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Outcomes in an Interdisciplinary Diabetes Clinic in Rural Primary Care

Dana E. King, MD, MS, Ashley B. Petrone, PhD, Frederick M. Alcantara, MD, Megan M. Elavsky, PharmD, Michelle O. Prestoza, MD, Judy Siebart, MS, RD, and Greg Castelli, PharmD

Department of Family Medicine, West Virginia University, Morgantown, West Virginia.

Abstract

Objective: The purpose of this study was to evaluate the effectiveness of an interdisciplinary diabetes team model of care in assisting patients to achieve improved glucose control in a primary care rural setting.

Methods: A family medicine clinic at a rural university medical center developed an interdisciplinary diabetes team clinic composed of a certified diabetes educator/dietitian, a case manager, a pharmacist, nursing staff, a family medicine resident, a psychologist, and a board-certified family medicine attending physician. Patients were referred if their hemoglobin A1c (HbA1c) was $\geq 9\%$ (75 mmol/mol); patients were seen for an initial consultation and for additional visits as needed.

Results: A total of 94 patients attended an initial visit and at least 1 follow-up within 6 months. Mean age was 57 ± 13 years, and 54% were female. Median time from the initial intensive diabetes clinic visit to a follow-up visit was 2.8 months. There was a significant reduction in median HbA1c percentage from 10.25% (88.5 mmol/mol) $\pm 1.4\%$ (range 73–104 mmol/mol) at the initial intensive diabetes clinic visit to 8.7% (72 mmol/mol) $\pm 1.8\%$ (range 52–92 mmol/mol) at a 1- to 6-month follow-up ($z = -7.161$, $P < 0.001$) and a significant difference between baseline HbA1c (10.25% [88.5 mmol/mol] $\pm 1.4\%$ [range 73–104 mmol/mol]) and latest HbA1c (1–18 months later) 8.4% (68 mmol/mol) $\pm 2.2\%$ (range 44–92 mmol/mol; $z = -7.022$, $P < 0.001$). Overall, 86% of patients had a lower HbA1c at follow-up, and 33% had an HbA1c $< 8\%$ (64 mmol/mol). There were no differences in patients' blood pressure, immunization rates, or lipid values between baseline and follow-up visits ($P > 0.05$).

Conclusions: An interdisciplinary team approach to glycemic control can achieve significant reductions in HbA1c in the rural primary care setting.

Keywords

diabetes care; interdisciplinary care; rural primary care

Correspondence to Dr Dana E. King, Department of Family Medicine, West Virginia University, Morgantown, WV 26505. kingdana@wvumedicine.org.

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In 2007, the American Diabetes Association recommended an interdisciplinary team (IDT) approach to type 2 diabetes mellitus (DM) management. Typically, an IDT includes one or more of the following: physician, pharmacist, nurse, dietician, certified diabetes educator (CDE), psychologist, and case manager working as a team to provide comprehensive type 2 DM care. This team approach addresses the basic requirements and foundations for patients living with DM, including behavioral, dietary, lifestyle, pharmaceutical interventions, and self-monitoring.^{1,2} During the past decade, the results of several studies show that an IDT approach contributes to hemoglobin A1c (HbA1c) level reductions, improved patient reported quality of life and type 2 DM self-management, and reduced hospitalizations compared with patients with type 2 DM treated using a traditional diabetes care model.^{3–8}

IDT outcomes have been identified mainly in urban primary care clinics.^{1,4,5} Experience with IDTs in rural primary care settings has been limited.^{9,10} Providing the IDT model in rural areas presents several challenges because of many factors, including patient finances and education level, geographic access to care, transportation limitations, and effective management of risk factors.^{11–13} Although the prevalence of type 2 DM has increased steadily, access to specialty DM care has not improved.^{14–16} With this enormous public health challenge comes the need to develop effective strategies to manage type 2 DM in the rural primary care setting by effectively adapting the IDT model to the rural setting.

The purpose of this study was to evaluate the effectiveness of an IDT model of type 2 DM care in a primary care rural setting. The main goal was to improve patients' HbA1c between baseline (at time of referral) and follow-up (between 3 and 6 months from baseline) and secondarily to address patient educational needs.

Methods

Study Site

This study was approved as exempt by the West Virginia University Health Sciences institutional review board and took place from June 2014 to October 2017 in the outpatient clinic of the West Virginia University Department of Family Medicine clinic in Morgantown, a town of approximately 30,000 located in rural Appalachia. The department is a patient-centered medical home (National Committee for Quality Assurance level 3) and is staffed by 18 physicians, 18 residents, 20 nurses, 1 dietitian and 1 CDE, 1 psychologist and 1 psychology intern, 1 licensed clinical social worker, and 1 pharmacist.

