

Improving Diabetes Care among Low-Income North Carolinians: Project IDEAL

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Abstract

Objectives: Many barriers exist in implementing evidence-based guidelines for diabetes care, particularly for low-income patients. To address this, the North Carolina Project IDEAL (Improving Diabetes Education, Access to Care, and Living) Diabetes Initiative was created.

Study Design/Setting: Fourteen programs representing different types of agencies and intervention strategies across the state participated in the initiative.

Data Collection: Separate random samples of medical charts of participating patients were reviewed at baseline (n=429) and three-year follow-up (n=656) to assess changes in six process (assessment of hemoglobin A1c, cholesterol, blood pressure, and urinary protein; conduction of foot and retina examination) and three outcome (glycemia, blood pressure, and lipid control) measures. Four national guidelines (DQIP, HEDIS, NCEP and ADA) were used as benchmarks.

Results: Large increases were observed for some measures (hemoglobin A1c control and testing, LDL-cholesterol testing), while modest increases were observed for others (dilated eye exam, blood pressure testing, and control).

Conclusions/Relevance: Project IDEAL was successful in improving access to high-quality diabetes care for low-income patients. Additional effort is needed to address specific areas of concern, particularly retinopathy screening.

Key Words: Quality of care, DQIP, HEDIS, NCEP, low-socioeconomic status.

Introduction

As with the rest of the nation, diabetes mellitus is a tremendous public health burden in North Carolina. Over 500,000 North Carolinians have diabetes, and about one-third of them have not been diagnosed. Diabetes is the seventh leading cause of death in the state and accounts for about 14% of all hospitalizations at a cost of about \$1.5 billion.¹ Persons with diabetes in North Carolina have an 80% greater rate of death from stroke, more than twice the rate of death from coronary heart disease, and three times the rate of death from hypertensive heart

disease, compared to those without diabetes.² North Carolina ranks in the top 25% of all states in diabetes mortality. The burden of diabetes in North Carolina is highest or higher, whichever is true, among the state's sizeable population of older adults, ethnic minorities, and persons of lower-socioeconomic status.

Evidence clearly suggests that the implementation of evidence-based guidelines for treatment of persons with diabetes can greatly reduce the risk of chronic complications associated with diabetes,^{3,4} and these guidelines are readily available. However, across a number of different patient populations, there is low adherence to these guidelines, generally as a result of patient- and

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provider-oriented barriers.⁵ Patients may have limited time or transportation to visit their doctor, while providers may be constrained by time or by challenges in communicating prevention strategies to patients. Thus, there is a need to implement unique and creative approaches to address these barriers to reduce the burden of diabetes.

This report describes a unique community-based initiative implemented in North Carolina designed to improve the quality of care and quality of life of many of the state's vulnerable diabetes population. Included in this report are results that describe improvements in the quality of care provided to patients of programs participating in the initiative.

Methods

The Project IDEAL Diabetes Initiative

Beginning in May 1999, The Kate B. Reynolds Charitable Trust funded 14 programs across North Carolina under the Project IDEAL (Improving Diabetes Education, Access to care and Living) Diabetes Initiative that proposed to enhance the delivery of healthcare services to and the quality of life of underserved North Carolinians with or at risk for diabetes mellitus. Organizations that received funding included public and private, non-profit, healthcare organizations that served populations with a substantial burden of diabetes and had evidence of collaboration among community organizations as well as demonstrated sustainability and local commitment. The range of funds provided to the programs during the three years was \$160,000-\$275,000.

The Kate B. Reynolds Charitable Trust contracted with the Wake Forest University School of Medicine (WFUSM) Department of Public Health Sciences to develop, administer, and evaluate the initiative. An advisory committee consisting of representatives of state, federal, and private public healthcare agencies was convened by the management team at WFUSM to provide guidance in the development of the request for proposals, to review proposals received, and to provide technical assistance and continuing education to participating programs.

