Improvements in Care and Reduced Self-management Barriers Among Rural Patients With Diabetes
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ABSTRACT: Context: Improved preventive care and clinical outcomes among patients with diabetes can reduce complications and costs; however, diabetes care continues to be suboptimal. Few studies have described effective strategies for improving care among rural populations with diabetes. Purpose: In 2000, the Park County Diabetes Project and the Montana Diabetes Control Program collaboratively implemented a countywide effort, which included health systems interventions and coordinated diabetes education, to improve the quality of diabetes care. Methods: Clinical data from the diabetes registries in 2 primary care practices, in addition to baseline and follow-up telephone surveys, were used to evaluate improvements in care, outcomes, education, and barriers to self-management. Findings: In the cohort of patients, the proportion receiving the following services increased significantly from 2000 to 2003: annual foot examination (43% to 58%), influenza (30% to 53%), and pneumococcal immunizations (39% to 70%). The median hemoglobin A1c values decreased significantly from baseline to follow-up (7.2% to 6.8%). Mean systolic and diastolic blood pressure decreased significantly over the 2 time periods (139 mmHg to 135 mmHg, and 78 mmHg to 75 mmHg, respectively). Significant decreases were also observed in barriers to self-management, including lack of knowledge (decrease from 12% to 5%), difficulties making lifestyle changes (36% to 27%), cost of monitors and test strips (25% to 16%), cost of medications (37% to 24%), and diabetes education (22% to 4%). Conclusions: Findings suggest that system changes in primary care practices and the implementation of accessible diabetes education can improve care and reduce barriers for rural patients with diabetes.

Several studies have described barriers to providing comprehensive diabetes care in rural settings.1-5 Although much is currently known about the optimal level of care for people with diabetes,6 adequate diabetes self-management can be a challenge for rural patient populations where primary health care access, health care professional shortages, and long distances to specialty services (including diabetes education) are commonly encountered barriers. Because diabetes self-management education has been shown to be

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effective at improving short-term behavioral and physiologic outcomes for patients with diabetes. Decreased access to education is an important barrier in rural settings. In addition, busy rural primary care practices often lack the organizational support and computerized tracking systems to initiate practical interventions to improve diabetes care. Most studies showing improvements in diabetes care and outcomes through systematic monitoring and quality improvement efforts have been conducted in urban settings, and there are few studies showing long-term improvements in diabetes care available to support “translation” of research to clinical practice in rural populations.

Montana is a large rural state with 56 counties, the majority of which are classified as rural or frontier. The Montana Diabetes Control Program, funded through the Centers for Disease Control and Prevention (CDC), has sought out community partners to improve diabetes care in these rural settings. In 2000, the Park County Diabetes Project and the Montana Diabetes Control Program initiated a collaborative effort to improve diabetes care by establishing patient registries in local primary care practices, implementing targeted quality improvement interventions, and improving access to diabetes education services within the county. This report describes effective changes in the delivery of preventive care, improved clinical outcomes, and reduced barriers to patient self-management for county residents from 2000 to 2003.

Methods

Setting. The Park County Diabetes Project, a partnership between 3 primary care clinics, the Livingston Memorial Hospital, and the Montana Diabetes Control Program, initiated a collaborative effort in October 2000 to improve diabetes care and community awareness among Park County residents. Park County is a frontier county with a population of 15,694 (6 people per square mile); 97% of Park County residents were classified as non-Hispanic white according to the 2000 census. Four clinics provide the majority of primary care for county residents. Three of these 4 clinics (a fee-for-service group practice with 6 primary care clinicians, a federally qualified community health center with 4 primary care clinicians, and a small primary care practice in Yellowstone National Park) are participating in this project. Based on an estimated 4.9% statewide prevalence of diabetes among adults, there are an estimated 588 adults in Park County with diagnosed diabetes.

