

Effectiveness of a Diabetes Education and Oversight Program to Improve Glycemic Control in
Adults with Uncontrolled Type 2 Diabetes

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Abstract

Purpose: The purpose of this pilot project was to measure the effectiveness of a diabetes education program that included close oversight of glycemic control amongst adults with uncontrolled type 2 diabetes.

Methods: A pilot study using pre/posttest design was implemented over a 4-week period for each participant (n=11). A simplified version of the Michigan Diabetes Knowledge Scale was utilized to test diabetic knowledge in a True/False/Don't Know format. Patient education utilized two handouts from the American Diabetes Association (ADA) and close oversight occurred through weekly telephone interviews of each participant.

Results: Posttest scores from the Michigan Diabetes Knowledge Scale exhibited an 8.7-point mean increase from pretest scores ($p=0.07$). Total mean glucose (n=11) from week 1 demonstrated a decrease of 14.3 mg/dL (0.79 mmol/l) ($p=0.25$) by week 4 as pre-lunch glucose demonstrated a statistically significant decrease ($p=0.01$).

Conclusions: Close oversight of individuals with type 2 diabetes may improve mean glucose averages in the fasting, pre-lunch, pre-supper, and bedtime states. Telephone encounters proved more effective over the use of educational handouts when participants were asked to compare the usefulness of both methods.

Background

According to the Centers for Disease Control and Prevention (CDC), diabetes has been diagnosed in approximately 30 million Americans and 90-95% of those diagnosed are known to have type 2 diabetes.¹ Diabetes is a growing concern in the United States population as the prevalence rate of diabetes has doubled between the years 1990-2008.² Within the past several years, primary prevention efforts have shown a decline in diabetic incidence rates in the U.S.² Diabetes education and oversight by clinicians may be attributed to the recent plateau of the diabetes prevalence rates in America. When diagnosing diabetes, most clinicians use the hemoglobin A1c standard. The International Diabetes Federation notes a hemoglobin A1c > 6.5% is the basis for a diabetes diagnosis.³ Additionally, worsening of B-cell function gradually deteriorates throughout the duration of the disease independent of treatment.⁴ Unfortunately for those diagnosed with type 2 diabetes, the mortality risk increases two to three-fold as their life expectancy decreases by 10 years.⁵

When comparing group vs. individual based diabetic educational programs, the research appears mixed as to which method of intervention produces the best results. Odgers-Jewell et al⁶ performed a systematic review comparing group-based interventions vs. individual based interventions (n=8,533). Interestingly, there was a greater reduction in hemoglobin A1c in group-based education at 6-10 months. Conversely, Kempf et al⁷ performed a 12-week trial of individual lifestyle interventions known as the self-monitoring of blood glucose (SMBG) program (n=405). The trial reported a statistically significant result ($P < 0.001$) in hemoglobin A1c reduction by 0.3% and further concluded this type of structured lifestyle intervention is applicable to motivate individuals with type 2 diabetes.⁷ Therefore, education and close oversight

for improving glycemic control should be a major focus to improve long term outcomes for this patient population whether in a group or individual format.

Purpose

The purpose of this pilot project was to measure the effectiveness of a diabetes education program that included close oversight of glycemic control amongst adults with uncontrolled type 2 diabetes

Methodology

Design

This project was a pre/posttest design. Approval was obtained by the University of Massachusetts, Lowell IRB. Approval was also obtained by the endocrinology practice where the project took place. A pre/posttest questionnaire (simplified Michigan Diabetes Knowledge Scale) was administered to participants on the initial and final encounters. Two educational handouts from the ADA were the basis of the initial and ongoing education and were provided to the participants on the initial assessment. Time between the initial and final assessments occurred over a 4-week period for each participant. Participants were contacted through telephone interviews on a weekly basis by the student investigator (Endocrinology Nurse Practitioner). Through these telephone encounters, participant's fasting, pre-lunch, pre-supper, and bedtime glucose trends were reviewed on a weekly basis. Further, pharmacologic titrations and additional education and support occurred during each of these telephone interviews.