Each of the 14 programs developed their own unique interventions based on the needs of their community to reach their target populations. Examples of such interventions included: establishing new diabetes education and care programs in existing but underutilized physical facilities; using mobile healthcare units; creating "health depots" (off-site stations where screenings were performed and health information was distributed) in rural communities; staffing satellite sites in community pharmacies, physicians' offices, and other locales; and sending visiting healthcare professionals (e.g., diabetes educators and nurse practitioners) to low-income residential facilities. These interventions are described in more detail elsewhere.⁶

Data Collection

To measure change in quality of care, a baseline and post-intervention chart review was conducted. Since we were unable to conduct an evaluation with separate control and intervention

sites, each of the programs served as their own controls, and data are presented in aggregate for the pre- and post-intervention time period. Each participating program identified their patients with diabetes from a list of patients either at their program site or at a collaborating clinic site. Patients were identified on the basis of having at least one diagnosis of diabetes in calendar year 1998 for baseline and calendar year 2001 for follow-up. Eligibility for the follow-up was based on patients who had participated in the interventions at each site. Program-specific and aggregate baseline reports were provided to each of the programs. Aggregate data for the baseline results have been published elsewhere.⁷ Cases were eligible for project inclusion if they met the following criteria:

- One face-to-face encounter with a diagnosis of diabetes at baseline or follow-up, and
- Over the age of 18 as of December 31, 1998 for baseline and December 31, 2001 for follow-up.

The lists of eligible patients was provided to Wake Forest University School of Medicine staff. For programs with 60 or fewer patients, all patients were included in the evaluation. For programs with more than 60 patients, a random sample of 60 patients was selected from that site. The random sample was created using a random number generator in SAS Statistical Software Program (Cary, NC). Three of the 14 programs did not participate in the baseline evaluation, and two of the 14 did not participate in the follow-up evaluation. Data for the baseline and post-intervention are presented in aggregate.

Demographic information for project cases was gathered from patient records and imported into an electronic data collection tool developed in collaboration with the Medical Review of North Carolina (MRNC), which is the Centers for Medicare and Medicaid Services (CMS)-designated Quality Improvement Organization (QIO) for North Carolina. The tool was developed to capture information on patient characteristics and care processes from primary care medical records. Specially trained nurses and health information management personnel employed by MRNC entered data into the tool. Reliability was conducted using intra-reader assessment of a 10% sample of charts with excellent results.

Quality Indicators

Project IDEAL quality indicators were based on the national Diabetes Quality Improvement Project (DQIP)⁸ and on Health Plan and Employer Data Information Set (HEDIS)⁹ diabetes-related measures. The DQIP indicators represented a common set of comprehensive, evidence-based measures supported at the time of program initiation by the American Diabetes Association (ADA), the Foundation for Accountability (FACCT), the National Committee on Quality Assurance (NCQA), and the Health Care Financing Administration (HCFA). For this project, six process measures [testing for hemoglobin A1c, low-density lipoprotein (LDL)-cholesterol, nephropathy, retinopathy, hypertension, and neuropathy] and three outcome

