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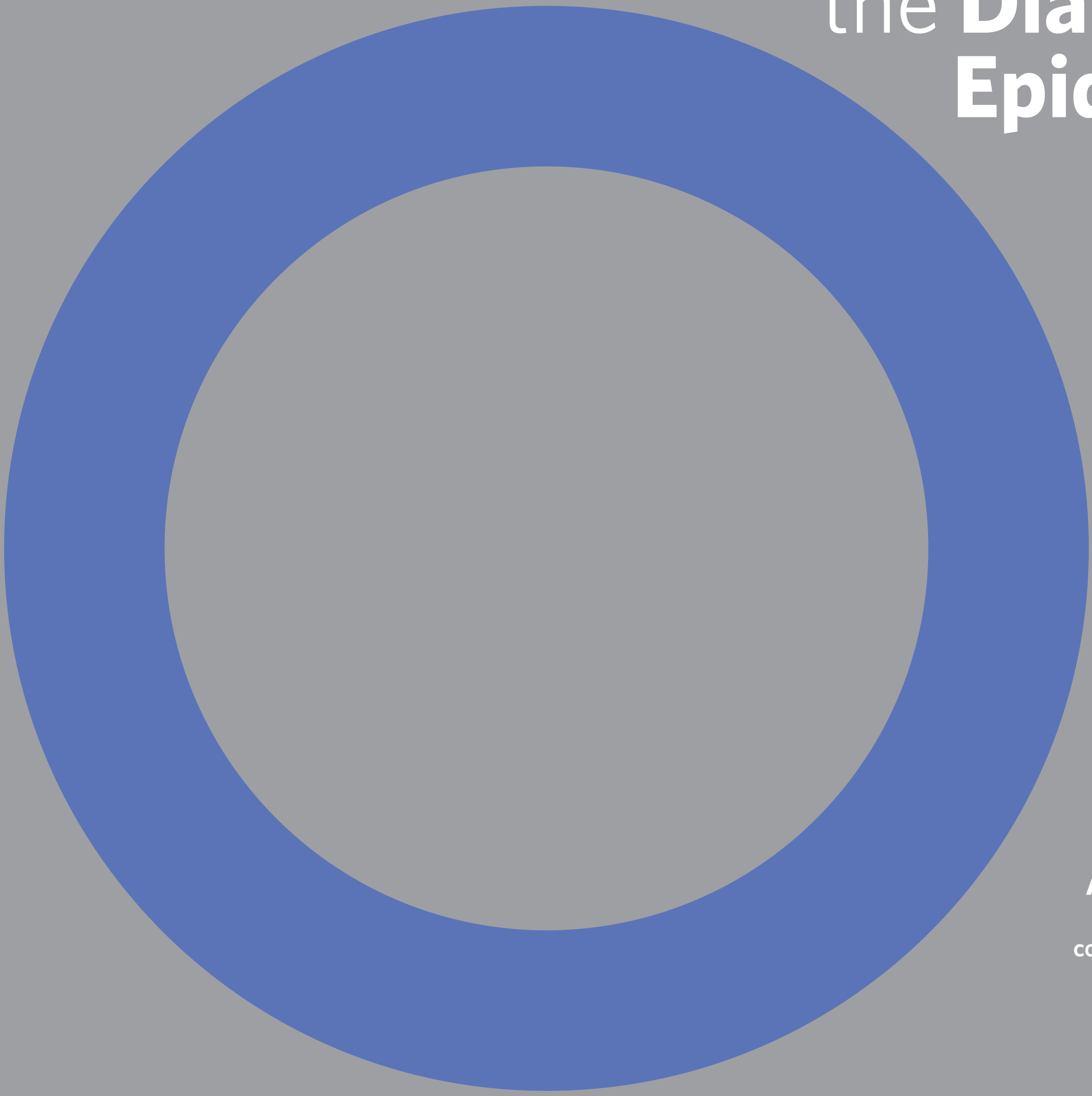
a journal of health policy analysis and debate

Confronting the Diabetes Epidemic



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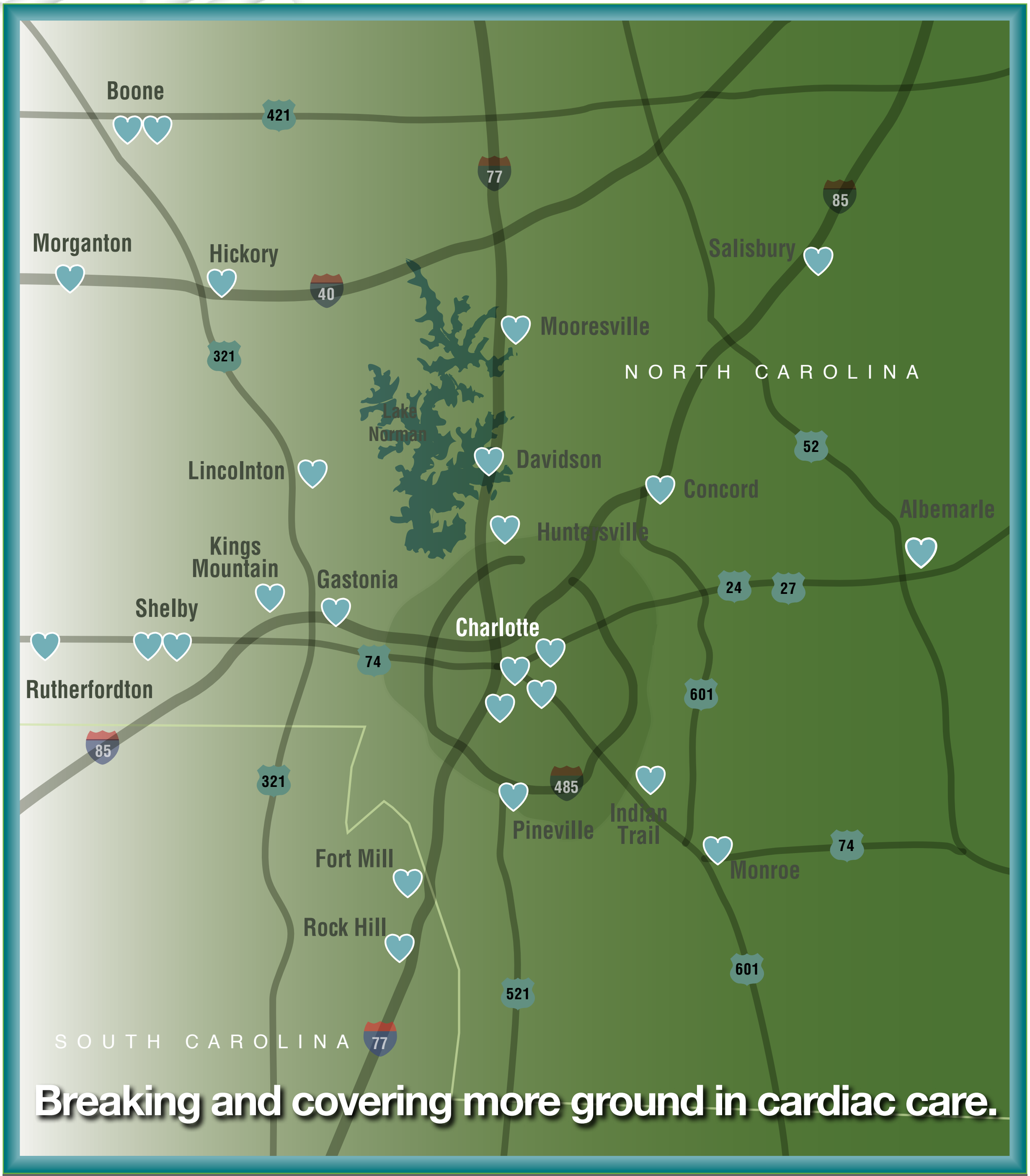

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Confronting the Diabetes Epidemic

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On the cover. The blue circle is the universal symbol for diabetes. The symbol was created in 2006 by the International Diabetes Federation (IDF) to give diabetes a common identity and to provide a means of showing support for the fight against diabetes. The symbol was originally developed for the campaign that resulted in the passage of United Nations Resolution 61/225, which recognizes November 14 as World Diabetes Day. The IDF holds all rights to the blue circle for diabetes. Find out more about the symbol at http://www.idf.org/blue-circle.

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Eat Smart, Move More **Health Tip**

Choose to Move More Every Day

Physical activity is essential for all of us. Children, adults and seniors can benefit from moderate activity every day. Take a walk with a friend, take the stairs instead of the elevator, or work in your yard. Dancing works too and is great fun! Thirty minutes or more of motion for adults and 60 minutes for children on most days can help keep you in shape and feeling good. Can't find a 30 minute chunk of time? Break it up throughout the day.

For more tips on how to move more every day where you live, learn, earn, play and pray, visit

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NORTH CAROLINA ™

Tar Heel Footprints in Health Care

*A periodic feature that recognizes individuals whose efforts—
often unsung—enhance the health of North Carolinians*

Carolyn Dunn, PhD, MS

Many North Carolinians have heard of Eat Smart, Move More, North Carolina, a movement that aims to prevent and reduce obesity in the state (available at: http://www.eatsmartmovemorenc.com); Eat Smart, Move More, Weigh Less, a 15-week weight management program (available at: http://www.esmmweighless.com); and Color Me Healthy, a program that encourages healthy eating and physical activity among preschool children (available at: http://www.colormehealthy.com). One of the main forces behind these programs is Carolyn Dunn, professor and nutrition specialist at the North Carolina Cooperative Extension, North Carolina State University (Raleigh, NC). Dunn is a founding member and past chair of the Eat Smart, Move More movement and coauthor of Eat Smart, Move More, Weigh Less and Color Me Healthy.

Vital components of most beneficial public health activities include the free exchange of knowledge and information among stakeholders and the presence of champions who can help transform the stakeholders' invaluable perspectives into a seamless mission. Surabhi Aggarwal, program manager for Eat Smart, Move More, Weigh Less, says of Dunn that "her passion, expertise, talent, and leadership in the field of nutrition and healthy living have inspired many to lead a healthier life." Dave Gardner, chair of Eat Smart, Move More, North Carolina, highlights the esteem in which Dunn's colleagues hold her views, asserting that, when Dunn speaks, "people listen because they believe and trust in what she has to say." These attributes are integral to what Gardener considers to be Dunn's greatest contribution to Eat Smart, Move More, namely, "the leadership she has provided," particularly with regard to knowing "who and how to bring key players together on an issue." This is crucial because the Eat Smart, Move More movement depends on the guidance and oversight provided by the many individuals and agencies throughout North Carolina that compose the campaign's leadership team.

Dunn chose a career in nutrition because nutrition is "vital to a healthy happy life—what better way to serve than to help people eat smart and move more, 2 things that can improve and lengthen their life?" Dunn leads by example through her passion for healthful cooking and her involvement in physical activities, including cycling, weight lifting, and running.

Dunn received a bachelor of science degree from Meredith College (Raleigh) and a master of science degree and doctorate in nutrition from the University of North Carolina–Greensboro. In 2009, Dunn received the Distinguished Alumna Award for Career Achievement from Meredith College. Dunn and colleagues are the recipients of the Nemours Vision Award for Child Health and the Dannon Award for Excellence in Community Nutrition. Dunn is a member of the Academy of Outstanding Faculty Engaged in Extension and the Sigma Xi research society. NCMJ

Contributed by Rachel E. Williams, MPH, research assistant, North Carolina Institute of Medicine, Morrisville, North Carolina (rachelemilywillams@gmail.com; present affiliation: research associate, SciMetrika, Durham, North Carolina).

Characteristics Associated With Glycemic Control Among Family Medicine Patients With Type 2 Diabetes

Julienne K. Kirk, Stephen W. Davis, Carol A. Hildebrandt, Elizabeth N. Strachan, Madhavi L. Peechara, Richard Lord

BACKGROUND As new payment models are developed for chronic diseases such as diabetes, there is a need to understand which patient characteristics impact glycemic control. This study examines the relationship between patient variables and glycemic control, defined as a hemoglobin A_{1c} (A_{1c}) level of <7%, in a cohort of family medicine patients with type 2 diabetes.

METHODS A total of 1,398 medical charts were selected using *International Classification of Diseases, Ninth Revision, Clinical Modification* codes for diabetes. To gather information not available through chart review, a survey was used to collect data on individual-level characteristics. Information included marital status, education level, income level, insurance status, activity level, receipt of diabetes education, living arrangement, employment status, and annual income. A cross-sectional design was used to obtain, via chart review, data about diabetes outcomes (ie, A_{1c} level, blood pressure, and low-density lipoprotein cholesterol [LDL-C] level).

RESULTS A mailed survey was completed by 669 patients (response rate, 47.9%). Almost half of patients in this sample achieved the goal A_{1c} level, LDL-C level (ie, <100 mg/dL), and/or blood pressure (ie, <130/<80 mm Hg). Medicare insurance (odds ratio [OR], 2.16 [95% confidence interval {CI}, 1.18-3.96]) and female sex (OR, 1.61 [95% CI, 1.01-2.56]) were associated with glycemic control. Other variables, such as annual income, education level, and receipt of diabetes education, that were expected to impact glycemic control were not significantly associated with an A_{1c} level of <7%.

LIMITATIONS The survey response rate was <50%, the study was conducted at a single site, and the chart data were retrospective.

CONCLUSIONS Our findings indicate that Medicare insurance and female sex were associated with glycemic control. Further evaluation is needed to identify determinants that lead to achievement of optimal glycemic control among individuals with type 2 diabetes.

Diabetes is currently the seventh leading cause of death in the United States, as revealed in data from 2007 on US death rates [1]. The incidence of this metabolic disease state is increasing at an epidemic frequency, and it is projected that if the incidence continues to increase, 1 in 3 Americans born in 2000 will have received a diagnosis of diabetes by 2050 [2]. Multiple organizations have put forth recommendations for diabetes-associated quality of care measures [3, 4]. The outcomes related to process-of-care measures among persons with diabetes have been evaluated in several studies, and findings indicate that overall goals are not being met and that disparities exist in the control of hemoglobin A_{1c} (A_{1c}) levels among minority populations [5, 6]. Despite the availability of evidence-based guidelines and vast knowledge about microvascular and macrovascular complications due to this disease, clinical goals for diabetes outcomes are not being routinely achieved in practice.

As health care reform moves forward, there is pressure to develop new payment systems that reward clinicians for achieving certain quality-of-care markers. If clinicians are to be held accountable for helping their patients with diabetes achieve quality outcomes, they need information on patient characteristics associated with reaching these clinical goals. Otherwise, there is no way to appropriately adjust for a clinician's case mix of factors, which are out of their control but impact a patient's ability to reach the targets. For instance, if income has a large impact on a patient's ability to reach certain goals, this needs to be considered before holding the clinician accountable for the patient's clinical outcomes. Information on these factors can lead to identification of patients who may have more difficulty managing their disease and can be helpful in the targeted use of limited resources. The current study uses the determinants-of-health framework to analyze outcomes for persons with type 2 diabetes. The determinants-of-health model states that health is not simply related to the medical care an individual receives but is also impacted by genetics, environment, and lifestyle. A large body of work has used this framework to look at population health outcomes [7-11]. These studies have included determinants such as income level, education level, and unemployment. Models that help predict outcomes of chronic illnesses such as diabetes should include patient-reported variables and their relationship to successful outcomes. Investigations that aid in understanding patient-specific determinants that contribute to an indi-

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vidual's ability to maintain the recommended A_{1c} level are needed.

Individual characteristics that have been evaluated in several studies of diabetes include sociodemographic and psychosocial variables, comorbidities, treatment regimen, behavioral factors, and diabetes duration [6, 12, 13]. Evaluation of age, sex, income level, and insurance status indicates that these factors are associated with poor glucose control, especially among minority populations [12]. Patient factors associated with control of A_{1c} level, blood pressure, and low-density lipoprotein cholesterol (LDL-C) level have also been assessed among managed care enrollees, and findings link age, race, income level, and education level with poor control [6]. As well, health literacy has been found to be independently associated with worse glycemic control [13]. The number of visits to a clinician, use of tobacco, and living status has not been fully evaluated in these trials. To determine whether any of these factors are associated with better control of diabetes, we surveyed a cohort of patients with type 2 diabetes and modeled the impact of self-identified characteristics on the control of their A_{1c} level.