Sample

Convenience sampling was utilized for this project. Eleven individuals (2 men and 9 women), with a mean age of 53, were recruited to participate in the project. Individuals were invited to participate if they met the following criteria:

- 1) Male or female age 18 or above with a new or previous diagnosis of type 2 diabetes
- 2) A recent hemoglobin A1c of 7% (53 mmol/mol) or greater within the past 6 months
- 3) Able to demonstrate compliance with his/her diabetic medications (diabetic medications do not include blood pressure or lipid lowering agents)
- 4) Acceptable diabetic regimens include insulin, oral glucose lowering agents, combination therapy of insulin and oral glucose lowering agents, or diet controlled (no medications)
- 5) Cannot be on an insulin pump therapy
- 6) Able to speak and understand English

Participants were invited to participate at the beginning of his/her routine office visit by a member of the office/medical staff. If the participant agreed to participate and subsequently met the inclusion criteria, consent was obtained, and the initial assessment occurred between the participant and investigator.

Setting

This project was conducted on an outpatient basis, in an endocrinology practice located in Massachusetts. All medical clinicians of the practice are trained in the field of endocrinology, specifically with the management of type 2 diabetes in adults.

Measure

The simplified Michigan Diabetes Knowledge Scale was utilized to measure participants pre and post intervention knowledge of diabetes. The simplified version of the Michigan Diabetes Knowledge Scale is comprised of twenty true/false/don't know questions. All twenty questions of the diabetes knowledge scale pertained to the knowledge of diabetic medications, diet, compliance, and potential negative health effects of having diabetes.

The measure has a reported internal reliability for the simplified knowledge scale of 0.71 (Cronbach's alpha).⁸ In addition, the researchers also found the simplified scale was easier to complete as the non-simplified scale had more non-responses.⁸

Intervention

Education initially occurred during the first office encounter utilizing two handouts (2 pages in length each) from the ADA; handouts were provided to the participant. One of the educational handouts overviews the dietary and exercise habits involved with improving glycemic control (Taking Care of Type 2 Diabetes⁹) while the other handout reviews the significance, management, and monitoring of type 2 diabetes itself (All About Blood Glucose¹⁰). Both handouts were provided at the same time, at the conclusion of the initial assessment.

Participants were encouraged to review the educational materials to promote an independent learning approach. An independent approach to learning was encouraged for this project as a systematic review of 31 randomized controlled trials revealed that those involved in a Diabetes Self-Management Education (DSME) program improved his/her hemoglobin A1c by 0.76% on direct follow-up.¹¹

With respect to close oversight, weekly telephone encounters were performed as the subsequent intervention, over the course of a 4-week period for each participant. Telephone encounters occurred during regular office hours of the medical practice; which was Monday-Friday from 9am-4pm. The participants were encouraged to contact the investigator during regular office hours if needed. Telephone encounters for the first three weeks consisted of eight follow up questions that involved the review of the participant's glucose trends, compliance, and diet. During the last encounter, questions 1-8 were congruent with the previous three weeks as the ninth question focused on the impact of the telephone encounters versus the educational handouts.

Participants monitored their own glucose at home, as the frequency of monitoring was determined based on their diabetic regimen (oral pharmacologic therapy may only warrant 1-2 glucose checks a day as insulin therapy may warrant 3-4 glucose checks a day due to a higher risk for hypoglycemia). In addition, participants were asked to self-monitor his/her blood glucose (SMBG), as this type of monitoring can be easily obtained by the patient at any time of the day and account for any wide fluctuations with respect to their blood glucose.¹² Further, this self-monitoring system allowed for the participants to easily report to the investigator his/her glucose ranges. For those participants on diabetic medications (insulin or oral diabetic agents), titrations

to their pharmacologic therapy were performed by the investigator if deemed appropriate and within practice guidelines.

Results

IBM SPSS (version 25) was used to examine data. As noted, a total of 11 participants completed the 4-week study. The mean simplified Michigan Diabetes Knowledge Scale pretest score was 82.2%, as the mean posttest score demonstrated an 8.7-point increase to 90.9%. There was no statistical significance ($p=0.77$) when mean test scores were compared through paired sample t-test analysis.