Clinic Design

The intensive diabetes clinic (IDC) implemented in the Department of Family Medicine facility provides consultation with a team composed of a CDE/dietitian, a case manager, a pharmacist, nursing staff, a family medicine resident, a psychologist, and a board-certified family medicine attending physician. The clinic is scheduled open for 1 half-day per week, held in the Department of Family Medicine office space.

Patients are referred to the IDC by their primary care physicians based on criteria that include newly diagnosed DM, an established diagnosis of DM with failure to achieve

improvement in glycemic control despite at least 6 months of medical intervention, or an HbA1c of greater 9% (75 mmol/mol).

Scheduled patients are seen in the family medicine clinic on a given afternoon. The patients are seen individually in succession by each team member (nursing, dietitian, pharmacy, mental health, physician), not in a group visit. Each patient and his or her essential data (eg, A1c measurement due, eye examination due, flu shot needed) are tracked using a whiteboard to ensure that each patient is seen by all relevant IDC team members and all of the necessary tasks are completed. Upon the patient's arrival at the clinic, a member of the nursing staff administers a brief survey to begin the process of evaluation of the patient's self-care knowledge and educational goals of the IDC appointment. The survey is a 1-page, 30-item self-made survey assessing confidence in self-care on a Likert-type scale regarding several different aspects of caring for DM, such as "I know what kind of diabetes I have" and "I know what to do if my sugar is too low" and similar questions derived from multiple other instruments.¹⁷

The member of the nursing staff also compiles background information consisting of vital signs, medications taken, most recent laboratory results, immunization status (including pneumonia, influenza, shingles), smoking status, and the status of appointments with specialists (Ophthalmology, Podiatry, and Dentistry). If no recent Ophthalmology consult is noted, the nursing staff member performs retinal screening imaging using an office-based telemedicine-linked retinal photography device (IRIS, Intelligent Retinal Imaging Systems, Pensacola, FL). The first "team huddle" determines how to initially assign team members to see patients and in what order. The team usually sees the patient in pairs (CDE/nurse, pharmacist/resident, psychologist, and then the resident/attending), but this varies based upon the patient's individual needs. The CDE/dietitian performs a history of the patient's nutrition, weight, and physical activity and assesses the patient's understanding of DM and blood glucose monitoring. Then, he or she counsels the patient regarding the recommended diet to be used. Further details of the nutrition assessment and education are described in Table 1. Also included is the discussion of issues relating to the patient's access to health care, medications, and testing supplies, commonly with respect to finances, health insurance, transportation, and current living arrangements.

The clinical pharmacist reviews the medications and home blood glucose readings if brought to the appointment, performs medication reconciliation, and does extensive medication and self-monitoring teaching. Further assessments and procedures performed with each patient are described in Table 2. The psychologist then conducts a psychological assessment of the patient's efforts to manage DM to date and provides positive feedback for efforts made. An assessment of stress and mood is performed and more formal surveys are conducted, if indicated.¹⁸ Further details of the behavioral health assessment procedures are described in Table 3.

The family medicine resident then reviews the history; discusses barriers identified by the patient on the self-assessment questionnaire; reviews laboratory results, glucose logs, and medications; and performs a physical examination (including a foot examination).

Once information has been gathered, a second “team huddle” is performed to discuss as a team the barriers identified by each team member, and a plan of action to address those barriers is formulated. This is facilitated by the attending physician. After the huddle, the resident and attending discuss the plan with the patient and field any questions that arise. In most cases, follow-up is scheduled for two more IDC visits approximately 1 month apart. Case management follows up with each patient between visits to address questions or newly identified needs. After the third IDC visit, and if the team agrees (ie, A1c has decreased or no further team interventions are planned), the patient ‘graduates from the IDC clinic care and is returned to usual care with his or her primary care physician.

Outcome Measures

To test the impact of the IDC, we recorded the following measures for each patient at the time of referral or first IDC clinic visit (baseline), at a second IDC visit within 1 to 6 months, and at the most recent clinic visit: HbA1c percentage, systolic and diastolic blood pressure, immunization rates, and blood lipids. Patients also were given a survey to complete and return at the initial visit and after the final IDC visit regarding the care they received.