Methods

A combination of data from chart reviews and patient surveys were used in the current study. Data from a primary chart review involving 1,398 patients in an academic family medicine clinic with type 2 diabetes found that having Medicare and being female were associated with better control of A_{1c} level [14]. The university-based family medicine teaching site where the chart review was performed consists of approximately 20 faculty physicians and physician assistants and 30 resident physicians who see patients on a regular basis. The estimated breakdown of payer mix for this practice at the time of chart review was Medicare (27% of patients), managed care (51%), commercial insurance (1%), Medicaid (18%), and self-pay (3%). This site has a total patient population of approximately 26,000 patients and receives approximately 55,000 patient visits annually. All charts for patients with type 2 diabetes were identified, and a survey was sent to each patient 8 weeks after the chart review was completed. The survey tool was created to query patients about factors that may impact their care. Content areas of the survey included socioeconomic characteristics, marital status, exercise level, employment status (including full or part-time), educational achievements, receipt of diabetes education, place of residence, and number and type of people living in the household. Some questions required patients to check off the best answer that applied. For example, when patients were asked about their living status, possible answers were "alone," "live with children," "live with spouse," "live with children and spouse," or "grandchildren live with me." Survey completers received a small incentive in the form of a $10 gift card for use at a local vendor. Surveys were eligible for analysis if they were returned within 6 months after the initial mailing.

The survey variables were chosen on the basis of the determinants-of-health model and health economic theory [15]. The impact of these characteristics on a patient's success in achieving glycemic control was evaluated. An A_{1c} level

TABLE 1.
Demographic Characteristics of 669 Family Medicine Patients With Type 2 Diabetes

Characteristic	Patients, no. (%)
Sex	
Male	264 (39.5)
Female	405 (60.5)
Age	
<65 y	425 (63.5)
≥65 y	244 (36.5)
Race	
African American	269 (40.2)
White	387 (57.8)
Body mass index[a]	
Overweight (≥25 to <30)	154 (23.0)
Obese (≥30 to <35)	272 (40.7)
Morbidly obese (≥35 to <40)	139 (20.1)
Use tobacco	127 (19)
Employed	262 (39.2)
Marital status	
Single	79 (11.8)
Divorced	138 (20.6)
Widowed	83 (12.4)
Married	359 (53.7)
Living status	
Live with children	85 (12.7)
Live with spouse	237 (35.4)
Live with children and spouse	95 (14.2)
Grandchildren live with me	22 (3.3)
Insurance	
Medicaid	29 (4.3)
Medicare	124 (18.5)
Private	458 (91.3)
Education level	
Less than high school	83 (12.4)
High school	171 (25.6)
Some college	197 (29.4)
College graduate	201 (30.0)
Annual income	
<$30,000	195 (29.1)
≥$30,000	410 (61.3)
Weekly exercise level	
<3 h	454 (67.9)
≥3 h	200 (29.9)
Received diabetes education	290 (43.3)

[a] Defined as the weight in kilograms divided by the square of the height in meters.

of <7% was used to indicate glycemic control; this benchmark was established by the American Diabetes Association as the recommended target [16]. Medical charts were selected using *International Classification of Diseases, Ninth Revision, Clinical Modification* codes for type 2 diabetes. Data from 2006 were collected regarding sex, race, body mass index (BMI; defined as the weight in kilograms divided by the square of the height in meters), smoking status, type of insurance, number of clinician visits, medications, A_{1c} level, LDL-C level, and blood pressure. Data from a random sample of 100 patients were cross-referenced for accuracy, and 4 charts were not included in the analysis because inaccurate data were detected. The study protocol was approved by the Institutional Review Board at Wake Forest School of Medicine.

Data analysis. Analyses were performed using SPSS, version 18.0 (SPSS). Descriptive statistics were calculated for all sociodemographic and clinical data. To examine the differences in outcomes between patients who returned the survey (ie, respondents) and those who did not (ie, nonrespondents), the groups were compared with respect to variables such as age, sex, race, BMI, smoking history, and diabetes outcome measures (including LDL-C level, blood pressure, and A_{1c} level), using χ^2 analysis and independent t tests. Logistic regression involving all measured covariates was used to evaluate each measured variable's independent association with glycemic control.

Results

A total of 669 (47.9%) of 1,398 patients completed the survey and were included in this study. Of the original mailed surveys, 28 were returned because of change of address, and 3 were returned by family members who indicated that the patients were deceased. Statistically significant differences between the survey respondents and nonrespondents were found for female sex, glycemic control, and age (P < .05). However, there was a difference of <10% between respondents and nonrespondents with regard to all sociodemographic and diabetes outcome variables. For example, 60.5% of respondents were female, compared with 53.1% of nonrespondents. A total of 57% of the patients to whom the survey was sent were female. The racial breakdown of the final sample was 40% African American, 58% white, and 2% Hispanic or Asian. More than half were female and were <65 years of age (Table 1). The mean age (± standard deviation [SD]) of the study population was 59.8 ± 12.9 years. The BMI was elevated for the majority of the cohort. The average income for approximately one-third of the study population was <$30,000 per year. The mean number of people living in the household was 2.3 ± 1.3.

Bivariate analysis of patient characteristics and sociodemographic variables indicated that race, tobacco use, and insurance type were significantly associated with glycemic control for survey respondents (Table 2). Data from the

TABLE 2.
Bivariate Predictors of Glycemic Control Among Family Medicine Patients With Type 2 Diabetes

Characteristic	Value	Test statistic	P
	Achieved control, % of patients	χ^2	
Sex (n = 599)		.048	.827
Male	47.7		
Female	48.6		
Race (n = 586)		11.79	.001
White	54.0		
Black	39.6		
Body mass index (n = 554)		5.67	.129
Normal/underweight	50.0		
Overweight	58.0		
Obese	46.7		
Morbidly obese	45.1		
Use tobacco (n = 599)		5.80	.016
No	50.7		
Yes	38.5		
Marital status (n = 592)		1.12	.290
Not married	46		
Married	50.3		
Living status (n = 589)		.88	.349
Live alone	51		
Live with someone	46.6		
Insurance (n = 597)		30.19	<.001
Private	37.6		
Medicaid	32.4		
Medicare	59.3		
Education (n = 583)		2.30	.512
Less than high school	46.2		
High school	46.6		
Some college	46.0		
College/graduate school	53.0		
Annual income (n = 538)		.012	.912
<$30,000	47.0		
≥$30,000	47.4		
Weekly exercise level (n = 584)		2.37	.124
<3 h	46.2		
≥3 h	53.1		
Diabetes education (n = 583)		4.53	.033
No	57.5		
Yes	46.4		
	Clinician visits, no., mean ± SD	t	
Achieved control (n = 599)		1.09	.276
No	6.00 ± 4.26		
Yes	6.40 ± 4.65		

Note. Glycemic control is defined as a hemoglobin A_{1c} level of <7%, based on American Diabetes Association criteria [16].

chart review indicated that the mean number (±SD) of physician office visits during the year before survey completion was 6.4 ± 4.65 for patients with glycemic control and 6.0 ± 4.26 for those without glycemic control (defined as an A_{1c} level of >7%). Among respondents, the mean A_{1c} level (±SD) was 7.5% ± 1.7%, the mean LDL-C level (±SD) was 105 ± 35.7 mg/dL, and the mean blood pressure (±SD) was 131/74 ± 15/10 mm Hg (Table 3). A total of 8.5% of respondents achieved all 3 diabetes outcome goals (ie, an A_{1c} level of <7%, an LDL-C level of <100 mg/dL, and a blood pressure of <130/<80 mm Hg). Data for outcomes was also evaluated by race.

A total of 290 respondents reported receipt of some type of diabetes education (in the form of a class, one-on-one teaching, or both). Receipt of diabetes education was not associated with glycemic control for this cohort of respondents (odds ratio [OR], 0.604 [95% confidence interval {CI}, 0.352-1.04]) (Table 4). Female sex (OR, 1.61 [95% CI, 1.01-2.56]) and Medicare insurance (OR, 2.16 [95% CI, 1.18-3.96]) were associated with glycemic control. No other predictive variables (ie, race, BMI, smoking status, number of clinician visits, education level, annual income, living with another person, marital status, or exercise) were, by logistic regression, statistically significantly associated with glycemic control.

Discussion

In this study of family medicine patients with type 2 diabetes, we analyzed self-reported characteristics and chart review data to identify characteristics associated with glycemic control. On the basis of logistic regression, patient variables that were predicted to impact glycemic control (eg, age, race, living status, receipt of diabetes education, and smoking status) were not statistically significantly associated with this outcome. We found that sex was predictive of glycemic control (Table 3). This relationship might have been impacted by the presence of a greater number of female than male respondents, as this was also found to be significant factor in the bivariate analysis (Table 2). A total of 60.5% of respondents were female, compared with 53.1% of nonrespondents; however, of the total population of 1,398 patients to whom surveys were sent, 57% were female. Medicare insurance was also associated with glycemic control. While the reasons for these findings may include Medicare coverage of regular visits, during which the A_{1c} level is monitored, our model controlled for the number of clinician visits, which was not found to be statistically significant. Different methods of delivering diabetes education have been found to be associated with an increased achievement of glycemic control [17, 18]. The results of this study

TABLE 3.
Quality of Care Measures, by Race, Among Family Medicine Patients With Type 2 Diabetes

Measure (goal[a])	Laboratory value Mean ± SD	Laboratory value Median (range)	Patients achieving goal, %
A_{1c} level, % (<7%)			
Overall	7.5 ± 1.7	7.0 (4.7-14.9)	43.2
African American	7.8 ± 1.9	7.3 (4.9-14.9)	36.1
White	7.2 ± 1.5	6.9 (4.7-12.5)	47.5
LDL-C level, mg/dL (<100 mg/dL)			
Overall	105.1 ± 35.7	100.5 (27.0-297.3)	36.3
African American	115.3 ± 38.3	109.0 (48.0-297.3)	29.0
White	97.8 ± 31.8	93.5 (27.0-213.0)	41.6
Systolic BP, mm Hg (<130 mm Hg)			
Overall	131.4 ± 14.9	130.6 (90.0-190.0)	44.7
African American	135.0 ± 16.0	134.0 (90.0-190.0)	38.7
White	128.9 ± 13.2	128.9 (93.0-176.0)	48.6
Diastolic BP, mm Hg (<80 mm Hg)			
Overall	73.6 ± 9.5	73.5 (46.0-113.0)	69.1
African American	76.7 ± 9.6	77.3 (50.0-113.0)	59.1
White	71.4 ± 8.8	70.9 (46.0-96.7)	75.7
All measures			
Overall			8.5
African American	...	...	5.2
White	...	...	10.6

Note. Data are for 669 patients. A_{1c}, hemoglobin A_{1c}; BP, blood pressure; LDL-C, low-density lipoprotein cholesterol.
[a]Based on American Diabetes Association criteria [16].

TABLE 4.
Findings of Logistic Regression Modeling to Determine Predictors of Glycemic Control Among Family Medicine Patients with Type 2 Diabetes

Characteristic	OR (95% CI)[a]	P[b]
Sex	1.61 (1.01-2.56)	<.05
Race	1.46 (0.960-2.23)	NS
Body mass index		
Underweight/normal	Reference	
Overweight	1.14 (0.506-2.55)	NS
Obese	0.897 (0.419-1.92)	NS
Morbidly obese	0.976 (0.424-2.25)	NS
Use tobacco	0.870 (0.525-1.44)	NS
Insurance		
Private	Reference	
Medicaid	1.18 (0.501-2.77)	NS
Medicare	2.16 (1.18-3.96)	<.05
No. of clinician visits	1.04 (0.993-1.10)	NS
Education level		
Less than high school	Reference	
High school	1.71 (0.834-3.52)	NS
Some college	1.36 (0.670-2.75)	NS
College/graduate school	1.71 (0.804-3.65)	NS
Annual income ≥$30,000	1.13 (0.680-1.88)	NS
Diabetes education	0.604 (0.352-1.04)	NS
Live with another person	0.761 (0.421-1.38)	NS
Married	1.54 (0.885-2.69)	NS
Exercise ≥3 h/wk	1.41 (0.897-2.20)	NS
Age ≥65 y	1.44 (0.787-2.62)	NS

Note. Data are for 669 patients. Glycemic control is defined as a hemoglobin A_{1c} level of <7%, Based on American Diabetes Association criteria [16]. CI, confidence interval; NS, not statistically significant; OR, odds ratio.

[a] For dichotomous variables, reference categories were male sex, African American race, do not use tobacco, annual income <$30,000, no diabetes education, not married, exercise <3 h/wk, age <65 y.

[b] Two-tailed, based on Wald statistics.

show that self-reported receipt of diabetes education was not significantly associated with glycemic control. Many patients are often referred to diabetes education when their A_{1c} level is poorly controlled. Data from a comprehensive meta-analysis show that self-management education leads to improved glycemia at immediate follow-up of patients (1-3 months) and with increased contact time [18].

While the mean A_{1c} level, LDL-C level, and systolic blood pressure were close to American Diabetes Association goals, the median values suggest that a large percentage of patients have not achieved the targeted values (Table 2) [16]. Only 8.5% of patients achieved all 3 diabetes outcome goals. An analysis of cross-sectional NHANES (National Health and Nutritional Examination Survey) data from 1999 to 2006 revealed that Medicare coverage after age 65 years was associated with an A_{1c} level of <7%, a blood pressure of <140/90 mm Hg, and total cholesterol level of <200 mg/dL [19]. Recent data from 5,425 veterans with diabetes showed that 17.3% had an A_{1c} level of <7%, a blood pressure of <130/80 mm Hg, and an LDL-C level of <100 mg/dL [20]. Over a 5-year period, the use of clinical reminders, enhanced education, and home-based telephone monitoring resulted in a higher percentage of patients reaching goals associated with diabetes control [20].

A limitation to these analyses is that the survey response rate was <50% of the total population with type 2 diabetes from this practice, and respondents may represent a sample of patients who are more compelled to improve their health. The difference between respondents and nonrespondents with regard to A_{1c} level and age might reflect a more motivated population. Other limitations involve the conduct of the study at a single site and the use of retrospective chart data. Patient literacy could also have impacted the survey response rate. Since the chart review was captured from electronic medical records that were introduced to the practice within the past 5 years, we could not accurately retrieve data on onset and duration of diabetes. In addition, survey information can be subject to overreporting by respondents. The absolute change in A_{1c} level was not captured before and after receipt of diabetes education in this analysis. We also did not collect information about the total time spent in diabetes education for each participant.

