

Assessing the Effectiveness of Diabetes Education Methods on Type 2 Diabetics' Glycemic Control



Outcomes: A Systematic Review

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ABSTRACT

Objective: To examine the various diabetes education methods used with adults living with 2 diabetes and assess their impact on HbA1c levels, improving glycemic control, and overall quality of long-term diabetes-related success.

Study Design, Setting, Participants and Intervention: Articles published between 2008-2018 extracted from EbscoHost Academic Complete using key words: diabetes interventions, diabetes education, HbA1c levels, blood glucose control, nutrition education, lifestyle education, and adherence. A 6-point inclusion and exclusion criteria, for each, were established. One researcher independently extracted articles, applied exclusion/inclusion criteria on all titles and abstracts, and then assessed for critical appraisal and final selection.

Outcome, Measures, Analysis: Participants were either in the intervention group or the control group. The impact of the education was assessed by measuring HbA1c levels to determine improved glycemic control. Weight, BMI, lipid panels, waist circumference, and fasting plasma glucose levels were also assessed.

Results: A total of 658 articles were found, 107 articles were examined based on their titles and abstracts. Seven articles were included in this review based on critical appraisal and meeting all inclusion/exclusion criteria. All seven studies reported improvements in HbA1c values. Education methods associated with a greater impact on HbA1c levels among adults with type 2 diabetes were structured, specific, and personalized diabetes education.

Conclusions and Implications: This systematic review found that implementing diabetes education that is structured and individualized may improve HbA1c levels and produce long-term success to improve overall diabetes-related outcomes among adults with type 2 diabetes.

INTRODUCTION

Type 2 diabetes remains a public health concern. Despite the number of efforts designed to improve diabetes-related outcomes, the number of individuals living with type 2 diabetes continues to increase. Type 2 diabetes affects 29.1 million adult Americans and is the seventh leading cause of death¹. Achieving a target HbA1c level of 7% or less is crucial in order to maintain glycemic control, however, 50% of individuals do not achieve or sustain this target level²⁻³. Uncontrolled diabetes can lead to a number of micro- and macrovascular complications such as renal failure, retinopathy, neuropathy, foot ulcers, and amputation and effective education strategies remain a necessity⁴⁻⁵.

METHODS

- A 3-step process was used to identify articles that met the inclusion criteria of: (1) participants having type 2 diabetes, (2) participants were adults (18 years or older), (3) randomized control research design, (4) studies measured changes in HbA1c levels, (5) were published in peer-reviewed journals, and (6) articles were issued during 2008-2018.
- Articles were excluded if: (1) participants had type 1 diabetes, (2) participants had gestational diabetes, (3) participants had eating disorders, (4) participants had other chronic disease, (5) changes in HbA1c levels were not measured, and (6) articles were published prior to 2008.
- Articles meeting inclusion and exclusion criteria were independently reviewed for use in this systematic review.
- Data was organized using Covidence software.