Establishing Diabetes Registries. As part of the collaborative, quality improvement effort, all patients were identified who had 1 or more clinic visits in the past year for which a bill included a diabetes diagnosis code (ICD-9 250.0-259.9). A team from the state Diabetes Control Program provided the practices with patient registry software called the Diabetes Quality Care Monitoring System (DQCMS), which was developed by the state program, and the team also abstracted demographic and clinical information from the medical records of patients with diabetes. The most recent date and the results of key indicators of diabetes care (such as A1c testing, blood pressure, serum lipid, urinalysis, foot and dilated retinal examinations, and immunizations) were noted. The state team entered these indicators into the DQCMS at the group practice and the small primary care clinic, and into the Patient Electronic Care System at the community health center. Both of these electronic data systems support ongoing patient care and quality improvement efforts, as described previously. 

Information about newly identified patients with diabetes was added to the systems as patients presented for care. A 1-page patient summary was generated and placed in the medical record to highlight services due at the next office visit. This sheet became a template to update the registry, thus making current information available for each subsequent visit. Registries in each clinic were maintained by the clinics’ diabetes coordinators, who were nurses already employed by the clinics and assigned to serve as diabetes nursing case managers under the program (upon program initiation, 1 nurse’s salary was paid by funding from the federal Health Resources and Services Administration, which helped support the local project; the second nurse continued to be paid under the clinic’s operations budget). In October 2000, there were 320 patients with diagnosed diabetes receiving care at these clinics, and that number increased to 392 by February 2003.

Changes in the Delivery of Diabetes Care and Education. Beginning in October 2000, the Park County Diabetes Project made a number of changes in the delivery of diabetes care and patient education. These included establishing and maintaining the patient registries described above; nurses conducting mail and telephone outreach to patients in need of services (eg, patients with elevated A1c values); mailing personalized patient education materials regarding the ABCs of diabetes (A1c, blood pressure, and low-density lipoprotein cholesterol [LDL-C] values); and providing ongoing continuing education workshops for the Park County Diabetes health care team. The team included the

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clinical staff within these practices and diabetes educators at the local hospital. Additionally, 4 of the education team members completed short, intensive, training programs in diabetes management and motivational counseling techniques at national diabetes centers.

Community-based activities were also implemented beginning in 2000, including organizing 6 1-day, foot-care clinics for patients with diabetes (194 participants); establishing a lending library for the community with patient education materials; and developing and disseminating a patient newsletter that described current, diabetes-related activities in the community and that highlighted key aspects of diabetes self-management. Park County Diabetes Project team members also conducted numerous activities at worksites and schools and through the local media to increase community awareness about diabetes.

The Park County Diabetes Project team made significant changes in the provision of diabetes education within the community. Previously, diabetes education services were provided through the hospital, and access to these services was limited to patients with the ability to pay. The team redesigned the education curriculum and standardized documentation tools for education, established a team of health professionals as faculty, provided group education sessions in community settings, and offered classes regardless of the person’s ability to pay. The diabetes nurse in each clinic also provided one-on-one diabetes education. The team adopted the national standardized guidelines for diabetes management, and in 2002, the Park County Diabetes team completed the process to become a nationally recognized education program through the American Diabetes Association.

The State Diabetes Control Program provided support to the primary care practices throughout the project. This included establishing the registries, promoting the implementation of quality improvement interventions through regular site visits, providing technical support to the Park County Diabetes Project to establish a recognized diabetes education program through the American Diabetes Association, and conducting the project evaluation.

**Project Evaluation.** Two strategies were used to evaluate the effectiveness of this project. First, clinical data from the cohort of patients with diabetes were analyzed to assess changes in the delivery of preventive services (eg, annual A1c testing, pneumococcal immunizations) and clinical outcomes (eg, A1c, blood pressure, and LDL-C values) from October 2000 to February 2003. The patient cohort consisted of those patients receiving diabetes care throughout the period between October 2000 and February 2003 at 2 of the 3 participating practices. Data from the third clinic, located in Yellowstone National Park, were excluded from this evaluation because the total number of patients with diabetes was small (n<20) and some of these patients were seasonal workers. Patients who were nursing home residents and those who died during the evaluation period were excluded. This left a total 213 patients in the cohort. Data analyses were performed using SPSS v11.5 software (SPSS Inc., Chicago Ill.). Pearson $\chi^2$ tests were used to compare the proportion of patients receiving preventive services in 2000 and again in 2003. Paired t tests were used to compare the mean systolic and diastolic blood pressures between the 2 points in time. The A1c values for patients at baseline were not normally distributed; therefore, we used a nonparametric, statistical test (Wilcoxon signed-rank test) to compare the median A1c values in 2000 to those in 2003.