Our findings are consistent with our previously published findings that female sex and Medicare insurance were associated with glycemic control in a university-based practice [14]. While Medicare insurance was associated with glycemic control, it was not linked to the number of clinician visits. Health plans participating in the Medicare program are required to publicly report performance measures from the Health Plan Employer Data and Information Set. Managed-care plans are particularly well positioned to improve care, because they finance and monitor the provision of health services to enrollees. Future research in this area should include variables such as health literacy and social support systems. As policymakers, employers, payers, physician groups, and patients call for improved quality of care, there exists a challenge to ascertain the best measures. Data are needed to further delineate patient characteristics and factors that lead to desired goals for diabetes management. NCMJ

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References

1. Centers for Disease Control and Prevention (CDC). Deaths: final data for 2007. In: Department of Health and Human Services, ed. National Vital Statistics Reports. Atlanta, GA: CDC; 2010. http://www.cdc.gov/nchs/FASTATS/lcod.htm. Accessed May 5, 2011.
2. Narayan KM, Boyle JP, Thompson TJ, Sorensen SW, Williamson DF. Lifetime risk for diabetes mellitus in the United States. JAMA. 2003;290(14):1884-1890.
3. National Committee for Quality Assurance. HEDIS 2009 Volume 2 Technical Update. http://www.ncqa.org/Portals/0/PolicyUpdates/HEDIS%20Technical%20Updates/2009_Vol2_Technical_Update.pdf. Released October 1, 2008. Accessed May 4, 2011.
4. Kirk JK, Bell RA, Bertoni AG, et al. Ethnic disparities: control of glycemia, blood pressure, and LDL cholesterol among US adults with type 2 diabetes. Ann Pharmacother. 2005;39(9):1489-1501.
5. Hoerger TJ, Segel JE, Gregg EW, Saaddine JB. Is glycemic control improving in US adults? Diabetes Care. 2008;31(1):81-86.
6. Selby JV, Swain BE, Gerzoff RB, et al. Understanding the gap between good processes of diabetes care and poor intermediate outcomes: Translating Research into Action for Diabetes (TRIAD). Med Care. 2007;45(12):1144-1153.
7. Shi L. The relationship between primary care and life chances. J Health Care Poor Underserved. 1992;3(2):321-335.
8. Shi L. Primary care, speciality care and life chances. Int J Health Serv. 1994;24(3):431-458.
9. Shi L, Macinko J, Starfield B, Xu J, Politzer R. Primary care, income inequality, and stroke mortality in the United States: alongitudinal analysis, 1985-1995. Stroke. 2003;34(8):1958-1964.
10. Shi L, Macinko J, Starfield B, et al. Primary care, infant mortality, and low birth weight in the states of the USA. J Epidemiology Community Health. 2004;58(5):374-380.
11. Shi L, Macinko J, Starfield B, Wulu J, Regan J, Politzer R. The relationship between primary care, income inequality, and mortality in US States, 1980-1995. J Am Board Fam Pract. 2003;16(5):412-422.
12. McBean AM, Huang Z, Virnig BA, Lurie N, Musgrave D. Racial variation in the control of diabetes among elderly Medicare managed care beneficiaries. Diabetes Care. 2003;26(12):3250-3256.
13. Schillinger D, Grumbach K , Piette J, et al. Association of health literacy with diabetes outcomes. JAMA. 2002;288(4):475-482.
14. Kirk JK, Strachan E, Martin CL, Davis SW, Peechara M, Lord R. Patient characteristics and process of care measures as predictors of glycemic control. JCOM. 2010;17(1):27-30.
15. Lalonde M. A new perspective on health of Canadians. Ottawa, Canada: Department of Supply and Services; 1974. http://www.hc-sc.gc.ca/hcs-sss/alt_formats/hpb-dgps/pdf/pubs/1974-lalonde/lalonde-eng.pdf. Accessed May 5, 2011.
16. American Diabetes Association. Standards of medical care in diabetes–2006. Diabetes Care. 2006;29(Suppl 1):S4–S42.
17. Welch G, Zagarins SE, Feinberg RG, Garb JL. Motivational interviewing delivered by diabetes educators: does it improve blood glucose control among poorly controlled type 2 diabetes patients? Diabetes Res Clin Pract. 2011;91(1):54-60.
18. Norris SL, Lau J, Smith SJ, Schmid CH, Engelgau MM. Self-management education for adults with type 2 diabetes. Diabetes Care. 2002;25(7):1159-1171.
19. McWilliams JM, Meara E, Zaslavsky AM, Ayanian JZ. Differences in control of cardiovascular disease and diabetes by race, ethnicityrace, and education: US trends from 1999 to 2006 and effects of Medicare coverage. Ann Intern Med. 2009;150(8):505-515.
20. Vouri SM, Shaw RF, Waterbury NV, Egge JA, Alexander B. Prevalence of achievement of A_{1c}, blood pressure, and cholesterol (ABC) goal in veterans with diabetes. Manag Care Pharm. 2011;17(4):304-312.

School Nurses and Children With Diabetes:
A Descriptive Study

Martha Keehner Engelke, Melvin Swanson, Martha Guttu, Michelle B. Warren, Sarah Lovern

BACKGROUND Managing diabetes in children is complex. The aims of this descriptive study were to describe the care provided to children with diabetes by school nurses using case management, to identify differences in care on the basis of the workload of the nurse and the age of the child, to explore the role of the nurse in responding to emergencies, and to describe the relationship between case management and quality of life.

METHODS School nurses completed an expanded health assessment. Individualized goals were established and interventions were provided on the basis of a protocol. Quantitative and qualitative data for children enrolled during the 2009-2010 academic year were analyzed.

RESULTS Eighty-six children were enrolled. The most common goals were related to establishing a safe school environment. Interventions varied depending on the workload of the nurse and the age of the child. Nurses assigned to 1-2 schools provided more intervention days (mean, 40.3 days) than did nurses assigned to 3-4 schools (mean, 24.4 days) ($P < .05$), particularly in the area of direct care. A total of 25 students experienced an emergency at school that initiated a cascade of events involving the parent (in 100% of cases), the teacher (in 96%), management of hyperglycemia (in 100%), and/or management of hypoglycemia (in 96%). For teens, case management improved quality of life, particularly the ability to communicate with health professionals.

LIMITATIONS The sample was small, and there was no comparison group.

CONCLUSIONS School nurses are effective in using case management to enhance the health and well-being of children with diabetes. This study should be replicated with a larger sample, a comparison group, and the inclusion of clinical outcomes.

Federal legislation requires that children with diabetes are educated in a safe environment, with the same educational opportunities as their classmates without diabetes [1, 2]. In North Carolina, children with diabetes must have an individual diabetes care plan initiated at the written request of a student's parent or guardian. The plan must address staff development for school personnel, emergency care, and actions to be taken by school personnel to support the student [3]. The school nurse is the most appropriate person to plan, coordinate, and monitor the care of students with diabetes [4, 5]. However, the basic education of a nurse includes minimal training in school nursing. In contrast to nurses in health care settings, the school nurse is often the only health professional in a school, and most school nurses are assigned to >1 school. While the National Association of School Nurses and Healthy People 2020 recommends a ratio of 1 nurse for every 750 school-age children, during the 2009-2010 academic year [6, 7], the ratio for North Carolina was 1:1,185 [8]. A recent systematic review of type 1 diabetes care in schools found no known research on how often children with diabetes see a school nurse [9]. In addition, there is some evidence that school nurses have only a moderate level of self-efficacy related to their ability to provide diabetes care, but this improves with training and experience [10].

Although some countries do not allow the delegation of diabetes care in school to unlicensed personnel [11], the practice is common in the United States. Individual states vary in the ways they provide diabetes care [12, 13]. In North Carolina, legislation requires that, when a child with diabetes attends school, at least 2 members of the school staff receive individual training in diabetes care management, including the administration of insulin and glucagon [3]. The American Diabetes Association provides guidance for training and care [14]. Of particular importance is the need for health care plans and emergency action plans [15]. Research on the effectiveness of school personnel providing diabetes care at school suggests that, even with training of school personnel, children, parents, and school staff feel that the school environment is less than optimal for meeting the needs of children and adolescents with diabetes [16-23].

To improve diabetes care, several strategies have been proposed. Some urban school districts have developed programs in which a diabetes resource nurse provides education and support to practicing school nurses [24]. Another model involves university-based diabetes centers that provide outreach programs [25, 26]. However, neither of these approaches is practical for rural school districts with limited resources.

The Health Care Division of the Kate B. Reynolds Charitable Trust responded to the need for well-trained school nurses to provide care to children with chronic ill-

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TABLE 1.
Goals and Interventions for Children with Diabetes

Goal(s)	Intervention(s)
I. Safe school environment	I. Direct care
EAP developed and implemented	Supervise/provide insulin
IHP developed and implemented	Supervise/provide oral medication
Medication orders/ authorization at school	Supervise/perform blood glucose
Medication/monitoring equipment at school	Assist student with management of hyperglycemia
Emergency contact information at school	Assist student with management of hypoglycemia
Teacher/staff complete diabetes training	Assist student with insulin pump
Staff demonstrates knowledge of diabetes	Supervise/provide urine test
Staff provides classroom accommodation	Assist/provide carbohydrate count
Staff demonstrates appropriate care	Provide emergency care
II. Symptom management	II. Student education/counseling
Decrease episodes of hypoglycemia	Diabetes overview
Decrease episodes of hyperglycemia	Hypoglycemia
Reduce symptoms (fatigue, irritability)	Hyperglycemia
III. Self-care	Carbohydrate count
Demonstrates age-appropriate knowledge of oral meds	Meal/snack plans
Demonstrates age-appropriate knowledge of insulin	Exercise
Recognizes symptoms of abnormal blood sugar and takes appropriate action	Medication administration
Uses insulin pump correctly	Testing blood sugar
Demonstrates age-appropriate knowledge of exercise and activity	Insulin pump
Demonstrates age-appropriate knowledge of diet	Urine testing
Self-administers or receives insulin according to EAP and IHP	Living with diabetes
Improve self-esteem	Making good choices
Performs carbohydrate count and takes appropriate action	Complications
Follows prescribed diet	Preventing emergencies
Maintains current weight	Teacher/academic issues
Loses weight	Psychosocial support
Improved self-management of diabetic regimen	Dealing with peers/friends
Demonstrates ability to check blood sugar and take appropriate action	Family issues
Demonstrates ability to check for ketones and take appropriate action	III. Parents/family interventions
IV. Academic success	Phone call to parent/guardian
Decrease number of health-related absences	Home visit
Decrease tardiness or time out of class	School visit by parent
Improve academic performance	Note sent home
Reduce disruptive classroom behavior	IV. Teacher/staff education
Increase participation in physical education/exercise	Classroom visit
Increase participation in extracurricular activities	Teacher
V. Family/peer relations	Cafeteria staff
Improve relationships with peers/friends	Bus driver
Improve family collaboration with school nurse	Custodian
Family improves psychosocial support to student	Physical education teacher
Family provides low box at school	Principal
Family provides medication/monitoring supplies	Assistant principal
Increase family understanding of child's illness and treatment	Guidance counselor
Family/guardian participates in care outlined in IHP	Secretary
VI. Health care coordination	V. Care coordination
Reduce emergency department visits/hospitalizations	Call to physician
Improve use of primary health care	Call to other health care professional
Improve coordination of care among health care professionals	Referral to (specify)
	Follow-up on referral
	Accommodations planning meeting
	Attend appointment with student

Note. EAP, emergency action plan; IHP, individual health plan.

nesses by funding a collaborative project between East Carolina University (ECU) College of Nursing and the North Carolina Department of Health and Human Services to implement a case management program. The program was targeted to smaller school districts that did not have a formal program. School districts were asked by the regional school nurse consultants to participate. If the districts agreed, a memorandum of understanding was developed between the school district and ECU College of Nursing. The regional consultants, project director, and project coordinator collaborated with the participating school nurses to develop a protocol for providing case management. The protocol was based on a nursing process model that included assessment, planning, intervention, and evaluation. Specific protocols were developed for asthma, diabetes, severe allergies, seizures, sickle cell anemia, weight management, behavioral/affective disorders, and pregnancy. The protocol included a set of goals and interventions that were used by the nurse to provide care. Educational resources were made available at the project Web site (available at: http://www.cmpnc.org). As part of the memorandum of understanding, school nurses attended 3 educational sessions during the school year on different aspects of case management. The project coordinator, who was an experienced school nurse, was available and responded to questions promptly, usually within an hour. A description of the conceptual model and general procedures related to the project has been published previously [27].

The second most common diagnosis (after asthma) among students enrolled has been diabetes. The aim of this article is (1) to describe the care provided to children with diabetes, (2) to identify differences in care on the basis of the workload of the nurse and the age of the child, (3) to explore the role of the school nurse in responding to emergencies, and (4) to describe the impact of school nurse interventions on quality of life.

Methods

Approval from the University and Medical Center Institutional Review Board at ECU was obtained. A parent or guardian provided consent before enrollment of students. The consent form was available in Spanish for parents of Hispanic children. School nurses enrolled students if the student had a chronic illness and ≥1 of the following: recent or new diagnosis, noncompliance with health care regimen, unstable illness, lack of health care, poor attendance, difficult family situation, transportation issues, poor academic performance, difficulty with peers and/or friends, and behavioral problems.

In addition to the usual health assessment performed by the school nurse, the nurse completed an expanded assessment that included written input from the parent and teacher on how well the child was managing in school and suggestions for working with the child. The nurse had the child complete the PedsQL 3.0 Type 1 Diabetes Module [28]. This is a measure of quality of life for children with diabetes. It is a 28-item instrument that has 5 subscales: symptoms, treatment barriers, treatment adherence, worry, and communication. It includes 3 slightly different versions that are based on age (ie, 5-7 years, 8-12 years, and 13-17 years). Responses are recorded on a 3-point scale for children 5-7 years old and on a 5-point scale for older children. All scores are converted to a score of 0-100 for interpretation. Although quality of life is not usually part of a school nurse's health assessment, it was included because there is some evidence that a supportive school environment improves quality of life [29-30]. Of particular relevance for this project was the subscale related to communication, which asks the child how much difficulty they have in talking to physicians and nurses, asking questions, and explaining their illness to other people. Improvement in this area was considered to be an indication that the school nurse had helped the student improve their ability to recognize and express their needs to physicians or other health care professionals.

After the nurse completed the assessment, individualized goals were determined. The nurse chose goals from a set of potential goals grouped into 6 categories: safe school environment, symptom management, self-care, academic success, family and peer relationships, and health care coordination. At the end of case management, the nurse evaluated the goals as "met," "partially met," or "unmet." To meet the goals, the nurse provided interventions grouped into 5

TABLE 2.
Characteristics of 86 Participating Children With Diabetes

Characteristic	Children, no. (%)
Sex	
Male	50 (58)
Female	36 (42)
Race	
White	57 (66)
African American	23 (27)
Hispanic	3 (3.5)
Other	3 (3.5)
Education level (grades)	
Elementary (K-5)	45 (52)
Middle (6-8)	24 (28)
High school (9-12)	17 (20)
Age	
5-7 y	14 (16)
8-12 y	45 (52)
13-17 y	27 (31)
Medicaid recipient	
No	45 (52)
Yes	37 (43)
Unknown	4 (5)

TABLE 3.
Goal Attainment for 84 Participating Children With Diabetes

Goal(s)	Had goal, children, no. (%)	Goal status, children, %		
		Met	Partly met	Unmet
I. Safe school environment				
EAP developed/implemented	77 (92)	100	0	0
IHP developed/implemented	68 (81)	94	3	3
Medication orders/authorization at school	77 (92)	99	1	0
Medication/monitoring equipment at school	81(96)	95	5	0
Emergency contact information at school	84 (100)	98	2	0
Teacher/staff complete diabetes training	82 (98)	99	1	0
Staff demonstrates knowledge of diabetes	81 (96)	84	16	0
Staff provides classroom accommodation	80 (95)	100	0	0
Staff demonstrates appropriate care	79 (94)	92	8	0
II. Symptom management				
Decrease episodes of hypoglycemia	58 (69)	66	34	0
Decrease episodes of hyperglycemia	67 (80)	46	46	8
Reduce symptoms (fatigue, irritability)	47 (56)	77	21	2
III. Self-management				
Demonstrates age-appropriate knowledge of oral meds	16 (19)	69	31	0
Demonstrates age-appropriate knowledge of insulin	58 (69)	79	17	4
Recognizes symptoms of abnormal blood sugar and takes appropriate action	67 (80)	72	27	1
Uses insulin pump correctly	31 (37)	77	19	3
Demonstrates age-appropriate knowledge of exercise and activity	53 (63)	74	26	0
Demonstrates age-appropriate knowledge of diet	60 (71)	45	52	3
Self-administers/receives insulin according to EAP/IHP	64 (76)	84	13	3
Improve self-esteem	57 (68)	51	46	3
Performs carbohydrate count and takes appropriate action	40 (48)	45	43	12
Follows prescribed diet	28 (33)	93	7	0
Maintains current weight	12 (14)	42	25	33
Loses weight	57 (68)	53	40	7
Improved self-management of diabetic regimen	66 (79)	83	15	2
Demonstrates ability to check blood sugar and take appropriate action	37 (44)	76	19	5
Demonstrates ability to check for ketones and take appropriate action	35 (42)	77	23	0
IV. Academic success				
Decrease number of health-related absences	42 (50)	69	24	7
Decrease tardiness or time out of class	36 (43)	64	25	11
Improve academic performance	38 (45)	50	32	18
Reduce disruptive classroom behavior	16 (19)	63	37	0
Increase participation in physical education/exercise	26 (31)	81	19	0
Increase participation in extracurricular activities	22 (26)	73	5	22
V. Family/peer relations				
Improve relationships with peers/friends	26 (31)	89	11	0
Improve family collaboration with school nurse	44 (52)	73	27	0
Family improves psychosocial support to student	29 (35)	72	28	0
Family provides low box at school	47 (56)	85	4	11
Family provides medication/monitoring supplies	64 (76)	89	11	0
Increase family understanding of child's illness and treatment	41 (49)	66	34	0
Family/guardian participates in care outlined in IHP	41 (49)	81	17	2
VI. Health care coordination				
Reduce ED visits/hospitalizations	29 (35)	83	14	3
Improve use of primary health care	31 (37)	87	13	0
Improve coordination of care among health care professionals	30 (36)	87	10	3

Note. EAP, emergency action plan; ED, emergency department; IHP, individual health plan.

categories: direct care, education and counseling, family and peer interventions, teacher and staff education, and care coordination. The goals and interventions are listed in Table 1. During the intervention period, nurses were asked to be proactive, to intervene at least weekly, and to focus not only on responding to problems but also on self-management. The education they provided to school personnel was based on the North Carolina Public Schools Diabetes Awareness Training and Action curriculum [31], which was available at our Web site. This curriculum is consistent with the requirements outlined in North Carolina Senate Bill 911 [3]. When the nurse provided an intervention, it was recorded on a flow sheet by logging into a password-protected, secure server. All interventions on a particular day were entered as 1 visit, and the unit of analysis was an intervention-day (ID). There may have been as many as 4-5 encounters with the child on a particular day. Therefore, an ID represents a conservative estimate of the actual number of encounters. The intervention sheet included space for narrative comments. These comments were analyzed informally by members of the research team and used to interpret the quantitative data. All data, including the comments, were downloaded into an Excel spreadsheet (Microsoft) and loaded into SPSS, version 17.0 (SPSS), for analysis. Independent-groups t tests were used to compare mean IDs between nurses assigned to 1-2 schools and nurses assigned to 3-4 schools. The paired-samples t test was used to compare quality of life scores between baseline and end of case management. Statistical significance was assessed at an α level of .05.

