records were used.

Statistical analysis

Statistical analyses were carried out using the program SPSS version 20.0. Continuous variables were expressed as mean ± standard deviation (SD), and categorical variables were expressed as frequency and percentage. Shapiro Wilk's test was applied to check whether the data has a normal distribution. Depending on whether they have a normal distribution or not, continuous variables were analyzed using the Mann-Whitney U test or independent samples t-test, and categorical variables were analyzed using Pearson's chi-square test. Statistical analysis results within a confidence interval of 95%, and the p-value of <0.05 was accepted as statistically significant.

Results

At the end of the study, 76 patients in the MI group (51 female, 25 male) were not different from the 33 patients in the non-MI group (21 female, 12 male) in terms of their age, gender, marital status, education status, medication, or duration of follow-up. Clinical and laboratory features of patients are shown in Table 1.

Table 2 shows the change in HbA1c levels of the patients. There was no difference in the baseline HbA1c level, which was measured at the time of study entry, between the MI group and non-MI group (p=0.697). At the end

of the follow-up duration, however, the mean HbA1c level in the MI group decreased by 0.62±1.89% (a decrease of 7.04% from the initial value), whereas the decrease in non-MI was 0.19±1.65% (decrease of 1.58% from the initial value) (Graphic 1). There was a statistically significant decline in the MI group (p=0.006).

Table 1. Clinical and laboratory characteristics of patients

|	**Receiving MI (n=76)**	**Not receiving MI (n =33)**	**p**
Age (mean±SD)	56.07±9.29	58.79±11.49	0.194
Gender Female, n, (%) Male, n, (%)	51 (67.11) 25 (32.89)	21 (63.64) 12 (36.36)	0.826
Marital Status Married, n, (%) Single, n, (%)	54 (71.05) 22 (28.95)	27(81.82) 6(18.18)	0.340
Educational Status Literate, n, (%) Primary School, n, (%) Secondary School, n, (%) High School, n, (%) University, n, (%)	21 (27.63) 30 (39.47) 9 (11.84) 11 (14.47) 5 (6.58)	4(12.12) 16(48.48) 5(15.15) 6(18.18) 2(6.06)	0.515
Medication OAD, n, (%) OAD + Insulin, n, (%)	61 (80.26) 15 (19.74)	27 (81.81) 6 (18.18)	0.850
Time of follow-up (Month)	22.63±11.93 (3-38)	24.33±11.29 (3-36)	0.489

(MI: Motivational interviewing, OAD: Oral antidiabetic)

Table 2. The Hb1Ac levels of patients

HbA1c (%)	**Receiving MI (n=76)**	**Not Receiving MI (n =33)**	**p**
Start (mean ±SD)	8.30±2.10	8.12±2.14	0.697
End (mean ±SD)	7.68±1.48	7.93±1.16	0.405
Start–End difference (mean ±SD)	0.62±1.89*	0.19±1.65**	