RESULTS

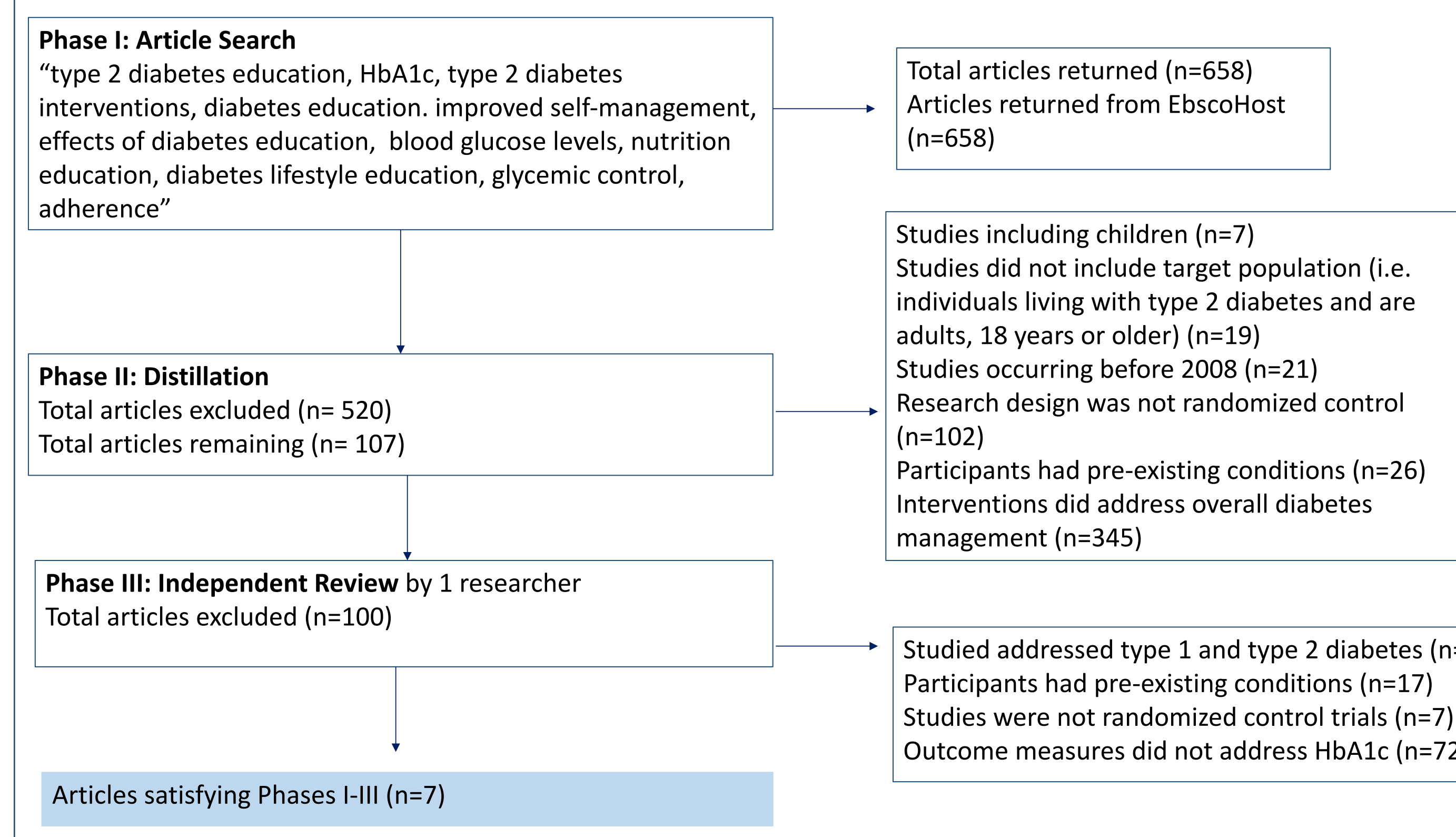


Figure 1. Article Extraction

- 7 articles were included in this review (Fig. 1).
- A total of 2,276 participants were included in the 7 studies.
- Study length ranged from 9 weeks to 18 months.
- The purpose of all studies was to determine the effectiveness of their intervention method on diabetes control indicators including fasting plasma glucose, post-prandial blood glucose and specifically HbA1c.
- All studies were randomized control trials.
- 4 studies included family members.
- 5 studies utilized structured education.
- 1 study used technology.
- The social cognitive theory was used as the basis of 1 education intervention.
- 1 study utilized printed education materials.

Table 1. Summary of Results in Systematic Review (n=7)