Table 1.
Summary of Quality Indicators for Project IDEAL Evaluation

Indicator	Description	Considerations
Glycemia Assessment	At least one measurement of HbA1c during study period.	
Glycemia Control	HbA1c <9.5% on most recent test or level of control unknown.	Persons with no HbA1c test during study period were considered to not be in good control.
Lipid Assessment	At least one measurement of lipids during study period.	
Lipid Control	LDL-C <130 mg/dL on most recent test or level.	Persons with no lipid assessment in the study period were considered to not be in good control.
Nephropathy Assessment	At least one screening for diabetic nephropathy during study period via urinalysis or microalbuminuria testing (latter only if indicated).	A positive test for macroalbuminuria was considered acceptable, but a negative test for macroalbuminuria required testing for microalbuminuria. Patients with a documented history of nephropathy per medical record review were excluded from the eligible cases for this measure (the denominator).
Diabetic Retinopathy Assessment	Receiving a dilated eye exam performed by an ophthalmologist or optometrist, or having a 30-degree fundus photography read by an optometrist or ophthalmologist during study period.	Cases meeting the criteria for biennial eye exams (having any two of the following: not taking insulin; HbA1c <8.0%; no evidence of retinopathy on previous year's eye exam) were excluded from calculation of the annual eye exam rate.
Blood Pressure Assessment	At least one measurement of blood pressure during study period.	
Blood Pressure Control	Systolic blood pressure less than 140 mmHg and a diastolic blood pressure less than 90 mmHg.	Persons with no measurement of blood pressure during the study period were assumed to not have good control.
Foot Examination	Having a visual foot inspection, a pedal pulse assessment, and a sensory examination during study period.	

measures [control of: hemoglobin A1c (HbA1c), LDL-cholesterol, and blood pressure] were reported. The quality indicators chosen for this project are consistent with DQIP and HEDIS 1999 diabetes related measures with the addition of blood pressure and foot examination measures. These measures, along with the criteria for documenting compliance for each measure, are described in table 1.

Statistical Analyses

All statistical analyses were performed using the SAS Statistical software program (Version 8.0, Cary, NC). Bivariate chi-square tests were performed to determine statistical significance in the proportion of patients meeting each of the quality of care indicators. In addition, the adjusted proportions at each time period were derived by fitting a random effects logistic

regression model, which took into account clinic cluster correlation and controlled for age, sex, race/ethnicity, and insurance status. The results were obtained by using the SAS macro GLIMMIX, extracting Wolfinger/O'Connell's pseudo-likelihood estimates, estimating the expected adjusted means at baseline and follow-up, and transforming back to the sample proportions.¹⁰ The 95% confidence intervals of the differences in adjusted proportions were found by bootstrapping using the SAS macro BOOT and selecting the default 200 sub-samples. The normal approximation was used to find the upper and lower bound of the confidence intervals.¹¹ Additionally, the bootstrapping procedure allowed for the estimated differences in proportions to be corrected for bias. Ordinary adjusted logistic regression was also performed. As the results were similar and the variance estimates from the mixed logistic regression analyses are preferred, only the latter results are presented here.

Results

Table 2 provides demographic and medical history information for baseline and follow-up samples for the aggregate data. The racial/ethnic distribution was significantly different at follow-up compared to baseline ($p=0.04$), with a larger proportion in the follow-up group of whites and those classified as “other.” The follow-up sample was also significantly older ($p<0.001$) than the baseline sample, which is reflected in the greater proportion of patients at follow-up on Medicare. Patients at follow-up were also less likely to be on insulin therapy ($p=0.02$).

Quality of care indicators for baseline and follow-up are described in Table 3. All indicators increased from baseline to follow-up. Testing of HbA1c significantly increased from 52.7% at baseline to 72.0% at follow-up (unadjusted difference:

+19.3%; adjusted difference: +39.3%, 95% Confidence Interval [CI], 31.7-47.0%). This is a modest estimate of HbA1c testing, since this indicator refers to at least one test per year. HbA1c control increased from 39.6% at baseline to 64.9% at follow-up (unadjusted difference: +25.3%, adjusted difference: +37.5%, 95% CI, 30.6-44.4%). Since persons without an HbA1c measure were considered not in control, we only examined those with at least one HbA1c measurement. If missing values for HbA1c were ignored, control increased from 74.7% at baseline to 89.2% at follow-up. Using more intensive thresholds,³ control to less than 8% increased from 26.0% to 55.0%, and control to less than 7.0% increased from 13.6% to 36.3%.