Results

Eighty-six students were enrolled. The mean length of time a child received case management was 7.1 months, and the median duration was 6.8 months. Most students were white (66%) and male (58%). Of the 63 participating nurses, the majority were assigned to 1 or 2 schools (25% and 43%, respectively), but 32% were assigned to 3 schools (25%) or 4 schools (7%). Factors related to the need for case management were unstable illness (62% of students), noncompliance (35%), recent or new diagnosis (29%), family situation (26%), and academic performance (25%). The characteristics of participating students are summarized in Table 2.

First, we examined the goals established by the school nurse. Data on goal attainment are listed in Table 3. Establishing a safe school environment was a priority. To do this, nurses developed emergency action plans and individual health plans. They trained staff in diabetes care. School nurses also accomplished goals related to self-management, academic success, and family and peer relations.

Next, we examined the interventions provided by the nurse and how these varied on the basis of the workload of the nurse and the educational level of the child. We believed that nursing care would vary on the basis of these 2 factors. Because of the sample size, statistical testing was limited to comparing interventions on the basis of workload. The average number of IDs was greater for nurses assigned to 1-2 schools than for nurses assigned to 3-4 schools. In addition, nurses assigned to fewer schools provided more direct-care IDs than did nurses assigned to more schools. Both of these differences were statistically significant and are described in Table 4. Nurses assigned to more schools provided slightly more teacher and staff education than did nurses assigned to fewer schools. This was possibly a reflection of the nurse's goal to ensure a safe school environment when the nurse was not present.

In terms of grade level, elementary school children received more direct care than did older students, but this was affected by the number of schools assigned to the nurse. On average, children in elementary school received 30.3 direct-care IDs when the school's nurse was assigned to 1-2 schools and 13.9 direct-care IDs when the school's nurse was assigned to 3-4 schools. Students in high school received more education and counseling than did children in lower grades, but again the number of assigned schools had an impact. When the nurse was assigned to 1-2 schools, the high school student received 18.9 IDs for education and counseling, and when the nurse was assigned to 3-4 schools, the student received 10.4 IDs. Nurses provided more teacher and staff education for elementary school chil-

TABLE 4.
Comparison of Total Intervention-Days and Categories of Interventions, by Number of Schools Assigned to the Nurse

	Intervention-days, no., mean ± SD	
Intervention	**Assigned to 1-2 schools**	**Assigned to 3-4 schools**
Overall	40.3 (31.6)[a]	24.4 (13.9)[a]
Direct care	25.3 (31.8)	11.7 (8.6)[a]
Student education/counseling	14.2 (13.9)	11.6 (6.7)
Teacher/staff education	13.4 (16.5)	14.9 (14.7)
Family education/counseling	14.5 (18.5)	10.9 (6.2)
HCP coordination	2.6 (2.3)	2.9 (2.5)

Note. A total of 59 nurses were assigned to 1-2 schools, and 27 nurses were assigned to 3-4 schools. HCP, health care professional; SD, standard deviation.
[a]$P \leq .05$.

dren than for middle or high school students. There was less variation by workload. For example, in elementary schools, nurses assigned to 3-4 schools provided a few more days of teacher and staff education than did nurses assigned to fewer schools (19.7 IDs vs 17.0 IDs), which may be related to attempts to ensure the safety of the students when they were not present.

Next, we examined emergency events. Twenty-five of 86 students had a total of 46 emergency events identified by the nurses. Most (68%) of the emergencies occurred among elementary school children, and most (72%) were documented by nurses assigned to 1-2 schools. For the 25 children who had emergencies, the nurse initiated a series of interventions. In all cases, the nurse assisted with hyperglycemic management, and in 96% of the cases, the nurse initiated hypoglycemic management. Nurses did not always record the exact blood sugar measurement, but 8 children had a blood sugar level of <70 mg/dL, and 4 had a blood sugar level of <50 mg/dL. There were 3 children whose blood sugar level was >500 mg/dL. The nurses' comments suggested that these extremes were often related to malfunctions of equipment, particularly insulin pumps. Other reasons for emergencies were episodic illnesses (diarrhea or nausea), negative behavior (student refused to eat or take medication), or parental issues (did not provide supplies or adjusted the insulin in a way that was not indicated by the medical plan). In addition to managing blood sugar levels, the nurse always called the parent. In some cases, the parent was unavailable or unwilling to become involved, and the nurse called several family members. During an emergency, the nurse worked closely with the teacher (in 96% of cases) and the principal (in 60%). They administered insulin (in 92% of cases), provided urine testing (in 72%), and helped the student count carbohydrates (in 88%), while counseling the child about meal and snack planning (in 88%) and making good choices (in 76%). The school nurse visited the classroom (in 68% of cases) and called the physician's office (in 56%). In some cases, the nurse noted that the policy of the physician's office was to speak only to parents, who relayed information to the nurse.

Finally, we examined the relationship between case management and quality of life, particularly the communication scale, by comparing baseline scores with final scores on the PedsQL 3.0 Type 1 Diabetes Module. These data are summarized in Table 5. Significant improvements were seen in both total scores and communication scores for adolescents but not for other groups.

Discussion

This descriptive study demonstrates the complexity of providing diabetes care in public schools. School nurses promote a safe school environment by initiating emergency action plans and individual health plans and by training school personnel. When nurses are assigned to fewer schools, they are able to provide more direct care, and this may be important for elementary school students, who need help with their diabetes care. Taras [32] suggests that, in the school environment, it is safer when a nurse administers insulin than when unlicensed personnel administer insulin, because insulin administration at school has inherent risks that are not present at home. When nurses work with high school students, they focus on education and counseling, rather than on direct care, and this appears to have a positive effect on quality of life, particularly in relation to the teen's ability to communicate with other health professionals. Previous research suggests that higher quality of life might be related to better glycemic control [25, 29, 33]. This improvement was not seen with younger children, who may not be developmentally ready to accept this responsibility.

Emergency situations are relatively common in school, particularly among younger children. Nurses assigned to fewer schools identified more emergencies, although there was no evidence to suggest that the children they cared for were more unstable. When the nurse is not present,

TABLE 5.
PedsQL Scores at the Beginning and End of the School Year

	Score, mean ± SD, by child age		
Score type	5-7 y	8-12 y	13-17 y
Overall QOL			
Beginning	70.33 (21.71)	69.07 (13.23)	64.97 (13.48)
End	66.82 (15.64)	69.40 (13.19)	70.57 (11.11)
Change	−3.51 (24.32)	0.32 (9.17)	5.60 (10.20)[a]
Communication subscale			
Beginning	70.51 (36.74)	74.71 (23.61)	63.26 (30.17)
End	65.38 (30.02)	76.55 (24.14)	74.62 (21.12)
Change	−5.13 (38.72)	1.84 (17.59)	11.36 (20.01)[b]

Note. A total of 13 children were aged 5-7 years, 43 were aged 8-12 years, and 22 were aged 13-17 years. In the text, the beginning of the school year is referred to as the baseline score, and the end of the school year is referred to as the final score. QOL, quality of life; SD, standard deviation.

[a] P = .05.

[b] P = .01.

emergencies are identified by someone else or are missed. Dealing with an emergency requires a significant amount of judgment and coordination. Sophisticated equipment, such as insulin pumps, can make living with diabetes easier. However, our data suggest that the consequences of equipment failure are serious and result in wide fluctuations in blood sugar measurements. Recognition and treatment of these problems is an area that requires professional judgment.

There are several limitations of this study. Most notably, it represents a very small percentage of children with diabetes in North Carolina public schools. Our focus was on developing the case management program, and we did not have adequate resources to collect data on children not enrolled in the program. Therefore, this study should be repeated with a larger sample and a comparison group. Another limitation was that all nurses did not have access to the students' hemoglobin A_{1c} levels, so we were not able to measure the impact of the interventions on diabetes control.

We believe that this study demonstrates the complexity of diabetes care in schools, as well as the need for school nurses who are well-trained professionals. North Carolina faces a severe budget crisis, and some have suggested that cutting school nurse positions is one way of reducing costs. However, the cost-effectiveness of school nursing must be evaluated in terms of not only what it costs to hire a nurse but also the costs incurred when a nurse is not present. These include less teacher time for direct education. One nurse commented on the intervention flow sheet that "the teacher is angry about...the amount of time focused each day on just this student and her inability to teach when checking blood sugar [levels] 6 or 7 times per day, dealing with low [levels], and supervising him to make him eat snacks and lunch."

Previous research suggests that school nurses are more likely to remedy health problems and send the child back to class, compared with other school personnel, thereby improving attendance [34]. School nurses can be a lifeline for a student with diabetes who is resistant to following their plan of care. One nurse stated that a student "refused to eat lunch and was placed in silent lunch and still would not eat. [I] sat with him and got him to eat.... It took him another 10 minutes while his class had left the cafeteria for him to eat."

Another cost relates to the liability incurred when the child does not receive appropriate care. Federal and state laws have been enacted to protect the rights of children with diabetes [1-3]. After one nurse called a parent about a low blood sugar measurement, the parent responded to the nurse, "[He] is not responsible. The school is [responsible], and the law will make you be responsible."

School nurses have been referred to as the "hidden health care professionals." They may be invisible to other health care professionals. Several nurses reported that some physicians' offices would not share information with them. While it may be preferable to have the parent be the main point of contact, there are situations in which the parent is not reliable and the child is at risk. As one nurse described, "Dad wants me to give one-third dose of insulin each hour and check blood sugar [level] hourly during the pizza party. I explained that I needed doctor's orders for this."

Diabetes is only one chronic illness, and providing care to children with chronic illnesses is only one component of the school nurse's role. Health screening, managing and monitoring communicable diseases, health promotion for students and staff, and developing programs to create a safe school environment are other key roles. Our data suggest that school nurses are vital in promoting the health and academic success of children. The question for North Carolina and other states that are facing economic constraints is, Will we meet this challenge or ignore it? NCMJ

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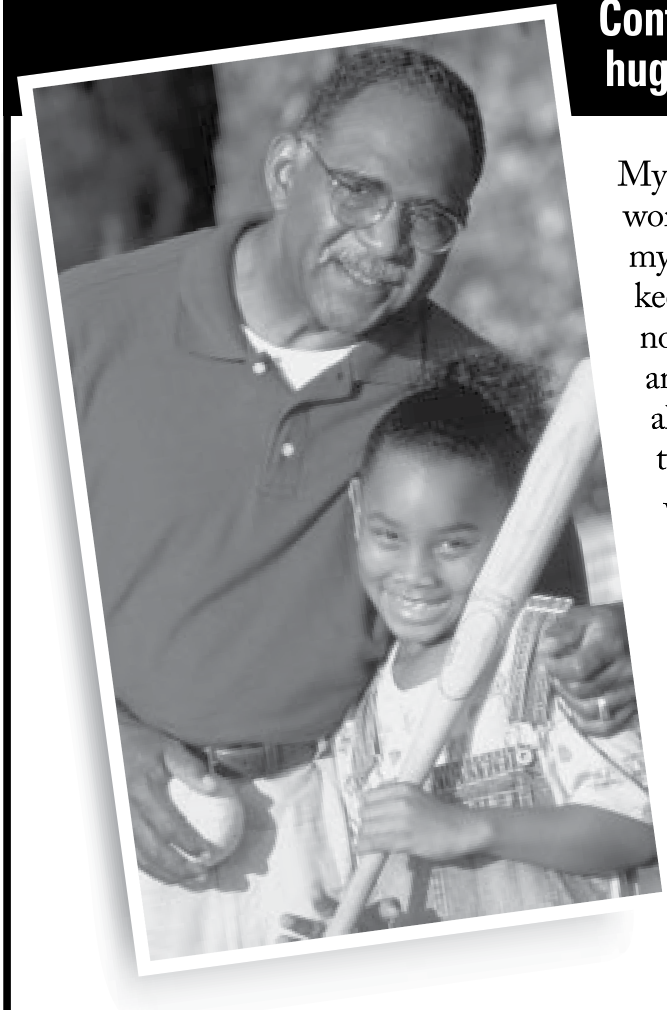
References

1. Americans With Disabilities Act of 1990, 42 USC §§12134, 28 CFR Pt 35 (Title II, Department of Justice).
2. Section 504 of the Rehabilitation Act of 1973, 29 USC §794, 34 CFR Pt 104.
3. NC Sess Law 2002-103, SB 911, §1 Gen Stat 115C-47.
4. American Diabetes Association. Safe at School: Safety and Fairness for Children with Diabetes. http://www.diabetes.org/assets/pdfs/schools/SAS-Booklet-2010.pdf. Revised June 25, 2010. Accessed July 7, 2010.
5. National Association of School Nurses (NASN). School Nurse Role in Care and Management of the Child with Diabetes in the School Setting. NASN Web site. http://www.nasn.org/PolicyAdvocacy/PositionPapersandReports/NASNPositionStatementsFullView/tabid/462/ArticleId/22/Diabetes-in-the-School-Setting-School-Nurse-Role-in-Care-and-Management-of-the-Child-with-Revised-20. Revised June 2006. Accessed January 19, 2011.
6. National Association of School Nurses (NASN). Caseload Assignments. NASN Web site. http://www.nasn.org/PolicyAdvocacy/PositionPapersandReports/NASNPositionStatementsFullView/tabid/462/ArticleId/7/Caseload-Assignments-Revised-2010. Revised 2010. Accessed January 20, 2011.
7. US Department of Health and Human Services. Healthy People 2020 Summary of Objectives. http://www.healthypeople.gov/2020/topicsobjectives2020/pdfs/HP2020objectives.pdf. Published December 13, 2010. Accessed January 19, 2011.
8. North Carolina Department of Health and Human Services (DHHS). North Carolina Annual School Health Services Report 2009-2011. Raleigh, NC: North Carolina DHHS; 2010. http://www.ncdhhs.gov/dph/wch/doc/stats/SchoolHealthServicesAnnualReport-2009-2010.pdf. Published March 2010. Accessed January 2011.
9. Wodrich DL, Hasan K, Parent KB. Type 1 diabetes mellitus and school: a review. Pediatr Diabetes. 2011;12:63-70.
10. Fisher KL. School nurses' perceptions of self-efficacy in providing