The second evaluation strategy used 2 telephone surveys of all patients with diabetes, 1 conducted in November 2000 and a second in February 2003. Adapted from the Behavioral Risk Factor Surveillance System (BRFSS), the survey questions were used to assess patient education, self-monitoring blood glucose (SMBG) practices, satisfaction with care, and barriers to diabetes self-management. Before each survey, a letter from physicians in the practices was sent to each patient describing the purpose of the telephone survey. Patients for whom telephone numbers were not available and those who were nursing home residents were excluded from these surveys. The response rates for the 2000 and 2003 surveys were 59% (n = 201) and 62% (n = 235), respectively. At baseline, there were no statistically significant differences between respondents and nonrespondents by age (mean age 64.9 years vs 62.8 years) or sex (female 56% vs 60% female). Additionally, there were no statistically significant differences between respondents to the baseline or follow-up surveys by age (mean age 64.9 years vs 64.4 years) or sex (54% female vs 54% female).

Respondents were asked a series of questions to assess diabetes education, SMBG practices, satisfaction with their care, and self-management barriers. To assess diabetes education, respondents were asked (1) “Have you ever taken a course or class in how to manage your diabetes yourself?” (2) “Has a health care provider ever taught you how to take care of your feet or showed you how to look for sores or irritations?” and (3) “Has a health care provider ever taught you how to monitor your blood glucose or sugar?” To assess SMBG practices respondents were asked “About how often do you check your blood for glucose or sugar? This includes times when it is checked by a family
member or a friend, but not when it is checked by a health care provider.” To assess satisfaction with care, respondents were asked “Overall, how satisfied are you with the care you receive for your diabetes?”

To assess self-management barriers, respondents were asked about a series of potential barriers. “Are you experiencing difficulties in managing your diabetes due to the following: lack of knowledge, treatment plan not working, difficulty making lifestyle changes, lack of support from family or friends, cost of monitor or blood glucose strips, cost of doctor visits, cost of medications, and cost of diabetes education.” Pearson χ² tests were used to compare the proportion of respondents reporting diabetes education, at least weekly SMBG, satisfaction with care, and barriers to diabetes self-management in 2000 to the proportion in 2003.

**Results**

**Patient Cohort.** The mean age of the patient cohort (N = 213) was 65.0 years, and 57% were female. Among these patients, the proportion receiving an annual foot examination, influenza immunization, and a pneumococcal immunization increased significantly from baseline to follow-up (Table 1). A1c and LDL-C testing during the previous 12 months decreased between the 2 points in time. The median A1c values decreased by 0.4 percentage points from baseline to follow-up, and the mean systolic and diastolic blood pressure also decreased during that time. There were no significant changes in the LDL-C values from baseline to follow-up.

**Telephone Surveys.** The proportion of respondents reporting diabetes education, foot care education, SMBG education, and at least weekly SMBG increased from baseline to follow-up (Table 2). Overall, satisfaction with diabetes care also increased (70% vs 77%). The proportion of respondents reporting a lack of knowledge or difficulties making lifestyle changes as barriers to diabetes self-management decreased significantly from baseline to follow-up (Table 2).