Measurement of lipids increased from 44.5% at baseline to 56.7% at follow-up (unadjusted difference: +12.2%, adjusted

Table 2.
Patient Descriptors for Baseline and Follow-up Samples

	Baseline (1998) (n = 429)	Follow-up (2001) (n = 656)	χ^2 P-value
Race/Ethnicity			
African-American	43.8%	35.8%	0.04
White	46.9%	52.4%	
Hispanic	1.6%	1.2%	
Other	7.7%	10.5%	
Gender			
Male	31.9%	34.0%	0.48
Female	68.1%	66.0%	
Age			
< 45	26.3%	13.4%	<0.001
45 – 64	49.4%	50.1%	
65 +	24.2%	36.3%	
Median Age (Years)	53	59	<0.001§
Medical History			
Insulin Use	29.6%	23.1%	0.02
Current Smoker	21.9%	13.1%	<0.001
History of CAD*	19.1%	14.8%	0.06
History of Hypertension	63.6%	62.8%	0.78
History of Nephropathy	6.3%	7.6%	0.40
History of Neuropathy	6.3%	6.9%	0.71
History of Peripheral Vascular Disease	3.7%	4.1%	0.75
History of Non-Traumatic LEA**	0.9%	0.2%	0.12§§
Insurance Status			
Medicaid, Medicare, HMO	25.4	39.6	>.001
Other	66.0	33.8	
Not Indicated	8.6	26.4	

*CAD denotes Coronary Artery Disease

**LEA denotes Lower Extremity Amputation

§ Test of Medians

§§ Fischer Exact Test used due to low frequencies

Table 3.
Percentage of Patients Meeting Quality Indicators at Baseline and Follow-up

Quality Indicator	Baseline	Follow-up	Absolute Difference	Adjusted Difference (95% Confidence Interval)
Hemoglobin (HbA1c) Test	52.7%	72.0%	+19.3%	39.3 (31.7-47.0)
HbA1c Control	39.6%	64.9%	+25.3%	37.5 (30.6-44.4)
Lipid Assessment	44.5%	56.7%	+12.2%	19.7 (13.0-26.3)
LDL Cholesterol (LDL-C) Test	23.6%	41.8%	+18.2%	21.6 (1.5-41.7)
Nephropathy Assessment	8.0%	25.4%	+17.4%	17.0 (10.1-24.0)
Dilated Eye Exam	6.3%	7.3%	+1.0%	4.3 (1.2-7.5)
Blood Pressure Testing	77.9%	82.8%	+4.9%	19.5 (9.7-29.3)
Blood Pressure Control	37.1%	43.6%	+6.5%	7.0 (0-14.1)
Complete Foot Exam	3.3%	21.2%	+17.9%	13.2 (6.7-19.6)

difference: +19.7%, 95% CI, 13.0-26.3%). While 23.6% of the baseline sample had LDL-C within accepted levels at baseline, that indicator increased to 41.8% at follow-up. Control of LDL-C below 100 mg/dL, consistent with Adult Treatment Panel (ATP) III guidelines,¹² increased from 9.1% to 24.4%.

Two of the most problematic indicators identified at baseline were nephropathy and retinopathy assessment. Nephropathy assessment increased dramatically, from only 8.0% of the aggregate baseline sample to 25.4% of the follow-up sample (unadjusted difference: +17.4%; adjusted difference: +17.0%, 95% CI, 10.1-24.1%). The percentage of documented dilated eye exams only increased from 6.3% to 7.3% (unadjusted difference: +1.0%; adjusted difference: 4.3%, 95% CI, 1.2-7.5%); however, the percentage of patients receiving a recommendation for an eye examination nearly quadrupled, from 4.9% at baseline to 19.0% at follow-up (data not shown).