*p=0.006, **p:0.504

(Hba1c: Glycated hemoglobin, MI: Motivational interviewing)
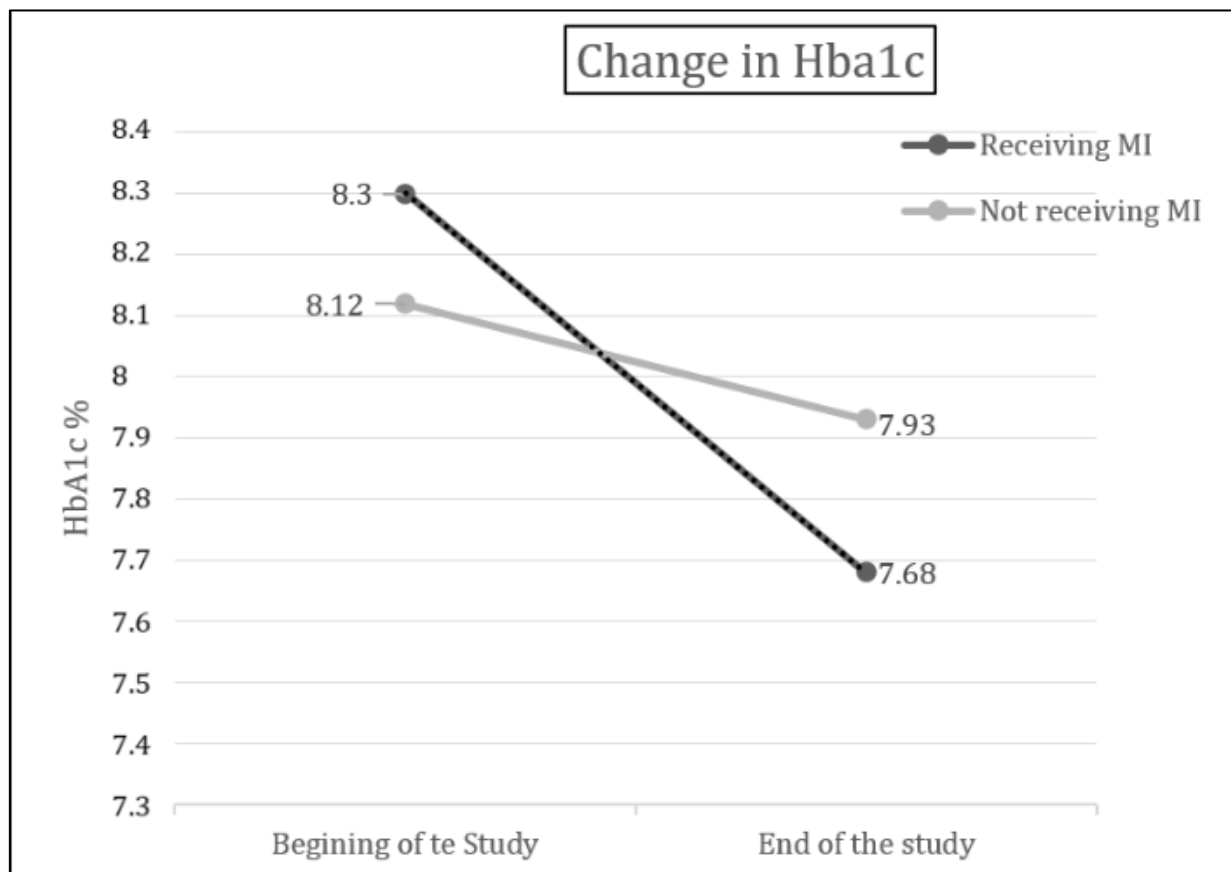
Figure 1. HbA1c change at the end of the study

Discussion

In this study, our aim is to investigate whether MI has an effect on blood sugar regulation, and we found a greater decrease in HbA1c levels of the patient who were subject to receiving MI compared to those who did not receive MI. While the average decrease in HbA1c was 0.62% in the group that received MI, it was only 0.19% in the group that did not receive MI.

All national and international guidelines recommend first-line lifestyle changes for T2DM patients. As such, the T2DM treatment guideline of the American Diabetes Association (ADA) highlights lifestyle changes play an important role both in the prevention of DM development and in the course of the disease and recommends medication shall be initiated when necessary.[9] Moreover, former research has demonstrated that lifestyle change is not only effective in achieving an HbA1c decrease in diabetic patients but also may help reduce the rate of T2DM development in pre-diabetic individuals by 40-58%.[10-12] Although lifestyle change is an efficient

method both in the prevention and treatment of diabetes, professionals in diabetes training claim behavior change is indeed the most challenging part of enhancing the health of diabetic individuals. From a behavior change perspective, it is further stated that traditional, advise-imposing attitudes that are frightening for the patient are putting barriers. Instead, counseling techniques that involve reinforcement and training for the patient, attempting to understand the patient in psychosocial aspects and changing behavior in the short term are facilitators.[13] There is no shortage of studies that report that MI, one of the techniques capable of behavior change, as well increases lifestyle change.[14-16] Provided that they are administered with a correct approach, MI strategies are adaptable to encourage self-care practice in diabetes, including a healthy diet/meal planning, physical activity, psychosocial adjustment, foot care, home blood sugar monitoring, medication adherence, and medical follow-ups oriented to assure lifestyle change in diabetes.

In the majority of studies in patients diagnosed with T2DM, MI features out with a potential to facilitate lifestyle change in comparison to other interventions based on its effectiveness and interactive nature. While results from most of the studies indicate MI has contributed to positive change in self-care activities such as healthy diet/meal planning, physical activity, foot care, and home blood sugar monitoring, some studies did not find a significant difference in diabetes-related self-care behaviors following MI.[16-20]

On the other hand, studies exploring the effects of MI on regulating blood sugar and decreasing HBA1c have controversial results. While several studies have detected a significant improvement in HbA1c levels in patients who have undergone MI, another study identified that patients had improved regardless they received MI or not. [21-24] Similarly, in the study conducted by Ismail K. *et al.* in 2018, MI had no effect on HbA1c levels.[25] A systematic review and meta-analysis carried out in 2014, the results from 13 studies of 1223 type-1 DM and 1895 T2DM patients were analyzed.[26] According to this analysis, the authors state the improvement in glycemic control in the MI patient group was 0.17% which was not statistically significant. In our study, on the other hand, the decrease in HbA1c levels, which stands for the improvement in glycemic control, was greater in the MI group compared to the group without MI. The decrease achieved in the HbA1c level was statistically significant in the MI group ($p=0.006$), whereas no significant decrease was noted in the group who were not interviewed ($p=0.504$).