diabetes care. J Sch Nurs. 2006;22(4):223-228.
11. Lange K, Jackson C, Deeb L. Diabetes care in schools: the disturbing facts. Pediatr Diabetes. 2009;10(13):28-36.
12. Hellems MA, Clarke WL. Safe at school: a Virginia experience. Diabetes Care. 2007;30(6):1396-1398
13. Melton D, Henderson J. Do public schools provide optimal support for children with diabetes [letter]? Prev Chronic Dis. http://www.cdc.gov/pcd/issues/2007/jul/06_0124.htm. Published 2007.
14. American Diabetes Association. Diabetes care in the school and day care setting. Diabetes Care. 2010;33(1):S70-S74.
15. Kaufman FR, Jackson C, Bobo N. Health care plans to manage diabetes at school. NASN Sch Nurse. 2010:226-228.
16. Hayes-Bohn R, Neumark-Sztainer D, Mellin A, Patterson J. Adolescent and parent assessments of diabetes mellitus management at school. J Sch Health. 2004;74(5):166-169.
17. Nichols PJ, Norris SL. A systematic literature review of the effectiveness of diabetes education of school personnel. Diabetes Educ. 2002;28(3):405-414.
18. Nabors L, Lehmkuhl H, Christos N, Andreone TL. Children with diabetes: perceptions of supports for self-management at school. J Sch Health. 2003;73(6):216-221.
19. Schwartz FL, Denham S, Heh V, Wapner A, Shubrook J. Experiences of children and adolescents with type 1 diabetes in school: survey of children, parents, and schools. Diabetes Spectr. 2010;23(1):47-55.
20. Jaquez F, Stout S, Alvarez-Salvat R, et al. Parent perspectives of diabetes management in schools. Diabetes Educ. 2008;34(6):996-1003.
21. Lewis DW, Powers PA, Goodenough MF, Poth MA. Inadequacy of in-school support for diabetic children. Diabetes Technol Ther. 2003;5(1):45-57.
22. Nabors L, Troillett A, Nash T, Masiulis B. School nurse perceptions of barriers and supports for children with diabetes. J Sch Health. 2005;75(4):119-124.
23. Wagner J, James A. A pilot study of school counselor's preparedness to serve students with diabetes: relationship to self-reported diabetes training. J Sch Health. 2007;76(7):387-392.
24. Bobo N, Kaup T, McCarty P, Carlson JP. Diabetes management at school: application of the healthy learner model. J Sch Nurs. 2011;27(3):171-184.
25. Faro B, Ingersoll G, Fiore H, Ippolito KS. Improving students' diabetes management through school-based diabetes care. J Pediatr Health Care. 2005;19(5):301-308.
26. Oduwole AO, Uko RI, Tade T, Doherty OK, Nwodo R, Imafidon EO. The effect of home visits on the quality of life of children and adolescents with type 1 diabetes mellitus. Pediatr Diabetes. 2011;12(4 Pt 1):335-340.
27. Engelke M, Guttu M, Warren M. Defining, delivering, and documenting the outcomes of case management by school nurses. J Sch Nurs. 2009:25(6):417-426.
28. Varni JW, Burwinkle TM, Jacobs JR, Gottschalk M, Kaufman F, Jones KL. The PedsQL in type 1 and type 2 diabetes: reliability and validity of the Pediatric Quality of Life Inventory Generic Core Scales and Type 1 Diabetes Module. Diabetes Care. 2003;26(3):631.
29. Kalyva E, Malakonaki K, Eiser C, Mamoulakis D. Health-related quality of life (HRQoL) of children with type 2 diabetes mellitus (T1DM): self and parental perceptions. Pediatr Diabetes. 2011;12(1):34-40.
30. Wagner J, Heapy A, James A, Abbott G. Glycemic control, quality of life, and school experiences among students with diabetes. J Pediatr Psychol. 2006;31(8):764-769.
31. North Carolina Public School System. Diabetes Awareness Training and Action. https://team.nursing.ecu.edu/ConExchange/Portals/17/cmpnc/DATA%20Overview.pdf. Raleigh, NC: North Carolina Public School System. Published August 2005. Accessed January 20, 2011.
32. Taras H. Who should administer insulin in schools? Sorting out the controversy. Pediatrics. 2009;124(4):1211-1212.
33. Lehmkuhl H, Nabors L. Children with diabetes: satisfaction with school support, illness perceptions and HbA_{1c} levels. J Dev Phys Disabil. 2007;20:101-114.
34. Pennington N, Delaney E. The number of students sent home by school nurses compared to unlicensed personnel. J Sch Nurs. 2008;24(5):290-297.



ORIGINAL ARTICLE

Project I See in NC:
Initial Results of a Program to Increase Access to Retinal Examinations Among Diabetic Individuals in North Carolina

Ramon Velez, Marshall Tyler, John Chen, Michael Babcock, William P. Moran

BACKGROUND Diabetic retinopathy is the leading cause of preventable blindness in adults. Project I See in NC was begun to determine whether access to eye screening for Medicaid recipients and uninsured patients with diabetes in North Carolina could be improved.

METHODS We targeted Medicaid recipients and uninsured adults with diabetes for screening in 2 Community Care of North Carolina Networks. Screenings were performed in primary care settings throughout 6 counties in the Northwest Community Care Network and 6 counties in Access III of Community Care of the Lower Cape Fear. Patients were screened using a high-resolution digital retinal camera with images read at a centralized reading center at Wake Forest School of Medicine.

RESULTS A total of 1,688 patients were screened from October 2005 through September 2007. Nearly 15% (282) were found to have mild, nonproliferative-to-proliferative retinopathy, while the majority of patients had no evidence of diabetic retinopathy. Nearly 12% (196) required referral to an ophthalmologist, with 5% (86) requiring urgent referral for potentially sight-threatening retinopathy.

LIMITATIONS We were not able to confirm which patients kept their ophthalmologic appointments; however, we are currently analyzing data from the Medicaid patients in our study who required ophthalmologic referral.

CONCLUSIONS Remote digital retinal screening for diabetic retinopathy is feasible in primary care settings in both urban and rural areas of North Carolina, and it may prove to be an effective means of reaching more patients who require annual screening examinations.

Diabetic retinopathy is the leading cause of preventable blindness in adults in the United States and is one of the complications most feared by patients [1]. With >600,000 North Carolinians at risk of losing their vision because of diabetic retinopathy, this complication has become an important state public health issue [2]. The American Diabetes Association recommends that patients with diabetes have annual dilated eye examinations to screen for retinopathy [3]. Patients found to have vision-threatening retinopathy can then be referred to ophthalmologists for consideration of laser photocoagulation, a treatment that has been shown in randomized controlled studies to prolong useful vision and reduce severe vision loss by >50% [4].

Despite the availability of effective treatments proven to reduce blindness among diabetic patients with retinopathy, many such patients continue to lose their vision [2]. A recent study examining the quality of diabetic care among low-income patients in North Carolina found a history of documented dilated eye examinations in only 6% of these patients [5].

Telemedicine screening for diabetic retinopathy has emerged as an important method for providing increased access to appropriate eye screening in primary care settings [6-8]. This technology has been widely accepted in large health care systems such as the US Department of Veterans Affairs [6, 9, 10] and the British National Health Service [11].

In an effort to increase the number of Medicaid recipients and uninsured patients with diabetes who receive annual dilated eye examinations and thereby decrease the number of patients at risk of developing blindness, Project I See in NC was developed as a collaborative effort between Community Care of North Carolina (CCNC) and Wake Forest School of Medicine (Winston Salem, NC). The collaboration was supported by grants from The Duke Endowment, the Kate B. Reynolds Charitable Trust, and the North Carolina Foundation for Advanced Health Programs. CCNC is a state-created program that connects Medicaid beneficiaries with medical homes and consists of 14 local health care networks with >3,200 primary care professionals [12]. CCNC has been a pioneer organization in improving clinical care quality and has programs aimed at improving care for patients with diabetes.

Here we describe outcomes from the first 2 years of this project's operations, in which 2 CCNC networks were chosen as demonstration populations for intervention. In these networks, a trained photographer screened Medicaid recipients and uninsured patients with diabetes for retinopathy, using a high-resolution nonmydriatic digital fundus camera.

Methods

Project I See in NC was designed to evaluate the feasibility of using high-resolution digital photography of the retina in a primary care setting to screen for sight-threatening dia-

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betic eye disease among uninsured patients and Medicaid enrollees in 2 CCNC networks: Northwest Community Care Network (NCCN; formerly Access II) and Access III of Community Care of the Lower Cape Fear (CCLCF). These networks were chosen because together they encompass 12 counties and represent both urban and rural communities in North Carolina.

Figure 1 shows a map of North Carolina and the location of the networks of our intervention. NCCN consists of 6 counties (Forsyth, Stokes, Surry, Yadkin, Davie, and Wilkes), and CCLCF consists of 6 counties (New Hanover, Brunswick, Columbus, Bladen, Pender, and Onslow). We screened individuals at 12 sites in NCCN and 23 sites in CCLCF.

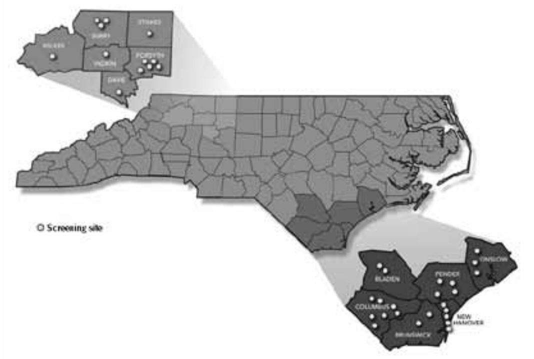
Patient recruitment. Screening was performed in primary care offices serving large numbers of Medicaid recipients, in health departments, in hospital-based outpatient clinics, and in free clinics serving uninsured patients. Trained personnel worked collaboratively with Medicaid nurse case managers to identify and invite Medicaid patients with diabetes to participate in screening. All eligible patients were required to sign a study consent form before their enrollment. A variety of other strategies were used to target Medicaid recipients and uninsured patient populations, including public announcements on local television stations, newspaper advertisements, letters from participants' physicians inviting them to participate in screening, and telephone calls to patients.

Intervention. At screening, all participants underwent a visual acuity examination, using Stereo Optec 800X visual acuity screening equipment. Patients' pupils were then dilated using 1% tropicamide eye drops. Patients with a history of glaucoma were excluded from pupil dilation and had photographs of undilated retinas taken. At least two 45° retinal photographs of each eye were taken. The first field of view was centered on the macula and the optic nerve. The second image field documented the supertemporal vascular arcade. In addition, each patient completed a questionnaire in which they were asked to provide information about age, sex, race, previous history of dilated eye examination, duration of diabetes, self-reported vision changes in the previous year, knowledge of comorbid conditions, and awareness of any existing retinopathy.

Screener and grader training. The 2 screeners received training from a member of of the study team (M.T.), who is a certified retinal angiographer. Screeners were trained on the use of the retinal camera, image storage, and transfer and received individual instruction with patients. They were given a textbook on ophthalmic photography to guide them [13], which was coauthored by one of the coinvestigators (M.T.). Additional training occurred on site as well, through continuous feedback on image quality provided to the 2 screeners.

We asked the screeners to make an initial assessment of image quality and abnormal findings in the field and asked that graders be alerted to patients potentially in need of urgent triage. The initial grader (R.V.) is a physician who trained himself in reading retinal photographs, using 2 training modules [14, 15]. The second grader (M.T.) is a certified retinal angiographer with >35 years as an ophthalmic photographer. The first grader read all of the images and triaged all images with abnormal findings to the second grader for verification of grading. An ophthalmologist was available for consultation with challenging images. We did not measure inter- or intragrader variability.

FIGURE 1.
Screening Sites in 2 Community Care of North Carolina Networks (CCNC) Participating in Project I See in NC



Note. Participating CCNC networks consisted of the Northwest Community Care Network (formerly Access II; top left) and Access III of Community Care of the Lower Cape Fear (bottom right).

Images were graded as normal, mild nonproliferative retinopathy (defined as <5 microaneurysms or hemorrhages), moderate-to-severe nonproliferative retinopathy (>5 microaneurysms or hemorrhages with or without cotton wool spots, hard exudates, and venous beating), or proliferative retinopathy (any neovascular changes or vitreous hemorrhages). Various other nondiabetic changes were commented on in our reports to primary care physicians, including disc changes suggestive of glaucoma and hypertensive changes.

Photographs were uploaded to the Internet by use of secure methods and were stored in a central computer at Wake Forest School of Medicine. The photographs were read by 2 trained readers, with an ophthalmologist available as needed. Individual reports containing the results of the eye examination and retinopathy screening were generated and mailed to the patients' primary care physicians, along with appropriate recommendations regarding the need for a referral to an ophthalmologist for further evaluation and/or the need for treatment of sight-threatening diabetic retinopathy or annual follow-up screening.

Data analysis. Descriptive analyses were performed to summarize means and standard deviations for continuous variables and to generate proportions for categorical variables. The bivariate relationships between the 2 networks and demographic characteristics, grade of diabetic retinopathy, and pattern of referral to ophthalmologists were examined. Continuous data were analyzed with the Student t test, and

TABLE 1.
Demographic Characteristics of Study Participants

Characteristic	Access III of Lower Cape Fear Network (N = 658)	Northwest Community Care Network (N = 1,030)
Age, y, mean, by sex		
Female	53	54
Male	52	52
Sex		
Female	456 (69)	655 (64)
Male	202 (31)	375 (36)
Race		
African American	328 (50)	411 (40)
White	292 (44)	506 (49)
Hispanic	30 (5)	107 (10)
Other	8 (1)	6 (1)
Insurance type		
Medicaid	266 (40)	413 (40)
Medicare	12 (2)	0
Uninsured	380 (58)	617 (60)
Diabetes type		
Type 1	35 (5)	78 (8)
Type 2	616 (94)	679 (66)
Unknown	7 (1)	273 (26)

Note. Data are no. (%) of participants, unless otherwise indicated.

categorical data were analyzed using the χ^2 test. Statistical significance was set at a P value of <.05 for all tests. Analyses were done using SAS, version 9.2 (SAS Institute).

Results

From October 2005 through September 2007, a total of 1,688 patients (679 Medicaid recipients, 12 Medicare recipients, and 997 uninsured patients) were screened for diabetic retinopathy (Table 1). The mean age of study participants was 53.3 years for females and 52.2 years for males. More Hispanics were screened in the NCCN than in the CCLCF (10.4% vs 4.6%). The majority of patients (59.1%) were uninsured. The proportion of patients reporting having type 1 diabetes was similar for both networks (5.3% in the CCLCF and 7.6% in the NCCN); however, more patients in the NCCN reported that they did not know what type of diabetes they had (26.5% vs 1.1%). This apparent difference may have resulted from an interviewer bias. The interviewer in the CCLCF was a nurse and may have probed patients for more information when they reported not knowing what type of diabetes they had; furthermore, there were more Hispanics in the NCCN, and language barriers may have contributed to this apparent difference.

Referral and retinopathy grades. Patterns of referrals to ophthalmologist are shown in Table 2 and grades of retinopathy are described in Table 3. There were no regional differences in the grade of retinopathy as diagnosed by teleretinal imaging, with 86% of participants overall showing no retinopathy, 8.5% showing mild nonproliferative retinopathy, 4.3% showing moderate-to-severe retinopathy, and 1.0% showing proliferative retinopathy. A total of 0.2% of participants had nongradable images. All patients with moderate-to-severe nonproliferative retinopathy or proliferative retinopathy were referred to an ophthalmologist. Urgent referrals were called in to the primary care physician's office, and all physicians were mailed patient reports with information when referrals were recommended within 3 or 6 months. Patients with poor visual acuity (less than 20/40 in either eye) were encouraged to see an eye specialist for refraction. If there was any suspicion of macular edema, patients were directed to an ophthalmologist.

Discussion

A recent article by Martin [16p1121] asks why the US health care system does not "keep people with preventable disabilities such as diabetes-related blindness from becoming disabled." Diabetic retinopathy is the most common cause of irreversible vision loss in persons with diabetes. Screening for retinopathy facilitates early detection, when this condition is most amenable to treatment. Indeed, retinopathy meets all of the criteria for conditions meriting screening: (1) the prevalence of the condition is high, (2) there is an accurate screening test, (3) an effective treatment is available, and (4) screening is cost-effective [17]. Despite this, systematic screening for diabetic retinopathy is not universally practiced.

Recent developments in digital retinal photography have made it cost-effective to bring this technology to primary care settings, where diabetic patients receive most of their care [7, 18, 19]. We were interested in reaching Medicaid recipients and uninsured patients because previous studies have shown that these groups are not being adequately screened [5, 20]. Other investigators have shown the feasibility of using digital retinal photography in primary care settings [10, 21].

Our approach was different in that we purposely selected to screen at multiple sites over a wide geographic region in North Carolina, which included urban and rural areas. These locations included primary care physicians' offices, public health departments, free community clinics, and hospital-based primary care clinics. The benefit of screening in these sites, instead of referring patients to ophthalmologists' or optometrists' offices for screening, is supported by a previous study with a similar population of patients. In that study, patients were randomized to receive either a digital retinal screening performed during their primary care visit or to be referred to an ophthalmologist for screening at a subsequent time [21]. All of the patients who received digital screening during their primary care visit received screening, whereas only 31% of those referred to an ophthalmologist's office actually kept their scheduled appointment for screening.