Statistical Analysis

Statistical analysis was performed using SPSS version 24 (IBM SPSS Statistics, Armonk, NY). Demographic information and clinic retention were expressed as percentages. Outcome variables were tested for normality using a Shapiro-Wilk test. To detect changes in normally distributed variables from baseline, follow-up, and recent, a one-way analysis of variance with repeated measures was used. To detect changes in nonparametric variables from baseline, follow-up, and recent, a Friedman test with post-hoc Wilcoxon signed rank test was used. Statistical significance was taken at $P < 0.05$.

Results

From June 2014 to October 2017, 94 patients were referred to the IDC with an HbA1c $\geq 9\%$ (75 mmol/mol) and attended an initial visit and at least 1 follow-up visit within 6 months. The mean age of the patient population was 57 ± 13 years, and 54% were female. The median time from the initial IDC visit to the follow-up visit was 2.8 months, and the median time from the initial IDC visit to the most recent clinic visit was 18.2 months.

There was a significant reduction in the median HbA1c percentage, from 10.25% (88.5 mmol/mol) $\pm 1.4\%$ (range 73–104 mmol/mol) at the initial IDC visit to 8.7% (71.6 mmol/mol) $\pm 1.8\%$ (range 52–91 mmol/mol) at the 1- to 6-month follow-up ($z = -7.161$, $P < 0.001$). There also was a significant difference in HbA1c between the baseline HbA1c: 10.25% (88.5 mmol/mol) $\pm 1.4\%$ (range 73–104 mmol/mol) and the most recent HbA1c taken any time from 6 to 18 months after the initial visit: 8.4% (68.3 mmol/mol) $\pm 2.2\%$ (range 44–92 mmol/mol; $z = -7.022$, $P < 0.001$). There was no difference in the HbA1c percentage between the 1- to 6-month follow-up and the 6- to 18-month follow-up HbA1c ($P = 0.257$). Overall, 86% of patients had an HbA1c reduction at follow-up after the DM clinic, and 33% had an HbA1c $< 8\%$ (64 mmol/mol). There were no differences in IDC

patients' blood pressure, immunization rates, or lipid values between baseline and follow-up visits ($P > 0.05$)

In addition, 30 of the 94 patients had surveys completed at baseline and follow-up. In this group, 66% of patients reported improvements in DM self-care knowledge from baseline to follow-up ($P = 0.008$). There also was a significant correlation between HbA1c reduction and self-care score improvement ($r = 0.483$, $P = 0.031$), which suggests that the patients who had the largest improvements in knowledge also saw the largest reductions in HbA1c.

Discussion

This study demonstrated an effective intervention to improve HbA1c using an IDT in a rural primary care setting. The multidisciplinary consultation and care resulted in a reduction of >2 percentage points in HbA1c between baseline and follow-up visits that was maintained at subsequent follow-up visits. In addition, the majority of patients had improved knowledge of DM self-care.

These results are consistent with previous studies in primary care and are important for several reasons.^{4,6–8} First, they support the use of IDT care in the primary care setting as a strategy to improve glucose control. A fundamental aspect of the team is interdependence between its members and how the members function together in an integrated manner while still providing individual expertise to support patient-centric goals.^{19,20} Second, the results extend the previous successful use of the model into the rural clinic setting. Because of the complexities of DM, as well as challenges identified in a rural community noted previously, a team approach may more easily identify and navigate the barriers compared with a sole provider.^{11–13,19,20} Furthermore, the documented results show a sustained effect that lasted up to 18 months after the IDT intervention. These results suggest that the IDT model produces a lasting effect on self-care and knowledge of the patients who participated and that the model can succeed in a rural primary care clinic setting. This conclusion is supported by the survey results of improved knowledge after completion of the IDC process.

This study had several limitations, including the length of follow-up limited to 18 months, the incompleteness of follow-up surveys, and the limitations of a before-and-after assessment study design. The length of follow-up was the result of the existence of the IDC clinic for only the last 2.5 years. Additional follow-up will be available in the future as the clinic continues. The completion rate for surveys at follow-up was not ideal, and the high rate of knowledge improvement may be because of a bias of “good responders” being more likely to complete the surveys. In addition, although this is a pre and post design rather than a randomized trial, the HbA1c results were present for all 94 patients, and the results document a clinically and statistically significant improvement in the majority of patients, despite usual care by the physician for months or years before the existence of the IDC clinic.