In this study, although we have demonstrated improvement in glycemic control through MI, upon which we also have detected recoveries in certain lifestyle changes, there were some limitations. First, of these, we did not use any scales to score lifestyle changes in this study. But still, we have observed and noted through our conservations with the patients we had administered MI that these patients were more informed about their disease, they were taking their medication more properly and timely, and they had better self-care. We have identified patients who got used to lifestyle changes such as adherence to the prescribed diet, getting regular exercise, and avoiding food that may elevate their blood sugar levels. Of note, advising the patients regarding

the meaning of HbA1c level as a criterion for the DM follow-up and assigning them responsibility concerning what must be done to decrease it helped foster patient motivation. Secondly, the number of patients included in the study was small. Third, patient follow-up times are partially heterogeneous. Finally, the study design is retrospective. The effects of motivational interviewing on blood sugar regulation can be demonstrated with a larger number of patients and in longer-term prospective studies.

Consequently, in this study, it was shown that motivational interviewing provided lifestyle changes (cessation of smoking, exercise, and alcohol cessation) in individuals with diabetes, resulting in improvement in glycemic control. In all national and international diabetes treatment guidelines, providing lifestyle change is one of the first-line treatments, and special attention is paid to this. Family physicians, one of the health professionals who play an important role in the treatment of diabetes, can also use this method to provide lifestyle changes by applying motivational interview techniques.

Ethical Considerations: Our study has been planned according to the Decisions of the Helsinki Declarations, and the required permission for the research has been granted by the local Clinic Research Ethical Board on 17th March 2020, with decision number 14.

Conflict of Interest: The authors declare no conflict of interest.

References

1. Satman I, Omer B, Tutuncu Y, et al. Twelve-year trends in the prevalence and risk factors of diabetes and prediabetes in Turkish adults. *Eur J Epidemiol.* 2013;28(2):169-80 (doi:10.1007/s10654-013-9771-5).
2. Saeedi P, Petersohn I, Salpea P, et al. Global and regional diabetes prevalence estimates for 2019 and projections for 2030 and 2045: Results from the International Diabetes Federation Diabetes Atlas, 9(th) edition. *Diabetes Res Clin Pract.* 2019;157:107843 (doi:10.1016/j.diabres.2019.107843).
3. American Diabetes A. 5. Facilitating Behavior Change and Well-being to Improve Health Outcomes: Standards of Medical Care in Diabetes-2020. *Diabetes Care.* 2020;43(Suppl 1):S48-S65 (doi:10.2337/dc20-S005).
4. Jackson R, Asimakopoulou K, Scammell A. Assessment of the transtheoretical model as used by dietitians in promoting physical activity in people with type 2 diabetes. *J Hum Nutr Diet.* 2007;20(1):27-36 (doi:10.1111/j.1365-277X.2007.00746.x).
5. Prochaska JO, Redding CA, Evers KE. The Transtheoretical Model and stages of change. In: Health Behavior and Health Education: Theory, Research and Practice, 4th ed. Wiley; 2008:97-121.
6. Chapman A, Liu S, Merkouris S, et al. Psychological Interventions for the Management of Glycemic and Psychological Outcomes of Type 2 Diabetes Mellitus in China: A Systematic Review and Meta-Analyses of Randomized Controlled Trials. *Front Public Health.* 2015;3:252 (doi:10.3389/fpubh.2015.00252).
7. Concert CM, Burke RE, Eusebio AM, Slavin EA, Shortridge-Baggett LM. The Effectiveness of Motivational Interviewing on Glycemic Control for Adults with Type 2 Diabetes Mellitus (DM2): A Systematic Review. *JBI Libr Syst Rev.* 2012;10(42 Suppl):1-17 (doi:10.11124/jbisrir-2012-246).
8. W.R. Miller, S. Rollnick. The Method of Motivational Interviewing. In: W.R. Miller, S. Rollnick ed. Motivational Interviewing Helping People Change, 3rd ed. Guilford Press, New York; 2013:25-36.
9. American Diabetes Association 3. Prevention or Delay of Type 2 Diabetes: Standards of Medical Care in Diabetes-2020. *Diabetes Care.* 2020;43(Suppl 1):S32-S6 (doi:10.2337/dc20-S003).
10. Pan XR, Li GW, Hu YH, et al. Effects of diet and exercise in preventing NIDDM in people with impaired glucose tolerance. The Da Qing IGT and Diabetes Study. *Diabetes Care.* 1997;20(4):537-44 (doi:10.2337/diacare.20.4.537).
11. Tuomilehto J, Lindstrom J, Eriksson JG, et al. Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. *N Engl J Med.* 2001;344(18):1343-50 (doi:10.1056/NEJM200105033441801).
12. Knowler WC, Barrett-Connor E, Fowler SE, et al. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *N Engl J Med.* 2002;346(6):393-403 (doi:10.1056/NEJMoa012512).