We did not encounter any reported adverse reactions due to pupil dilation with 1% tropicamide eye drops. The risk of precipitating acute narrow angle glaucoma is very small and may be smaller than the risk of missing proliferative retinopathy in a diabetic patient [22]. We advised patients to be aware of symptoms and to seek acute medical care in the event of an episode of acute narrow angle glaucoma. The absence of acute angle glaucoma in this study should reassure primary care physicians and encourage them to relearn the art of performing dilated eye examinations by use of the direct ophthalmoscope. In addition, the low frequency of nongradable images in our study is likely attributed to having patients' eyes dilated unless contraindicated and is consistent with the rate in a previous report [23].

In our study, nearly 12% (196) of the patients we screened required referral to ophthalmologists for further assessment. Urgent referral was required for 5% of patients (86) for evaluation of potentially vision-threatening retinopathy. At the time of our screening, none of the 196 patients referred to ophthalmologists were aware that they had retinopathy. Although we were not able to confirm which patients actually kept appointments with ophthalmologists, we are currently merging our study patients with North Carolina Medicaid claims data to evaluate actual health care use.

A 30%-50% reduction in the incidence of blindness has been observed in 2 population-based studies from areas that had universal screening for retinopathy [24, 25]. These observations contributed to the establishment of national screening programs for diabetic retinopathy in the United Kingdom [11, 26]. In the United States, a similar program of digital retinal screening was initiated in the Veterans Administration system in 2005 [6, 9].

Our study demonstrated that it is feasible to achieve widespread retinal screening of Medicaid patients in these 2 CCNC networks. Currently, North Carolina Medicaid does not reimburse digital retinal screening in primary care, although Medicare and most types of private insurance do. Given the serious consequences of not screening and treating people at risk for diabetic retinopathy, we encourage Medicaid to reconsider coverage of digital retinal screening for diabetic patients in the primary care setting. The medical and social consequences of vision loss resulting from undiagnosed diabetic retinopathy are too great to be ignored [27]. The CCNC networks provide an ideal medical home in which to provide comprehensive care of diabetic patients that includes diabetic eye screening and referral. NCMJ

TABLE 2.
Retinopathy Status Among Study Participants and Protocols for Referral to Ophthalmologists

	No. (%) of participants	
Retinopathy status, referral protocol	Access III of Lower Cape Fear Network (N = 658)	Northwest Community Care Network (N = 1,030)
None[a]	571 (87)	921 (90)
Nonurgent, refer in 6 mo	13 (2)	20 (2)
Nonurgent, refer in 3 mo	32 (5)	44 (4)
Urgent, refer promptly	42 (7)	45 (4)

Note. Differences in percentages between networks, stratified by referral protocol, were not statistically significant.

[a] Rescreen in 1 year.

TABLE 3.
Grade of Diabetic Retinopathy Among Study Participants

	No. (%) of participants	
Grade	Access III of Lower Cape Fear Network (N = 658)	Northwest Community Care Network (N = 1,030)
None	551 (83.7)	901 (87.5)
Mild, nonproliferative	61 (9.3)	82 (8.0)
Moderate to severe, nonproliferative	38 (5.8)	35 (3.4)
Proliferative	6 (0.9)	11 (1)
Nongradable	2 (0.3)	1 (0.1)

Note. Differences in percentages between networks, stratified by grade, were not statistically significant.

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County Health Department (Burgaw); in Davie County, the Davie County Hospital (Mocksville); in Forsyth County, Community Care Clinic (Winston-Salem), the Downtown Health Plaza (Winston-Salem), Forsyth County Health Department (Winston-Salem), Novant Diabetic Nutrition Services (Winston-Salem), and the Wake Forest OPD Clinic (Winston-Salem); in Stokes County, the Stokes-Reynolds Memorial Hospital (Danbury); in Surry County, Foothills Family Medicine (Elkin), Northern Hospital of Surry County (Mt. Airy), and Pilot Mountain Civic Center (Pilot Mountain); in Wilkes County, the Wilkes Regional Medical Center (North Wilkesboro); and in Yadkin County, Hoots Memorial Hospital (Yadkinville).

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References

1. Centers for Disease Control and Prevention (CDC). National Diabetes Fact Sheet: National Estimates and General Information on Diabetes and Prediabetes in the United States, 2011. Atlanta, GA: CDC, US Department of Health and Human Services; 2011.
2. Diabetes Prevention and Control Branch, North Carolina Division of Public Health. The Burden of Diabetes in North Carolina: Prevalence, Complications, and Costs, 2008. Raleigh, NC: North Carolina Department of Health and Human Services; 2008. Available at: http://www.ncdiabetes.org/library/_pdf/Diabetes%20Burden%20Bk.pdf. Accessed April 20, 2011.
3. Executive summary: standard of medical care in diabetes—2011. Diabetes Care. 2011;34(Supp 1):S4-S10.
4. Mohamed Q, Gillies MC, Wong TY. Management of diabetic retinopathy: a systematic review. JAMA. 2007;298(8):902-916.
5. Bell RA, Camacho F, Duren-Winfield VT, et al. Improving diabetes care among low-income North Carolinians: Project IDEAL. N C Med J. 2005;66:96-102.
6. Conlin PR, Fisch BM, Orcutt JC, Hetrick BJ, Darkins AW. Framework for a national teleretinal imaging program to screen for diabetic retinopathy in Veterans Health Administration patients. J Rehabil Res Dev. 2006;43(6):741-748.
7. Merin LM, Guentri K, Recchia CC. Digital detection of diabetic retinopathy—increasing access, reducing risk, improving outcomes. J Ophthalmic Photog. 2004;26(2):59-66.
8. Silva PS, Cavallerano AA, Aiello LM, Aiello LP. Telemedicine and diabetic retinopathy: moving beyond retinal screening. Arch Ophthalmol. 2011;129(2):236-242.
9. Cavallerano AA, Cavallerano JD, Katalinic P, et al. A telemedicine program for diabetic retinopathy in a Veterans Affairs Medical Center—the Joslin Vision Network Eye Health Care Model. Am J Ophthalmol. 2005;139(4):597-604.
10. Conlin PR, Fisch BM, Cavallerano AA, Cavallerano JD, Bursell SE, Aiello LM. Nonmydriatic teleretinal imaging improves adherence to annual eye examinations in patients with diabetes. J Rehabil Res Dev. 2006;43(6):733-740.
11. Verne J. A national screening programme for diabetic retinopathy. BMJ. 2001;323:5-6.
12. Dobson AL, Hewson DL. Community Care of North Carolina—an enhanced medical home model. N C Med J. 2009;70(3):219-224.
13. Tyler ME, Saine PJ, Bennett TJ. Practical Retinal Photography and Digital Imaging Techniques. Philadelphia, PA: Butterworth-Heinemann Medical; 2003.
14. Brucker J. Visual Impairment and Treatment of Five Complications of Diabetes: A Guide for Primary Care Practitioners. Module 2. Philadelphia, PA: Pennsylvania Diabetes Academy; 1985.
15. Towler HMA, Patterson JA, Lightman S. Diabetes and the Eye [CD-ROM]. 2nd ed. Oxford, United Kingdom: BMJ Books; 1998.
16. Martin T. Going blind on our watch. Health Aff (Millwood). 2006; 25(4):1121-1126.
17. Tugwell P, Knottnerus A, Idzerda L. New tutorial on screening. J Clin Epidemiol. 2011;64(3):229-230.
18. James M, Turner DA, Broadbent DM, Vora J, Harding SP. Cost effectiveness analysis of screening for sight-threatening diabetic eye disease. BMJ. 2000;320:1627-1631.
19. Javitt JC, Canner JK, Sommer A. Cost effectiveness of current approaches to the control of retinopathy in type 1 diabetics. Ophthalmology. 1989;96(2):255-264.
20. Moss SE, Klein R, Klein BEK. Factors associated with having eye examinations in persons with diabetes. Arch Fam Med. 1995;4:529-534.
21. Taylor CR, Merin LM, Salunga AM, et al. Improving diabetic retinopathy screening ratios using telemedicine-based digital retinal imaging technology: the Vine Hill study. Diabetes Care. 2007;30(3):574-578.
22. Pandit RJ, Taylor CR. Mydriasis and glaucoma: exploding the myth. A systematic review. Diabet Med. 2000;17(10):693-699.
23. Pugh JA, Jacobson JM, Van Heuven WA, et al. Screening for diabetic retinopathy: the wide-angle retinal camera. Diabetes Care. 1993;16(6):889-895.
24. Arun CS, Ngugi N, Lovelock L, Taylor R. Effectiveness of screening in preventing blindness due to diabetic retinopathy. Diabet Med. 2003;20:186-190.
25. Stefansson E, Bek T, Porta M, Larsen N, Kristenssen K, Agardh E. Screening and prevention of diabetic blindness. Acta Ophthalmol Scand. 2000;78:374-385.
26. Christie B. Scotland to start screening programme for diabetic retinopathy. BMJ. 2002;324:871.
27. Rein DB, Zhang P, Wirth KE, et al. The economic burden of major adult visual disorders in the United States. Arch Ophthalmol. 2006;124:1754-1760.


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ORIGINAL ARTICLE

Public Health Case Studies in Diabetes Prevention and Control:
Innovation, Partnerships, and Funding

Mary V. Davis, Margaret M. Cannon, April Reese, Beth Lovette, Deborah S. Porterfield

BACKGROUND In 2006, we conducted case studies of 4 North Carolina local health departments (LHDs) that scored highly on an index of diabetes prevention and control performance, to explore characteristics that may serve as barriers or facilitators of diabetes prevention and control services.

METHODS Case studies involving in-depth interviews were conducted at 4 LHDs. Sites were selected on the basis of 2 variables, known external funding for diabetes services and population size, that were associated with performance in diabetes prevention and control in a 2005 survey of all North Carolina LHDs. Fourteen interviews (individual and group) were conducted among 17 participants from the 4 LHDs. The main outcome measures were LHD characteristics that facilitate or hinder the performance of diabetes programs and services.

RESULTS Interviews revealed that all 4 high-performing LHDs had received some sort of funding from a source external to the LHD. Case study participants indicated that barriers to additional service delivery included low socioeconomic status of the population and lack of financial resources. Having a diabetes self-management education program that was recognized by the American Diabetes Association appeared to be a facilitator of diabetes services provision. Other facilitators were leadership and staff commitment, which appeared to facilitate the leveraging of partnerships and funding opportunities, leading to enhanced service delivery.

LIMITATIONS The small number of LHDs participating in the study and the cross-sectional study design were limitations.

CONCLUSION Leadership, staff commitment, partnership leveraging, and funding appear to be associated with LHD performance in diabetes prevention and control services. These factors should be further studied in future public health systems and services research.

Chronic diseases cause 70% of mortality in the United States and affect 133 million persons [1]. Diabetes is among the most important chronic conditions affecting Americans today. In North Carolina, an estimated 828,000 persons have diabetes, nearly one-third of whom do not know they have the disease [2]. In 2009, the prevalence of diagnosed diabetes was 9.6% among persons ≥18 years of age [3]. However, a recent survey of all 85 local health departments (LHDs) in North Carolina [4] suggested that most LHDs have limited capacity and performance in diabetes prevention and control services in communities. The survey also found that external funding and population size were characteristics associated with higher capacity and performance. These findings support the observation that chronic diseases in general are relatively neglected in public health practice [5]. These findings also support previous research demonstrating that the size of the population the LHD serves and that LHD funding affect performance [6-8]. Although survey findings described service characteristics and variation in service provision across the state, these findings did not identify factors that may serve as barriers or facilitators to performance of services or suggest strategies to increase service performance.

The purpose of this study was to conduct case studies of 4 North Carolina LHDs that scored highly on the performance survey, to further investigate LHD characteristics, particularly those that are amenable to change and that can inform performance improvement efforts, that may serve as barriers or facilitators to performance of diabetes services. Case study methods, including those involving qualitative data collection and analysis, allow for in-depth understanding of a problem [9-11], which, in this case, involves factors that are barriers or facilitators of performance of diabetes services. The study was a collaboration among investigators at the University of North Carolina–Chapel Hill (UNC-Chapel Hill), the North Carolina Division of Public Health's (DPH's) Diabetes Prevention and Control Program, and the North Carolina Association of Local Health Directors.

Methods

Case study selection. We purposively selected 4 LHDs to participate as case study sites in this research. The 9 LHDs that scored highest on a 10-point index of diabetes prevention and control services in a 2005 survey of all 85 NC LHDs (mean score for all LHDs [± standard deviation], 3.5 ± 1.9) [4] were placed into 4 categories that were based on the size of population served (>100,000 or ≤100,000 individu-

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als) and the presence or absence of Diabetes Today (DT) funding (ie, funding from the state public health agency to develop local diabetes programs). These 2 variables were associated with performance in the survey [4] and were selected as the frame within which to explore variation in and barriers and facilitators to diabetes service delivery. Of the 9 eligible sites, 4 served a large population and had DT funding, 3 served a small population and had DT funding, and 2 received no DT funding, with 1 serving a large population and 1 serving a small population. Both LHDs that received no DT funding were included in the sample. Because both of these LHDs were in the eastern region of the state, we also targeted LHDs in the other cells that were geographically in the eastern part of the state. Of the initial 4 LHDs invited to participate through the health director, only 1 refused; a second LHD with matching category criteria was substituted and successfully recruited.

Case study interview guide and interviews. A structured interview guide was created that followed the original survey framework [4], which was based on the 10 Essential Public Health Services and the Local Public Health System Performance Assessment Instrument developed by the National Public Health Performance Standards Program at the Centers for Disease Control and Prevention [12]. Additional items examined the interviewee role in diabetes services at the LHD, the importance of diabetes to the community, the provision of specific types of diabetes prevention and control services, the history and changes in diabetes services in the past 5 years, and a list of barriers and facilitators to providing diabetes services, funding sources, and partners. Items were based on the expertise of the authors and expert reviewers and on previous literature on LHD performance. Questions were open ended, with the exception of the list of barriers and facilitators. Experts in diabetes and case study methods reviewed the instrument. By use of the structured interview guide, face-to-face case study interviews were conducted by 2-person teams, with one of the research team members participating in all interviews at all sites. The staff interviewed were selected by each case study site. Interviews lasted 1-2 hours and took place over 4 months in 2006. Interviews were taped and transcribed. The study protocol was approved by the institutional review boards of the DPH and UNC-Chapel Hill, and the research effort was approved and supported by the DPH and the North Carolina Association of Local Health Directors.

Case study analysis. Data from the 2005 survey (ie, scores on the performance index, number of full-time equivalent [FTE] personnel in diabetes prevention and control, and types of service provided) were included as part of the data for each case study site. These data were examined to confirm that case study LHDs provided more services overall and to investigate whether case study sites were likely to provide specific services. To examine barriers and facilitators to providing services, individual LHD case records were created from transcribed interviews. Data were coded using both a priori and emergent coding schemes. A priori codes were used to validate barriers and facilitators to providing diabetes services. The following analyses were conducted: (1) within-case analysis for each LHD and (2) cross-case analysis to identify common themes. NVivo was used to conduct content analysis [13], to identify common response themes across interviewees and cases and for analyzing multiple case studies, as described by Miles and Huberman [14].

Results

Seventeen persons participated in interviews individually or in groups at the 4 LHDs; 7 were nurses (eg, a nurse practitioner, public health nurse, or director of nursing), 5 were nutritionists (eg, a dietician or nutrition director), 2 were health educators, and 1 each was a health promotion supervisor, program manager, and executive director for a local Healthy Carolinians (ie, health coalition) group.

Case study site survey scores on the 10-point index of diabetes prevention and control services ranged from 5.69 to 7.21, compared with the state mean of 3.5. The number of diabetes-associated FTEs ranged from 0.5 to 1.0 (mean, 0.75) for diabetes prevention services and from 0 to 1.4 (mean, 0.7) for diabetes control services. The number of certified diabetes educators (CDEs) ranged from 0 to 4 per LHD, with 3 of the LHDs having at least 1 CDE. The staff who most commonly provided diabetes prevention and control services were nurses, health educators, and nutritionists. Other staffing positions varied depending on the type of programs and services offered by the LHD.