Author (Year)	Age & Number of Participants	Study Design & Duration	Intervention Methods	Evaluation Measures	Intervention Outcomes
Abaza et al. (2017)	52 ± 9 years N= 73	RCT 3 months (12 weeks)	-Intervention: received daily diabetes educational SMS messages & reminder prompts to rake tests and record readings -Control: received no SMS messages -Both groups received a introductory booklet of diabetes care instructions and a monitoring table to record blood glucose readings	Weight, blood glucose level, HbA1c	-Decrease in body weight by 1.3 kg in intervention (0.5 kg in control) -Decrease in blood glucose levels by 61 mg/dl in intervention (decrease of 19 mg/dl in control) -Mean drop of -1.05% in HbA1c in intervention group (-0.69% in control)
Adachi et al. (2013)	Intervention: 60 ± 11 years Control: 62 ± 10 years N=193	Prospective RCT 6 months	-Intervention: structured, individual-based lifestyle education all centered around glycemic control -Control: received information on dietary intake estimated using FFQW82 and general advice on glycemic control	HbA1c, BMI, blood pressure, FPG, lipid profiles (LDL, HDL, and TG)	-Greater mean change in HbA1c from baseline in intervention (95% confidence interval) compared to control (-0.7% vs. -0.2%). -No statistically significant changes in BMI, FPG, blood pressure, LDL, HDL, and TG. -Larger energy and fat intake at dinner associated with an increase in HbA1c -Larger vegetable intake at breakfast and whole day associated in HbA1c reduction
Aljha et al. (2012)	Intervention: 51 ± 7 years Control: 55 ± 10 years N=62	RCT 12 weeks	-Intervention: self-care group education to intervention(case) group including lectures, face-to-face, use of films, booklets, etc.; follow-up calls from a nurse -Control: received conventional management and usual education for diabetes	FBG, 2-hour post-prandial blood glucose, HbA1c, patient adherence to treatment	-Reduction in FBG in both groups -Significant reduction in 2-hour post prandial blood glucose and HbA1c (66 mg/dl, 1.4% decline respectively)
Fan et al. (2016)	63 ± 10 years N= 280	RCT 6 months	-Intervention: 1-hour individualized face-to-face diabetes education tailored to personality traits (based on personality assessment); follow-up phone call every month for 6 months; 10 min phone call once a month to address any issues. -Control: 1-hour face-to-face group diabetes education; no personality assessment conducted; follow-up and monthly telephone interviews still conducted.	BMI, waist circumference, blood pressure, FPG and post-prandial blood glucose, blood lipid panel, and HbA1c	-Decreased BMI, waist circumference, FPG, post-prandial blood glucose, blood pressure (p<0.01) in both groups -decreased total cholesterol, TGs, LDL (p<0.01) in both groups -Greater decrease in BMI, waist circumference, FPG, post-prandial blood glucose and HbA1c in intervention group (p<0.05)
Guo et al. (2013)	Intervention: 57 ± 11 years Control: 57 years ± 10 years N= 1,289	RCT 16 weeks	-Intervention: received structured educational program (OPENING program) regarding 7 different modules, and additional individualized complication education; received telephone follow-up calls -Control: received education according to study center's own practices (i.e. insulin injections, SMBG); no telephone follow-up calls	HbA1c, proportion of patients achieving HbA1c levels, changes in FBG, incidence of hypoglycemia	-Significant decrease in HbA1c in intervention (9.38±1.98% to 7.22±1.04%) and control (from 9.46±1.90% to 7.38±1.12%) -Proportion of patients achieving target HbA1c in intervention vs. control 43.81% and 36.86% respectively -Lower final FBG in control group -Hypoglycemic events in intervention and control groups were 2.28 and 1.75 episodes per-person-year respectively
Miller et al. (2009)	Intervention: 56 ± 8 years Control: 60 ± 7 years N= 103	RCT (pre-post test) 9 weeks	-Intervention (immediate group): 9 weekly group sessions (each 1.5-2 hours) addressing self-monitoring, goal setting, portion sizes, CHO counting, GI and factors that influence post-prandial blood glucose -Control(delayed): received same intervention methods just 9 weeks later and served as a control condition	Empowerment, self-efficacy, knowledge, outcome expectations, glucose monitoring, glucose control	-Significant improvement in all knowledge areas, self-efficacy, empowerment and dietary GI values for immediate group -Significant improvement in dietary barrier, family support, and glycemic control -Delayed group saw similar improvements in knowledge, self-efficacy, empowerment and dietary measures -Greater glycemic control improvement in delayed group
Selea et al. (2011)	40-65 years old N= 276	RCT 18 months	-Intervention: received printed education materials "healthy lifestyle with diabetes type 2" -Control: did not receive education materials -Both received a diabetes questionnaire regarding empowerment and patient attitudes -3 modalities: insulin, oral hypoglycemic drug and lifestyle intervention	FPG and HbA1c Required correct answers (RCAs) on questionnaire	-Significantly improved HbA1c (glycemic control) at 3 (8.00 ± 1.66% vs. 9.06% ± 2.23% and 6 (7.67 ± 1.75% vs. 9.06 ± 2.23%) months compared to baseline -RCAs significantly improved after 3 months of the study (64.5 ± 33.7% vs 55.6 ± 33.2%)

RESULTS & DISCUSSION

Commonalities among diabetes education intervention methods



- Lifestyle Changes
- Glycemic Control
- Carbohydrate Counting
- Complications
- Self-Monitoring

Figure 2. Common components of diabetes education in intervention groups.

- Per the inclusion criteria, each study measured changes in HbA1c but also weight, BMI, blood pressure, lipid panels, waist circumference, and fasting plasma glucose. Some studies even assessed qualitative measures such as empowerment and self-efficacy.
- Education interventions discussed in the 7 studies are featured above (Fig. 2).
- Favorable outcomes, lowered HbA1c levels, were demonstrated in all 7 studies and reiterated the need for continuous diabetes education.
- Results indicate that by using specific, individualized diabetes education it was more likely to produce greater changes in HbA1c levels and thus contributing to better glycemic control.
- Education intervention methods included use of technology (i.e. SMS text messaging), group-based education, printed education materials, face-to-face counseling and the use of educational materials, specified education tailored to personality traits, etc.
- Studies demonstrated that successful diabetes self-management requires a great deal of knowledge and support to evoke behavior change.
- Specific, individualized diabetes education allows individuals to maintain long-term HbA1c levels as it instills healthy behaviors and they are provided with the tools and resources to be successful.

CONCLUSIONS AND IMPLICATIONS

Type 2 diabetes continues to rise in incidence affecting millions of adults¹; despite preventative measures and diabetes education, there remains a strong need for effective interventions to delay the onset or progression of the disease to improve diabetes-related outcomes and overall quality of life. Implementing specific, individualized, and structured diabetes education is an ideal intervention style as it produces favorable outcomes of lowered HbA1c levels. This systematic review concluded that there are numerous intervention methods available that produce short-term success, however, the need for long-term, sustained methods remains. Future research should be conducted to examine the effects of diabetes education methods and their ability to maintain improvements in HbA1c levels over a longer period of time, including long-term follow-up appointments as those hold patients accountable to their self-management practices. Providing continuous follow-ups allow patients to ask real-time questions or address concerns that may arise that could demotivate them or hinder their success.

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