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**Table 1. Preventive Care and Clinical Outcomes Among Patients with Diabetes (N = 213) at Baseline (October 2000) and Follow-up (February 2003)**

<table>
<thead>
<tr>
<th>Preventive care</th>
<th>Baseline n (%)</th>
<th>Follow-up n (%)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood pressure screening (past year)</td>
<td>181 (85)</td>
<td>175 (82)</td>
<td>.43</td>
</tr>
<tr>
<td>A1c test (past year)</td>
<td>189 (89)</td>
<td>157 (74)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>LDL-C* test (past year)</td>
<td>133 (62)</td>
<td>108 (51)</td>
<td>.02</td>
</tr>
<tr>
<td>Foot examination (past year)</td>
<td>92 (43)</td>
<td>124 (58)</td>
<td>.002</td>
</tr>
<tr>
<td>Influenza immunization (past year)</td>
<td>63 (30)</td>
<td>113 (53)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Pneumococcal immunization (ever)</td>
<td>83 (39)</td>
<td>150 (70)</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Clinical outcomes</th>
<th>Median†</th>
<th>Median†</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1c (%)</td>
<td>7.2 (6.4-8.5)</td>
<td>6.8 (6.3-7.9)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Systolic blood pressure (mmHg)</td>
<td>139 (19)</td>
<td>135 (19)</td>
<td>.01</td>
</tr>
<tr>
<td>Diastolic blood pressure (mmHg)</td>
<td>78 (11)</td>
<td>75 (11)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>LDL-C* (mg/dL)</td>
<td>113 (41)</td>
<td>109 (37)</td>
<td>.15</td>
</tr>
</tbody>
</table>

* LDL-C indicates low-density lipoprotein cholesterol; † Median (25th to 75th percentiles); ‡ SD indicates standard deviation.

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**Table 2. Telephone Survey of Patients with Diabetes at Baseline (October 2000) and Follow-up (February 2003)**

<table>
<thead>
<tr>
<th>Education, SMBG† practices, and satisfaction with care</th>
<th>Baseline* (%)</th>
<th>Follow-up† (%)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ever taken a class on managing diabetes</td>
<td>37</td>
<td>53</td>
<td>.001</td>
</tr>
<tr>
<td>Ever taught SMBG by health professional</td>
<td>86</td>
<td>94</td>
<td>.005</td>
</tr>
<tr>
<td>SMBG at least weekly</td>
<td>61</td>
<td>74</td>
<td>.006</td>
</tr>
<tr>
<td>Ever taught how to take care of your feet by health professional</td>
<td>69</td>
<td>89</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Satisfaction with diabetes care (very satisfied)</td>
<td>70</td>
<td>77</td>
<td>.10</td>
</tr>
</tbody>
</table>

Barriers to self-management. Are you experiencing difficulties in managing your diabetes due to the following:

- Lack of knowledge: 12% vs 5% (P = .006)
- Treatment plan not working: 12% vs 8% (P = .10)
- Difficulty making lifestyle changes: 36% vs 27% (P = .04)
- Lack of support from family or friends: 8% vs 8% (P = .81)
- Cost of monitor or blood glucose strips: 25% vs 16% (P = .02)
- Cost of doctor visits: 21% vs 15% (P = .08)
- Cost of medications: 37% vs 24% (P = .004)
- Cost of diabetes education classes: 22% vs 4% (P = <.001)

* N = 201; † N = 235; ‡ SMBG indicates self-monitoring of blood glucose.
Barriers resulting from the cost of blood glucose monitors and test strips, medications, and diabetes education also decreased significantly during the course of this project. Other self-management barriers decreased over time (treatment plan, cost of doctor visits), but these changes were not statistically significant. There were no statistically significant changes in the proportion of the patients reporting a lack of family support.

**Discussion**

This is one of only a few studies documenting improved diabetes care, outcomes, and reduced self-management barriers in a rural population. The changes in diabetes self-management barriers are notable, as is the decrease in the A1c and blood pressure values for this patient population over the 3-year period. Although we are unable to quantify the relative contribution of the different activities (eg, registries, clinical interventions, access to diabetes education, or community awareness) to these improvements, we believe that each element contributed to the overall level of improvement. Our findings regarding improved preventive care and A1c values are consistent with the findings from other disease management interventions conducted in urban areas and diabetes self-management education interventions in which A1c values on average were reduced by 0.5 and 0.4 percentage points, respectively.