Conclusions

The implications of these findings are that the IDT model in rural primary care may help to achieve a lasting reduction in HbA1c. The model, if confirmed and adopted more widely,

could have a dramatic impact on complication rates and subsequent healthcare costs, as illustrated in several studies.^{21,22} It is unlikely that the IDT model can be duplicated in rural primary care without support for the time spent by the pharmacist, care coordinator, registered dietitian, and psychologist, who contribute so much to the knowledge and self-care of the patient in this model. Further research will help to evaluate the model further and elucidate the most efficient and effective ways to broaden the approach throughout primary care.

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Key Points

- There was a significant reduction in median hemoglobin A1c percentage from $10.25\% \pm 1.4\%$ at the initial visit to $8.7\% \pm 1.8\%$ at 1- to 6-month follow-up ($P < 0.001$).
- Hemoglobin A1c improvement persisted at follow-up 6 to 18 months after the interdisciplinary care team visits.
- There were no differences in patients' blood pressure, immunization rates, or lipid values between baseline and follow-up visits.

Table 1.**Nutrition, lifestyle assessment, and education in the intensive diabetes clinic**

•	Review of patient's biometrics (weight/height/BMI/BP)
–	If overweight or obese, use motivational interviewing to help patient finds ways to start on a weight-reduction program, using 5%–10% weight loss during the next 3 mo as a goal. Set SMART goals weekly, one for exercise and one for diet.
–	Reduce sodium and increase potassium to help lower BP.
•	Review of pertinent laboratory values (eg, hemoglobin A1c, microalbumin, cholesterol panel, creatinine)
–	Establish short- and long-term goals for hemoglobin A1c based on the patient's age and condition.
–	Establish goals for lipids and dietary/lifestyle patterns to help improve the numbers.
–	If chronic kidney disease is present, adjust diet according to current recommendations.
•	Assess dietary/water intake
–	Customize the carbohydrate level for each patient according to preference, tolerances, and medications used.
–	Encourage consumption of water according to assessed need.
•	Review of tobacco status
–	Counsel patient on the importance of quitting and provide support via the quit line, classes, and nicotine replacement therapy.
•	Review of the glucometer/log book
–	Identify patterns and ways to improve readings.
–	If the patient does not test, use motivational interviewing to help patient recognize that it is an important tool in managing diabetes mellitus.
–	Set goals for fasting, postmeals, preexercise, etc.
–	If patient does not have a meter, then provide one and instruct on the use of it.
•	Review patient's medical records and interview the patient to see whether foot and eye examinations were conducted within the past year.
•	Ask patient about dental health; encourage patient to obtain cleanings/examinations every 6 mo.
•	Assess patient physical activity level
–	Develop a plan to help increase activity per tolerance up to 30 min/d.
–	Set goals for activity.

BMI, body mass index; BP, blood pressure; SMART, specific, measurable, achievable, relevant, and time-bound.

Table 2.**Pharmacy Assessment and Education in the IDC**

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<ul style="list-style-type: none">•••••••••	Review patient's electronic medical record for medication history, preventive screenings, and laboratory findings
	Provide medication reconciliation at time of appointment, including prescribed and over-the-counter therapies and herbal supplements
	Review cost-effectiveness of therapies and make recommendations based on insurance coverage, medication formularies, and available manufacturer coupons
	Counsel patients on new medications including indication, dosing, adverse effects, and monitoring
	Assess home point-of-care blood glucose readings and make recommendations for therapy adjustments
	Educate patients on device administration including insulin, glucagon-like peptide-1 agonists, and glucometers
	Review presentation of hypoglycemia and steps for management
	Complete an adherence assessment and identify barriers for taking medicines/therapies as prescribed
	Offer telephone follow-up for further therapy monitoring (eg, insulin adjustments, new medication tolerability)
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IDC, intensive diabetes clinic.

Table 3.

Summary of the behavioral health process in the intensive diabetes clinic

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- Review the patient's electronic health record to determine whether any previous mental health or substance abuse issues or interventions have been noted
 - Greet the patient and establish rapport
 - Reinforce the efforts the patient has made to date to improve his or her diabetes mellitus
 - Identify barriers the patient is experiencing, and if indicated, administer the Diabetes Distress Scale-2, followed by the Diabetes Distress Scale-17 if the Diabetes Distress Scale-2 is positive
 - Assess mood through the administration of the Patient Health Questionnaire-2, followed by the Patient Health Questionnaire-9 if the Patient Health Questionnaire-2 is positive
 - Assess substance use, stress levels, and support system as relevant to diabetes mellitus management
 - Use motivational interviewing techniques
 - Encourage the patient to identify concrete, measurable changes that they are willing to consider and solicit a commitment to implement those changes
 - Offer a follow-up appointment with a psychologist or mental health professional if indicated
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