13. Dellasega C, Anel-Tiangco RM, Gabbay RA. How patients with type 2 diabetes mellitus respond to motivational interviewing. *Diabetes Res Clin Pract.* 2012;95(1):37-41 (doi:10.1016/j.diabres.2011.08.011).

14. Brug J, Spikmans F, Aartsen C, Breedveld B, Bes R, Fereira I. Training dietitians in basic motivational interviewing skills results in changes in their counseling style and in lower saturated fat intakes in their patients. *J Nutr Educ Behav.* 2007;39(1):8-12 (doi:10.1016/j.jneb.2006.08.010).

15. West DS, DiLillo V, Bursac Z, Gore SA, Greene PG. Motivational interviewing improves weight loss in women with type 2 diabetes. *Diabetes Care.* 2007;30(5):1081-7 (doi:10.2337/dc06-1966).

16. Calhoun D, Brod R, Kirlin K, Howard BV, Schuldberg D, Fiore C. Effectiveness of Motivational Interviewing for Improving Self-Care Among Northern Plains Indians With Type 2 Diabetes. *Diabetes Spectrum.* 2010;23(2):107-14 (doi:10.2337/diaspect.23.2.107).

17. Rubak S, Sandbaek A, Lauritzen T, Borch-Johnsen K, Christensen B. General practitioners trained in motivational interviewing can positively affect the attitude to behaviour change in people with type 2 diabetes. One year follow-up of an RCT, ADDITION Denmark. *Scand J Prim Health Care.* 2009;27(3):172-9 (doi:10.1080/02813430903072876).

18. Lakerveld J, Bot SD, Chinapaw MJ, et al. Motivational interviewing and problem solving treatment to reduce type 2 diabetes and cardiovascular disease risk in real life: a randomized controlled trial. *Int J Behav Nutr Phys Act.* 2013;10:47 (doi:10.1186/1479-5868-10-47).

19. Heinrich E, Candel MJ, Schaper NC, de Vries NK. Effect evaluation of a Motivational Interviewing based counselling strategy in diabetes care. *Diabetes Res Clin Pract.* 2010;90(3):270-8 (doi:10.1016/j.diabres.2010.09.012).

20. Welch G, Zagarins SE, Feinberg RG, Garb JL. Motivational interviewing delivered by diabetes educators: does it improve blood glucose control among poorly controlled type 2 diabetes patients? *Diabetes Res Clin Pract.* 2011;91(1):54-60 (doi:10.1016/j.diabres.2010.09.036).

21. Chen SM, Creedy D, Lin HS, Wollin J. Effects of motivational interviewing intervention on self-management, psychological and glycemic outcomes in type 2 diabetes: a randomized controlled trial. *Int J Nurs Stud.* 2012;49(6):637-44 (doi:10.1016/j.ijnurstu.2011.11.011).

22. Celano CM, Gianangelo TA, Millstein RA, et al. A positive psychology-motivational interviewing intervention for patients with type 2 diabetes: Proof-of-concept trial. *Int J Psychiatry Med.* 2019;54(2):97-114 (doi:10.1177/0091217418791448).

23. Huang CY, Lai HL, Chen CI, et al. Effects of motivational enhancement therapy plus cognitive behaviour therapy on depressive symptoms and health-related quality of life in adults with type II diabetes mellitus: a randomised controlled trial. *Qual Life Res.* 2016;25(5):1275-83 (doi:10.1007/s11136-015-1165-6).

24. Gabbay RA, Anel-Tiangco RM, Dellasega C, Mauger DT, Adelman A, Van Horn DH. Diabetes nurse case management and motivational interviewing for change (DYNAMIC): results of a 2-year randomized controlled pragmatic trial. *J Diabetes.* 2013;5(3):349-57 (doi:10.1111/1753-0407.12030).

25. Ismail K, Winkley K, de Zoysa N, et al. Nurse-led psychological intervention for type 2 diabetes: a cluster randomized controlled trial (Diabetes-6 study) in primary care. *Br J Gen Pract.* 2018;68(673):e531-e40 (doi:10.3399/bjgp18X696185).

26. Jones A, Gladstone BP, Lubeck M, Lindekilde N, Upton D, Vach W. Motivational interventions in the management of HbA1c levels: a systematic review and meta-analysis. *Prim Care Diabetes.* 2014;8(2):91-100 (doi:10.1016/j.pcd.2014.01.009).