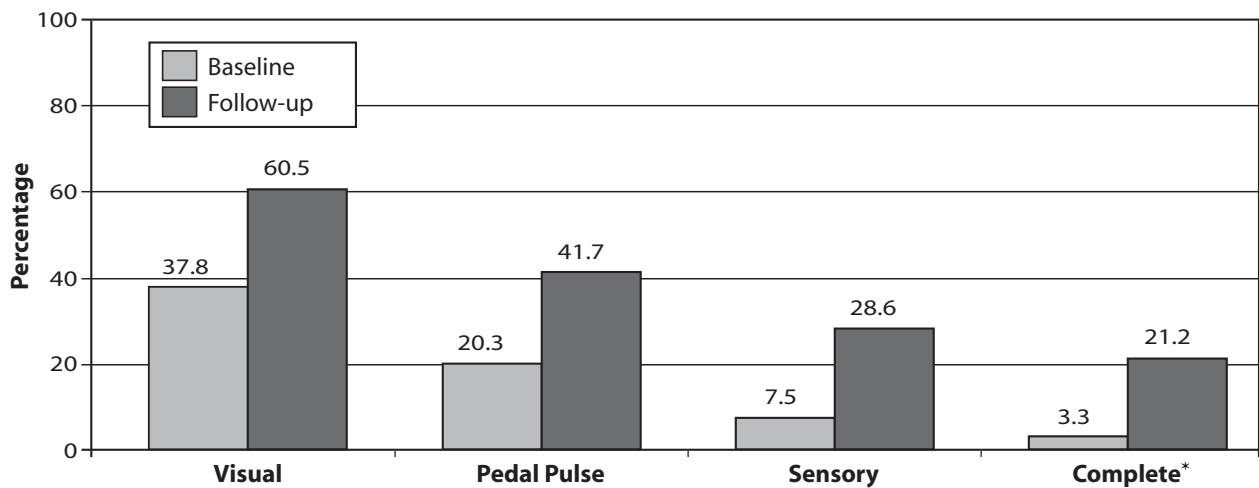
The vast majority of patients received a blood pressure measurement during both study periods. Blood pressure control

(defined as systolic blood pressure less than 140 mmHg and diastolic blood pressure less than 90 mmHg) increased from 37.1% at baseline to 43.6% at follow-up, although this difference was not statistically significant. Using the more recent JNC VI high blood pressure recommendations¹³ (systolic blood pressure less than 130 mmHg and diastolic blood pressure less than 85 mmHg), the percentage of patients with good control increased from 22.8% to 27.9%.

Foot examinations were another area of concern in the study population. Complete foot exam (having a visual, pedal pulse, and sensory exam) increased from only 3.3% at baseline to 21.2% at follow-up (unadjusted difference: 17.9%; adjusted difference: 13.2%, 95% CI, 6.7-19.6%). All three types of foot exams increased from baseline to follow-up (see figure 1). The most common examination was a visual inspection (37.8% at baseline, 60.5% at follow-up), followed by an assessment of pedal pulses (20.3% at baseline, 41.7% at follow-up).

Further examination of the control measures revealed that

Figure 1.
Distribution of Various Types of Foot Examinations among Project IDEAL Participants, Baseline and Follow-up



* Complete means having all three assessments within the study period.

few patients met all the criteria for adequate control (data not shown). Using the more stringent criteria (HbA1c less than 7%, systolic blood pressure less than 135 mmHg, and LDL-cholesterol less than 100), only 1% of patients met all of those criteria at baseline, and 5% met those criteria at follow-up. Using more conservative criteria (HbA1c less than 8%, systolic blood pressure less than 140 mmHg, and LDL-cholesterol less than 130 mg/dl), 3% met those criteria at baseline and 14% met those criteria at follow-up.