Survey results reveal that case study LHDs were more likely to provide specific diabetes prevention and control services, compared with all LHDs in the state. Interview participants confirmed that these LHDs focus on providing the following services: (1) coordinating and providing diabetes self-management education and diabetes screening services, (2) working with local partners (described below) to strengthen and reinforce services for people with or at risk for diabetes and to link people to needed personal health services through physician referral systems, and (3) operating clinics and case management programs for persons with diabetes. Each of the 4 LHDs have referral systems for diabetes primary and/or specialty care. One LHD operates its own diabetes clinic, and another has practitioners that initiate diabetes therapy for persons with newly diagnosed diabetes who are experiencing a delay in obtaining a primary care appointment outside of the LHD. One LHD also operates a diabetes case management program for county employees. An overall description of diabetes prevention and control services identified at the case study sites is presented in Table 1.

Barriers. Interviewees were presented with the following list of potential barriers to providing diabetes services: low socioeconomic status of the population; lack of a dedicated funding stream for diabetes; small LHD size (eg, small

TABLE 1.
Diabetes-Related Activities at 4 Case Study Local Health Departments (LHDs), According to the 10 Essential Public Health Services Framework

Essential service	Case study LHD activities
1. Monitor health status to identify community health problems	Conduct community health assessments.
2. Diagnose and investigate health problems and health hazards	None of the LHDs have an epidemiologist on staff. Ways of diagnosing and investigating health problems reported by staff include the following: obtain and/or analyze data independently, seek assistance from an epidemiologist (at the state health department), and obtain assistance from a local university.
3. Inform, educate and empower people about health issues	Coordinate ADA-recognized self-management education programs. Collaborate with local health care professionals, primarily to obtain referrals from health care professionals to provide diabetes education and/or medical nutrition therapy to patients. Provide patient education outside of the LHD , either at other health care professionals' offices or in an industry setting. Conduct other awareness, education, and health promotion activities in conjunction with community partners for persons with diabetes or prediabetes/diabetes risk factors.
4. Mobilize community partnerships to identify and solve health problems	All agencies rely on local partnerships to strengthen/reinforce services provided to people with or at-risk for diabetes (see examples in the body text and in essential services 3, 4, and 7-9).
5. Develop policies/plans that support individual and/community health efforts	Two agencies described involvement in activities that influence the public health policy process in diabetes prevention and control: Issue briefs, provide public testimony, or participate on an advisory board. Provide assistance to the state in developing diabetes education curriculum.
6. Enforce laws and regulations that protect health and safety	On the basis of responses to the survey that indicated very little performance by most LHDs with regard to this essential service, this area was not probed during the interviews.
7. Link persons to needed personal health services	Create referral systems for either primary or specialist care. Operate a clinic for persons with diabetes. Provide follow-up care for patients waiting for an appointment for clinical care outside of the LHD. Implement a case management program for county employees with diabetes. Provide diabetes screening services.
8. Assure a competent public and personal health care workforce	Participate in training provided by the East Carolina University Diabetes Fellowship.
9. Evaluate effectiveness, accessibility, and quality of personal and population-based health services	For LHDs with an ADA-recognized program, report required indicators to the ADA. Contract with a local university to assist with evaluation. Conduct health care professional and patient satisfaction surveys.
10.Conduct research for new insights and innovative solutions to new health problems	None of the interviewees reported involvement in diabetes-related research at their LHD.

Note. See [12] for information about the Essential Public Health Services framework. ADA, American Diabetes Association.

budget and number of FTEs); staffing challenges, including lack of training and turnover; and rural location. All 14 participants confirmed that low socioeconomic status of the population is a barrier, and >70% confirmed that lack of a dedicated diabetes-associated funding stream is a barrier (Table 2). At least one interviewee in each LHD confirmed that small LHD size, staff turnover, and rural location are barriers to providing services. Interviewees identified the following additional barriers: lack of physical space for services and, for some persons with diabetes, perceived stigma of receiving services in an LHD. Interviewees from all 4 sites described the importance of expanding diabetes-related services by increasing clinic hours and hiring more staff to overcome these barriers.

Facilitators. Of the 8 facilitators to providing diabetes services presented to interviewees (Table 3), all interviewees agreed that having a high prevalence of diabetes in the county facilitates support for services because of the raised awareness of the disease in the community and the perceived need to address it. Other common facilitators included (1) access to data on diabetes (presumably because this can help to garner support from LHD or county leadership to develop programs or services, although this was not explored further), (2) the presence of a diabetes "champion" in the LHD, (3) a lack of other health care professionals in the county (which might have resulted in the creation of more LHD diabetes programs and services), and (4) the presence of a diabetes-related community coalition.

Additional facilitators identified by interviewees that emerged from our analyses were funding sources other than DT, having American Diabetes Association (ADA) recognition for a diabetes self-management education program, partnerships, and LHD leadership. Funding was identified as the major facilitator for providing diabetes prevention and control services. Although only 2 LHDs were known to have external funding before the interviews, it was learned that all 4 LHDs applied for and received additional funding. Funding sources included foundations, state and county

TABLE 2.
Barriers to Providing Diabetes Programs and Services at 4 Local Health Departments (LHDs), According to 14 Interviewed LHD Staff Members

Barrier	Interviewees, no. (%)[a]	LHDs, no. (%)
County socioeconomic status	14 (100)	4 (100)
Lack of dedicated diabetes-associated funding stream	10 (71)	4 (100)
Small LHD size (budget, FTEs)	9 (64)	4 (100)
Staff issues (availability, training, turnover)	9 (64)	4 (100)
Rural location	8 (57)	4 (100)

Note. FTE, full-time equivalent.
[a] Not all interviewees responded to questions because they did not know the answer or because the question was not applicable.

governments, and hospital and health care systems. These resources were used to hire and retain staff; to plan, implement, and sustain programs; to provide diabetes education through media outlets and collaborations with health care professionals; to purchase supplies, such as blood glucose test strips; and to support CDEs in providing diabetes education to county employees and in health care professionals' offices. The 2 LHDs with DT funding used those funds as seed grant money and to support communications; these LHDs also applied for additional funding from other sources.

Three LHDs have an ADA-recognized diabetes self-management program. According to interviewees, these programs bring more attention to their services and status to their program and, in some cases, bring referrals from neighboring counties. ADA-recognized programs in LHDs can bill Medicare, Medicaid, and some insurance companies for services; however, interviewees reported that correctly billing for these services has been challenging. For the LHD that does not have an ADA-recognized program, this is primarily because the neighboring hospital has one and the LHD does not wish to be perceived as being in competition.

The LHDs described relying on local partnerships to strengthen and reinforce services provided to people with or at risk for diabetes. One interviewee asserted that "We don't do anything in isolation.... [T]he reason that we are as effective as we are...is that none of us has enough resources to do it all." LHD staff described working with a variety of partners, including Healthy Carolinians groups, local health care professionals, Medicaid managed care networks, churches, hospitals, local universities and colleges, and local businesses. Most of the LHDs partner to some extent with local health care professionals, and 2 of the LHDs specifically market diabetes education and nutrition therapy services to health care professionals.

Interviewees emphasized the importance of leadership by the health director and/or staff members' direct supervisors as a facilitator to providing diabetes services. Personnel at 2 agencies indicated that the health director is a "champion" of diabetes programs and services, with one stating that their director is "a champion in everything that needs to be taking place. I mean, he just has a lot of drive and initiative." In addition, interviewees expressed appreciation for the leadership style of the health director. Interviewees from another LHD explained that their supervisor allows them freedom in designing and implementing programs; according to one, "We are allowed to be innovative in our own approaches on how we deal with things." Content analysis revealed that supportive leadership is characterized by a health director who acts as a champion for services, serves as a resource to staff, and gives staff the autonomy to do their jobs in an innovative manner.

Discussion

To improve the public health system's ability to prevent and control chronic diseases, it is necessary to assess current public health agency practice and develop appropriate and valid strategies to improve performance. Studies have identified variation in levels of performance and pointed to characteristics that may explain some of the variation, primarily at the LHD level [6-8, 15-17]. Variables associated with overall LHD performance include number of LHD staff [8]; expenditures [6-8]; education level of the health director [8]; type of jurisdiction [7]; type of administrative relationship between state and local agencies [7, 17]; population characteristics, such as size [7, 17-19] and poverty rate [6]; and presence or characteristics of a board of health [6, 8, 17]. These studies have been quantitative in nature and typically do not provide in-depth understanding of factors that affect performance, particularly factors that are amenable to change and agency influence or that can inform LHD improvement efforts [20]. This article explores factors that affect performance in chronic disease prevention and control services, which is a relatively neglected area of public health practice [5].

TABLE 3.
Facilitators to Providing Diabetes Programs and Services at 4 Local Health Departments (LHDs), According to 14 Interviewed LHD Staff Members

Facilitator	Interviewees, no. (%)	LHDs, no. (%)
Having a high prevalence of diabetes in the county	14 (100)	4 (100)
Having access to data on diabetes	13 (93)	4 (100)
Having a diabetes "champion" in the LHD	13 (93)	4 (100)
Lack of other health care professionals in the county	11 (79)	4 (100)
Having a diabetes-related coalition	9 (64)	4 (100)
Having received Diabetes Today training and funding	6 (43)	2 (50)
Having a self-management program that is accredited by the American Diabetes Association	3 (21)	2 (50)
Having "diabetes" or "chronic disease" in the mission statement	3 (21)	2 (50)

Case studies were conducted in 4 NC LHDs that scored highly on a diabetes prevention and control services performance index. Case study LHDs were selected specifically to include those serving small populations (and assumed to have smaller budgets) and those without known external funding for diabetes prevention and control services, since population size and DT funding were the 2 characteristics found to be associated with performance in the survey. Notably, although the LHDs with DT funding scored higher on the performance index, all 4 LHDs had multiple external funding sources, which facilitated diabetes service provision. When compared with LHDs statewide, case study LHDs had more FTEs involved in diabetes prevention and control and were much more likely to provide specific services.

Not surprisingly, barriers to providing services are primarily financial. There are few funding streams dedicated to supporting diabetes prevention and control services. Enhanced service delivery appears to happen through interconnected factors, including supportive leadership, funding from a variety of sources, and partnerships. In turn, supportive leadership appears to foster staff autonomy, innovation, and commitment. Although staff commitment was not specifically measured, LHD staff who participated in these interviews appear to have a high commitment to providing diabetes programs and services. We hypothesize that leadership and staff commitment can result in identification and attraction of funding and in creation and maintenance of community partnerships. Partnerships and funding can be related in 1 of 3 settings: when proposals are submitted collaboratively, when the LHD receives a grant that benefits other partners, and/or when a partner receives a grant that benefits the LHD. As described by interviewees, funding generally leads to more staff and an increased budget for programs and services.

The findings of this study are supported by case study research conducted among 5 diabetes prevention and control programs in state health departments [21]. Among factors that facilitate diabetes services among the state health departments were fitting programs and services to the context, building relationships, and negotiating systems through leadership, the latter 2 characteristics being very similar to this study's findings regarding partnerships and leadership. In a second study of state health departments developing new activities in diabetes prevention, in addition to partnerships and funding as identified in this work, other factors supporting development of effective interventions were planning, policies, benchmarks for progress, and data [22].

Findings from this study may be limited to LHDs with characteristics similar to those included in this study [11]. Furthermore, findings are limited to observations of the LHDs studied and do not include considerations of causation. Interview participants were selected by the LHDs and were typically frontline staff involved in implementing the programs; assessments of barriers and facilitators may have been different if health directors or medical directors were interviewed. The study included only high-performing LHDs and therefore does not permit comparisons with average or low-performing LHDs.

In the LHDs we studied, performance of diabetes services appears to be facilitated by leadership that supports innovation and commitment, staff commitment, and enhanced funding, which are leveraged through partnerships to meet community needs. These insights enhance the literature on factors that affect LHD performance. Much of the previous literature has identified factors associated with LHD performance that are not easily amenable to change or that cannot inform LHD performance efforts, such as poverty rates or population size [6, 18-20]. Supportive leadership style, including hiring staff who are highly committed to solving community problems, partnership leveraging, and accessing funding, are teachable skills [23]. Facilitating recognition for LHD self-management education programs, as is now occurring in North Carolina through the North Carolina Diabetes Education Recognition Program, is an action step for other state health departments that is suggested by the findings of this study. Nevertheless, these insights are limited to these 4 LHDs. Future public health systems and services research should examine whether intervening on these factors can enhance the performance of diabetes prevention and control services. NCMJ

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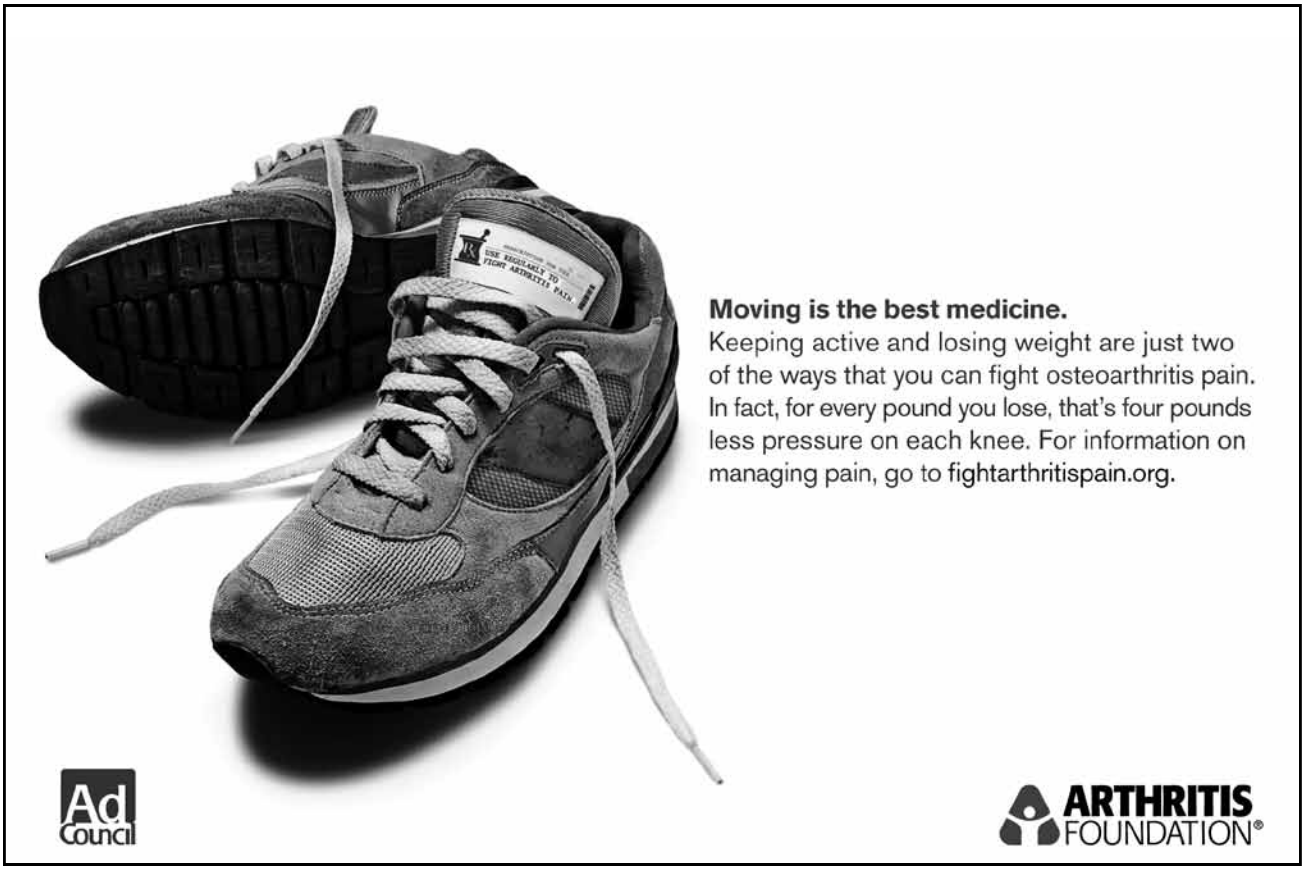
References

1. Chronic disease overview. Centers for Disease Control and Prevention Web site. http://www.cdc.gov/chronicdisease/overview/index.htm. Accessed May 14, 2011.
2. Diabetes and Prevention Control Branch, North Carolina Department

of Public Health. The burden of diabetes in North Carolina: prevalence, complications, and costs. http://www.ncdiabetes.org/library/_pdf/Diabetes%20Burden%20Bk.pdf. Accessed May 14, 2011.