Total mean glucose for week 1 ($n=11$) was 180.2 mg/dl, as the total mean glucose for week 4 trended down to 165.9 mg/dl. The result was not statistically significant ($p=0.25$). Pre-lunch glucose demonstrated the highest level of improvement with a 28.5 mg/dl (1.58 mmol/l) decrease from week 1 to week 4 ($p=0.13$). Fasting glucose showed a 19.3 mg/dl (1.07 mmol/l) decrease ($p=0.7$), pre-supper showed a 4.4 mg/dl (0.24 mmol/l) decrease ($p=0.73$), as bedtime glucose demonstrated a 16.9 mg/dl (0.94 mmol/l) decrease ($p=0.82$) in mean glucose over a 4-week period.

Ninety eight percent of participants reported taking their diabetic medications as prescribed. Only 9% of participants reported an episode of hypoglycemia (glucose < 45 mg/dl) throughout the duration of the project; 80% of participants reported they were compliant with his/her diabetic diet. Only one participant reported the educational handouts had a greater influence on his/her diabetic knowledge and glycemic control versus weekly telephone encounters.

Discussion

Mean posttest scores from the Michigan Diabetes Knowledge Scale did show an improvement of approximately nine points, though the amount of improvement was not statistically significant. There was notably a high compliance rate with participants taking their diabetic medications as prescribed, in addition to maintaining a diabetic diet. It should also be noted that hypoglycemia was minimal throughout the study. Only one participant reported the ADA handouts were most beneficial throughout the study (versus weekly telephone encounters) for improved glycemic control and diabetic knowledge.

Total mean glucose amongst all participants from week 1 to week 4 did show a decrease of approximately 14 mg/dL, though this finding was not statistically significant. When comparing each week individually, pre-lunch glucose from weeks 1-4 demonstrated the highest level of improvement with a mean decrease in glucose of 28.5 mg/dL ($p=0.01$). Pre-supper glucose showed the least amount of decrease in mean glucose with a reduction of only 4.4 mg/dL from weeks 1-4. Further, fasting glucose showed a moderate mean glucose reduction of 19.3 mg/dL, though was not statistically significant.

A noted strength of the study may have included behavior changes among participants as compliance rates with medications and diet were high, close oversight and interest from the investigator may have encouraged greater compliance. Participants of this study overwhelmingly favored weekly telephone encounters for improved diabetic knowledge and glycemic control. This may suggest that clinicians should consider telephone encounters to improve patient outcomes, with respect to the management of type 2 diabetes. Further, education in the form of handouts alone may not be as effective as combining written information with close follow-up for improving diabetic knowledge. The results of this study suggest that close oversight of adults

with type 2 diabetes improved, though not significantly, diabetic knowledge and glycemic control, over a 4-week period. Perhaps a longer period of follow-up would yield improved results in glycemic control.

Limitations

The small sample size ($n=11$) of this study may have prevented the attainment of statistical significance when comparing pre-posttest scores and glucose averages. To minimize this limitation, the researcher focused on weekly trends of glucose means versus the significance of paired sample t-tests. In addition, the recruitment of participants occurred in a solo endocrinology practice; therefore, convenience sampling was utilized. Due to this method of recruitment, in addition to having a small sample, generalizability to a broader population of adults with type 2 diabetes is not possible. However, there was an increase in knowledge, an 8.7-point mean increase in posttest scores.

Implications for Practice

The results of this study suggest that close oversight of adults with type 2 diabetes may improve both diabetic knowledge and glycemic control. Although this study focused primarily on type 2 diabetes, clinicians may associate the methods of this study with other chronic diseases for improved patient outcomes.

Through the research, it was evident participants of this study significantly preferred telephone encounters as a means for improved outcomes. The use of educational handouts proved ineffective in this sample as clinicians should consider a different method for education. This may further indicate that patients prefer individual contact from their clinician with respect

to his/her plan of care. As a result, clinicians should highly consider the use of personal contact with their patients over the use of visual methods (such as handouts).

Clinicians may not necessarily utilize weekly telephone encounters as close oversight, though may adopt their own method for managing chronic illnesses. Such methods may include the utilization of nurse practitioners/physician assistants; which of whom can be designated to monitor high risk patients more consistently. Another method may also include the addition of dietitians to the medical practice. Dietitians add a multidisciplinary approach to care and can be used as a great resource for monitoring patient's nutritional status on a steadfast basis. Therefore, the method chosen by the clinician should be tailored based on the type of medical practice, in addition to the type of patient population being treated. It should be noted there is not one superior method to care; however, a systematic and multidisciplinary approach should be used by the clinician as a means for implementation.

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