Rural primary care practices in Montana have been described recently as not adequately following the American Diabetes Association’s guidelines. Our findings at baseline for preventive care and outcomes are similar to those reported in that study, in which 81% of patients had an annual A1c test, less than a third had an influenza or pneumococcal immunization, and the mean A1c, blood pressure, and LDL-C values were 7.4%, 139 per 75 mmHg, and 111 mg/dL, respectively. Both studies actually indicate that rural practices are following the recommendations for care, but that diabetes education is a particular challenge in rural communities. Only 1% of the patients in the previous study had a referral for diabetes education. For rural communities, one of the key areas in which change is needed may be improving access to diabetes education. This could be accomplished through distance communication strategies, such as telemedicine, or through the provision of educational support and resources to assist health professionals to improve their diabetes education skills and their ability to develop quality education programs.

Previous studies have shown that case management services by nurses for patients with diabetes can improve preventive care and clinical outcomes. Because these services are not currently covered by Medicare, providing case management is a major barrier to implementing these services in both rural and urban communities. In the Park County program, case management was provided as part of the diabetes nurses’ regular duties.

There are a number of limitations to this study. First, time-series analyses were used to evaluate the impact of the interventions on preventive care, clinical outcomes, and self-management barriers, and no comparison group was used; therefore, it is possible that the improvements documented here were the result of secular trends. Second, we assessed changes in preventive care and clinical outcomes among the cohort of patients receiving care both in 2000 and 2003. There may be variation in the delivery of care for the entire patient population that is not fully represented in the cohort we assessed. However, a previous study found little variation in diabetes care or outcomes between patient cohorts and cross-sectional patient populations in similar settings. A third, closely related possibility involves selection bias. The patients receiving care in 2000 and in 2003 may not fully represent the cohort of patients initially enrolled in these diabetes registries. Patients who left the care system after 2000 may have had different care and outcome experiences, and thus, the results we report may be biased. Fourth, A1c testing and LDL-C testing decreased from 2000 to 2003, and there may be differences in the cohort of patients who were tested at baseline and follow-up vs those tested only at baseline. However, there were no significant differences in the LDL-C values of those patients tested in both 2000 and 2003 (mean LDL-C = 113, SD = 41) compared to those tested in 2000 only (mean LDL-C = 106, SD = 43, P = .43). A comparison of A1c values between patients tested in both 2000 and 2003 and those tested in 2000 only was not possible, as there were only 2 patients tested in 2000. Fifth, the reliability of collection and entry of clinical data at these primary care practices potentially could have varied over time. Finally, our telephone surveys do not reflect the experiences of patients without telephones, and self-reported information regarding education and self-management barriers is subject to potential recall bias and socially desirable response patterns.

This ongoing, quality improvement effort by the Park County Diabetes Project team will be sustained through the existing resources of the practices and through revenue generated from their diabetes education program, which receives reimbursement from Medicare, Medicaid, and private insurers. The Montana Diabetes Control Program is also
collaborating with 23 additional primary care practices and 2 diabetes education centers in Montana that provide care to more than 7,000 patients with diabetes. Overall this represents approximately 19% of the adult population with diagnosed diabetes in Montana. The State team provides these practices with the DQCMS software, trains staff in the use of the software, performs the medical record reviews to establish the registries, and promotes the implementation of quality improvement interventions through regular site visits. The State program also provides technical support to practices seeking to establish a recognized diabetes education program through the American Diabetes Association, and a peer-mentoring program to help individual health care professionals improve their diabetes education skills. The majority of these practices are multi-specialty, group, or rural primary care clinics that have maintained their registries and implemented interventions to improve diabetes care and outcomes through their existing resources.14,19

In conclusion, our findings suggest that system changes in primary care practices and the implementation of accessible diabetes education can improve care and reduce barriers for rural patients with diabetes on a countywide level. This successful collaboration between the Park County Diabetes Project and the Montana Diabetes Control Program provides a viable model for translating improvements in evidence-based care into many similar rural settings.

References