Discussion

This study showed modest to significant increases in the quality of care provided to low-income patients with diabetes among participants in a statewide diabetes initiative. This is important because the dramatic increase in the prevalence of diabetes in recent years translates to tremendous increases in future healthcare costs related to treatment of diabetes and its complications.¹⁴ Reducing the complications of diabetes requires a strong, concerted effort from both the healthcare provider team and the individual with diabetes. While implementation of diabetes clinical guidelines, which are readily available to primary and specialty care providers, has been proven to be effective in reducing the risks associated with diabetes,^{3,4} many barriers exist. Racial and ethnic differences in access to and use of healthcare services occur and disproportionately affect the underserved. Low health literacy prevents many patients from making full use of the latest treatments and up-to-date clinical information on their illness. Additionally, provider barriers such as limited clinic time with patients, inability to manage multiple guidelines, and negative perceptions of patients influence healthcare providers' implementation of diabetes care guidelines.¹⁵

General awareness regarding health-related issues and the benefits of accessing healthcare services could be improved through culturally appropriate community-based outreach and education programs.^{16,17} However, each community will face a unique set of barriers, which precludes a one-size-fits-all solution. Healthcare delivery customized by local health leaders, but based on proven guidelines (the method demonstrated in Project IDEAL), may be necessary to achieve maximal benefits for racially diverse and medically underserved populations.

A number of studies have shown that adherence to clinical guidelines is poor for patients with diabetes, and this pattern appears to be consistent across a variety of populations. A sample of these studies is reviewed briefly here. Using the claims from Medicare beneficiaries in 1997-1999, Arday and colleagues¹⁸ observed that only 67.8% of patients with diabetes received an annual HbA1c test, 68.3% received eye exams, and 56.8% received a lipid profile. In an assessment of quality of care among patients at 55 mid-western federally-funded community health centers, Chin and colleagues¹⁹ found that 70% had at least one measurement of HbA1c, 26% had a dilated eye examination, and 51% had received some type of foot care. Using HMO data in California, Peters and colleagues,²⁰ found that 44% of patients with diabetes had received at least one HbA1c test,

48% had received a test of urinary proteins, and only 6% had received at least one foot examination. Consistent with these data, we also found low levels of adherence to diabetes care guidelines⁷ in the baseline sample of low-income, largely ethnic minority patients selected for this project.

Our study has a number of limitations that must be taken into consideration. First, this study did not have a true control group, so the outcomes could have been attributed to factors other than the intervention, such as possible increased awareness of diabetes care in the community and in the healthcare arena, implementation of other local diabetes initiatives, and availability of additional healthcare resources. Also, since all sites participated in the intervention and, thus, were not blinded to treatment group as in a randomized placebo-controlled trial, there is the possibility that outcome measures were more aggressively pursued and recorded to enhance the results of the program initiative. However, this is somewhat unlikely given that systematic improvements were not shown in this study and that these data come from chart review and not from self-report by providers. In most cases, individuals coding data into the medical chart were not directly associated with the study.

The programs participating in Project IDEAL developed and implemented their own unique interventions with financial support from The Kate B. Reynolds Charitable Trust and technical support and evaluation from the Wake Forest University School of Medicine. Many opportunities for improvement were identified in the baseline data from 1998. Follow-up aggregate data revealed significant improvement for most quality indicators that supports the overall program intent: to deliver appropriate diabetes care and services to underserved North Carolinians. However, given the rather conservative assessment of quality care in this report, there is still much room for improvement. Also, the lack of an observed improvement in assessment of diabetic retinopathy indicates that this might be an area for future targeted interventions.

Conclusions

This study has a number of limitations which affect the generalizability of these results. First, there is insufficient data to test the impact of program-specific interventions. Second, the results reflect short-term changes in quality of care measures, which may not be sustained for extended periods of time. Third, these data were limited to medical chart reviews in primary care facilities, which may not adequately reflect the level of care being administered. Nonetheless, these results support the contention that programs that customize the delivery of healthcare to fit the unique needs of the community, such as demonstrated in Project IDEAL, can be successful in improving the quality of care that patients, particularly those of low-income communities, receive in primary care settings. Mechanisms for dissemination and maintenance of these approaches are needed to broaden the impact of diabetes control efforts in the population. **NCMJ**

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