3. 2009 BRFSS survey results: North Carolina. Diabetes. North Carolina State Center for Health Statistics Web site. http://www.schs.state.nc.us/SCHS/brfss/2009/nc/all/diabete2.html. Accessed May 14, 2011.
4. Porterfield DS, Reaves J, Konrad TR, et al. Assessing local health department performance in diabetes prevention and control—North Carolina, 2005. Prev Chronic Dis. 2009;6(3):A87. http://www.cdc.gov/pcd/issues/2009/jul/08_0130.htm. Accessed May 14, 2011.
5. Frieden TR. Asleep at the switch: local public health and chronic disease. Am J Public Health. 2004;94(12):2059-2061.
6. Mays GP, Halverson PK, Baker EL, Stevens R, Vann JJ. Availability and perceived effectiveness of public health activities in the nation's most populous communities. Am J Public Health. 2004;94:1019-1026.
7. Mays GP, McHugh MC, Shim K, et al. Institutional and economic determinants of public health system performance. Am J Public Health. 2006;96:523-531.
8. Scutchfield FD, Knight EA, Kelly AV, Bhandari MW, Vasilescu IP. Local public health agency capacity and its relationship to public health system performance. J Public Health Manag Pract. 2004;10:204-215.
9. Patton MQ. Utilization-Focused Evaluation. 3rd ed. Thousand Oaks, CA: Sage Publications; 1997.
10. Yin RK. Case Study Research Design and Methods. 2nd ed. Thousand Oaks, CA: Sage Publications; 1994.
11. Davis MV, MacDonald PDM, Cline S, Baker EL. Evaluation of public health response to hurricanes finds North Carolina better prepared for public health emergencies. Public Health Rep. 2007;22(1):17-26.
12. National Public Health Performance Standards Program. Centers for Disease Control and Prevention Web site. http://www.cdc.gov/od/ocphp/nphpsp/. Accessed March 25, 2009.
13. Neuendorf K. The Content Analysis Guidebook. Thousand Oaks, CA: Sage Publications; 2002.
14. Miles M, Huberman AM. Qualitative Data Analysis: An Expanded Sourcebook. 2nd ed. Thousand Oaks, CA: Sage Publications; 1994.
15. Freund CG, Liu Z. Local health department capacity and performance in New Jersey. J Public Health Manag Pract. 2000;6:42-50.
16. Richards TB, Rogers JJ, Christenson GM, Miller CA, Taylor MS, Cooper AD. Evaluating local public health performance at a community level on a statewide basis. J Public Health Manag Pract. 1995;1:70-83.
17. Beitsch LM, Grigg M, Menachemi N, Brooks RG. Roles of local public health agencies within the state public health system. J Public Health Manag Pract. 2006;12:232-241.
18. Turnock BJ, Handler A, Hall W, Potsic S, Nalluri R, Vaughn EH. Local health department effectiveness in addressing the core functions of public health. Public Health Rep. 1994;109:653-658.
19. Scutchfield FD, Knight E, Kelly A, Bhandari M, Vasilescu I. Relationship of local public agency structural capacity to public health system performance. Presented at: Public Health Systems Research Affiliate Meeting; June 26, 2003; Nashville, TN.
20. Erwin PC. The performance of local health departments: a review of the literature. J Public Health Manag Pract. 2008;14(2):E9-E18.
21. Ottoson J, Rivera M, DeGroff A, Hackely S, Clark C. On the road to the national objectives: a case study of diabetes prevention and control services. J Public Health Manag Pract. 2007;13(3):287-295.
22. Goodman RM, Larsen BA, Marmet PF, et al. The public health role in the primary prevention of diabetes: recommendations from the chronic disease directors' project. J Public Health Manag Pract. 2008;14(1):15-25.
23. Umble KE, Orton S, Rosen B, Ottoson J. Evaluating the impact of the Management Academy for Public Health: developing entrepreneurial managers and organizations. J Public Health Manag Pract. 2006;12(5):436-445.



POLICY FORUM

Confronting the Diabetes Epidemic

Introduction

If there were a contest to name the disease of the 21st century, diabetes would certainly be a strong contender. Diabetes, once thought to be an affliction in developed countries, has now become the signature condition that accompanies economic development. Diabetes has characteristics of the modern world in that it is often silent and invisible, much like the electronic and information technology that now surround us and controls our lives. Yet, that infrastructure can "go wrong," much as our individual systems malfunction when the signs and symptoms of diabetes arise. Diabetes is partly a function of the genetic codes that we are born with. How we maintain ourselves determines whether that "designed-in" flaw that gives rise to diabetes will cause a real problem. Our diet, our level of physical activity, and our physical and social environments all are associated with the rise of diabetes.

Diabetes may be silent and invisible as it develops, but it causes blindness, kidney failure, and circulatory disease that leads to amputation, and it is a major factor in stroke and heart disease. Although the disease is classed under a single, commonly mentioned diagnosis—diabetes—it is a very complex and evasive condition that expresses itself in many ways. The mechanisms by which diabetes expresses itself are complex and often illogical to the layperson. For a systemic disease that affects the secretion of a key hormone, insulin, to be diagnosed by peering into the eyes does not always make sense, but that is the nature of diabetes. Its silence and its complexity lead some to call it an "insidious" disease. This anthropomorphic expression matches its character.

The solution to the diabetes problem involves a combination of personal, societal, and medical responses. We must be aware of our risk for diabetes, and this requires education and support from medical professionals. When at risk, we need to have access to nutritious food and exercise, to restrain the disease, which is not simple to achieve in a world that favors diabetes accelerants; our work and leisure activities value inertia over movement, and we are embraced by a convenience-food culture. Prevention has been shown to be effective in reducing costs, as well as consequences. We can intervene when appropriate with drugs and therapies that reduce symptoms and mitigate risk. These interventions require monitoring and adjustment, however, which can be costly activities without an efficient system for their management. North Carolina has shown the way to keep these costs low, through efforts such as the Asheville Project and those associated with the Community Care of North Carolina system. These bellwether initiatives can only work in environments that prepare the workforce to support the diabetic patient and that educate individuals who help prevent the precursors of diabetes from becoming a costly and debilitating disease.

Diabetes is pervasive, but it is not democratic. While it may be seen as a disease of dietary excess, overeating and poor diet are now conditions of low-income people and groups. Changing these realities for the good of the health of the people is a task as complex as the chemical pathways associated with diabetes in an individual. Coalitions of citizens and patients, families and friends, and practitioners and payers have emerged to help cope with, if not reverse, the trends caused by our environments. The disease of the 21st century may yet yield to the resolve of the 21st century, as humans endeavor to prevent, treat, and heal a complex problem with complex but coherent solutions. NCMJ

Thomas C. Ricketts III, PhD, MPH
Editor in Chief

ISSUE BRIEF

The State of Diabetes in North Carolina

Joseph Konen, Joyce Page

The diabetes epidemic is rapidly growing in North Carolina. In 1999, an estimated 366,000 residents were living with diagnosed diabetes. Ten years later, the prevalence of diagnosed cases had increased to approximately 659,000. Diabetes is the seventh leading cause of death in the state and decreases life expectancy by up to 15 years. If the epidemic remains unchecked in the state, annual health care costs are predicted to exceed $17 billion by 2025. Prevention of diabetes and diabetes-related complications through treatment and disease self-management is paramount in changing this deadly and costly course and demands continued innovation in health programs and services and new partnerships among health professionals. This article reviews the diabetes burden in North Carolina and sets the stage for commentaries and sidebars in the accompanying policy forum.

The diabetes epidemic is growing. The International Diabetes Federation estimates that the number of people around the world with diabetes will grow by >50%—from 285 million to a staggering 438 million—by 2030 [1]. In North Carolina, as elsewhere, the prevalence of diabetes and associated diseases represents a burden and challenge not only for individual with the disease but also for their families, policymakers, health services systems, and communities. Preventing diabetes and diabetes-related complications through treatment and disease self-management is paramount in changing this deadly and costly course and requires continued innovation and new partnerships among stakeholders. This issue of the NCMJ is devoted to exploring the burden of diabetes in North Carolina and the public and private efforts to address this epidemic. Included are articles on the epidemiology of diabetes, innovative research programs to prevent and treat diabetes, public and private partnerships to manage diabetes through health care delivery and self-management education, use of community health workers to lead cost-effective programs that promote lifestyle changes, and thought-provoking perspectives on the need for additional research and changes in reimbursement for diabetes care.

Epidemiology and Cost of Diabetes

Diabetes defined. Diabetes is a group of diseases marked by high levels of blood glucose resulting from defects in insulin production, insulin action, or both. Many forms of diabetes exist, the most common of which are type 1 diabetes, type 2 diabetes, and gestational diabetes. Type 1 diabetes results when the body loses its ability to produce insulin, a hormone that regulates the level of glucose in blood. This form of the disease, which account for approximately 5% of all diagnosed cases, is believed to be caused most often by an autoimmune reaction in which the body's immune system destroys pancreatic beta cells that make insulin. Type 2 diabetes results from a combination of resistance to the action of insulin and insufficient production of insulin relative to the body's demand. In adults, this form of diabetes is associated with older age, obesity, family history of diabetes, history of gestational diabetes, impaired glucose metabolism, physical inactivity, and race/ethnicity and accounts for approximately 90%-95% of all diagnosed cases. Type 2 diabetes is being diagnosed more frequently among children and adolescents, especially among obese individuals. Gestational diabetes, a common complication of pregnancy, can lead to perinatal complications in mothers and fetuses, macorsomia (ie, excess birth weight), and a substantial increase in the likelihood of a cesarean section. Gestational diabetes occurs in 2%-10% of pregnancies. Mothers with gestational diabetes have a 35%-60% chance of developing diabetes 10-20 years after giving birth [2]. Mothers with gestational diabetes are also at risk for developing type 2 diabetes after pregnancy. Other types of diabetes result from specific genetic conditions, surgery, medications, infections, pancreatic disease, and other illnesses. These less common types of diabetes account for 1%-5% of all diagnosed cases [3].

Among adults, diabetes is the leading cause of new cases of blindness, kidney failure, and nontraumatic amputation, as well as a leading contributor to heart disease, stroke, and depression. In the policy forum of this issue of the NCMJ, Mount and colleagues [4] review the relationship between dementia and diabetes among African Americans, and Dowd [5] examines the association between diabetes and hearing loss.

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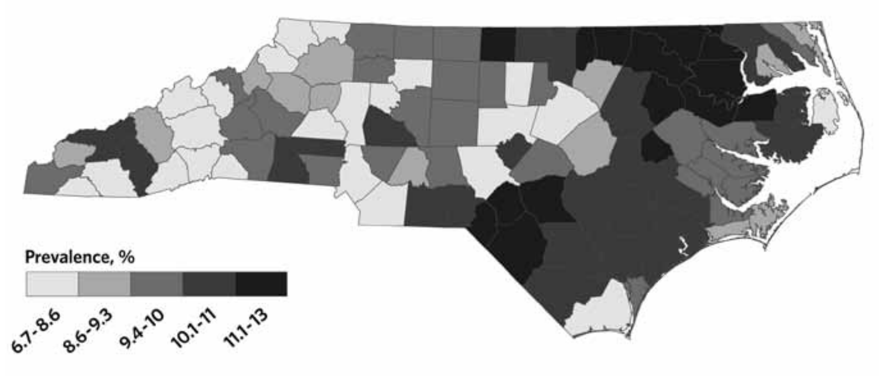
FIGURE 1.
Age-Adjusted Prevalence of Diabetes Among North Carolina Adults in 2008, by County



Note. Data are from [8].

Epidemiologic characteristics. The Centers for Disease Control and Prevention (CDC) estimated that, in 1999, 366,000 persons in North Carolina had diagnosed diabetes [6]. During the same year, 11.1 million persons in the United States had diagnosed diabetes [7]. Just 1 decade later, the numbers had almost doubled, with 673,000 cases of diagnosed diabetes in North Carolina and 19.7 million cases nationwide [6, 7]; Figure 1 summarizes the age-adjusted prevalence, by county, among North Carolina adults in 2009. The CDC's most recent report estimates that, in 2010, 25.8 million people in the United States had diagnosed or undiagnosed diabetes [9]. Another 79 million American adults (age, U20 years) had prediabetes, which increases their risk of developing diabetes [9]. Diabetes is the seventh leading cause of death in North Carolina and the nation and decreases life expectancy by up to 15 years [3, 10].

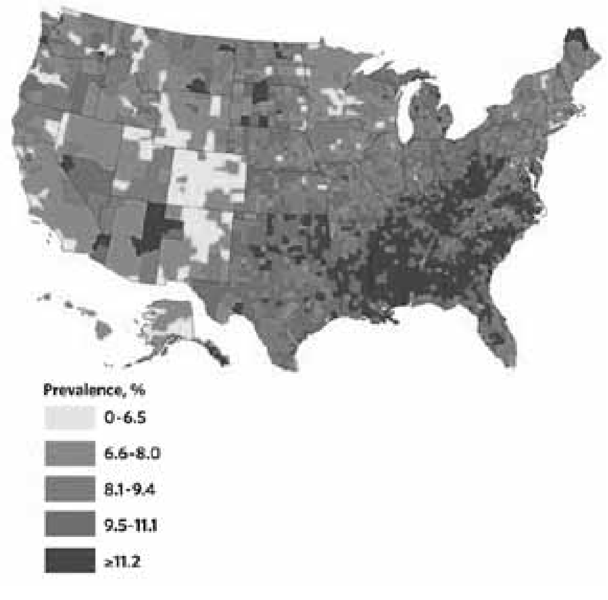
In 2011, the CDC published a map of the county-level diabetes prevalence in the United States (Figure 2) [11]. The map was based on data from national health surveys and shows the clustering of high diabetes rates in a so-called diabetes belt spanning 15 states, including North Carolina (Figure 3). The diabetes prevalence in the belt is 11.7%, compared with 8.5% elsewhere.

CDC researchers found that people living in the diabetes belt were more likely to be obese and to have a sedentary lifestyle, compared with people in the rest of the United States. This region also had more residents >65 years of age and a greater percentage of African Americans, 2 groups in which the risk of diabetes is particularly high. Lifestyle factors alone accounted for almost one-third of the difference in diabetes rates inside and outside the diabetes belt, but even young people with a slim waistline were more likely to have diabetes if they lived in the diabetes belt than if they lived outside it; reasons associated with this finding are not clear.

In the policy forum, Young and Potru [12] provide a closer examination of the epidemiologic characteristics of diabetes in North Carolina and discuss how meaningful use of electronic health records can facilitate collaborative efforts among North Carolina's health professionals and organizations to prevent and control the disease. Three other commentaries discuss matters relevant to specific demographic groups. Mount and colleagues [4] and Bell [13] highlight health-related inequities among African Americans and American Indians, respectively, among whom the diabetes burden is disproportionately higher than that for other racial/ethnic groups. Mattson [14] looks at the Affordable Care Act's role in expanding health care access and insurance coverage to prevent and treat diabetes in children, a group in which, as cited above, the incidence of type 2 diabetes is increasing.

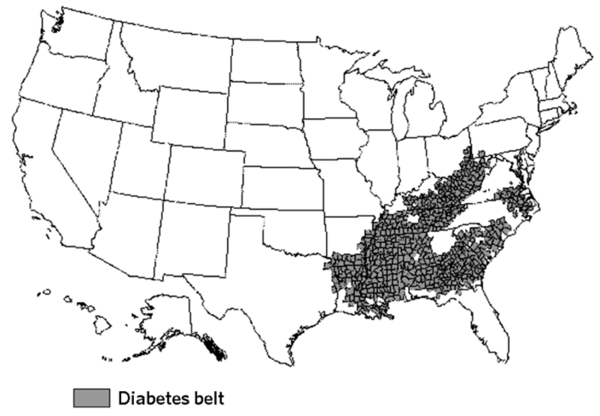
Medical costs. The estimated total financial cost of diabetes in the United States in 2007 was $174 billion, which included the costs of medical care, disability, and premature death [3]. One of every 5 health care dollars is spent on dia-

FIGURE 2.
Prevalence of Diagnosed Diabetes Among US Adults in 2007, by County



Note. Adapted from [11].

FIGURE 3.
Diabetes Belt



Note. Adapted from [11].

betes care, and 1 of every 10 health care dollars spent is for circumstances attributable to diabetes [15]. After adjustment for age and other demographic factors, annual health care expenditures among people with diabetes are 2.3-fold higher than those for people without diabetes.

North Carolina spent approximately $5.3 billion on excess medical costs and lost productivity attributable to diabetes [16]. From July 2007 to June 2008, the North Carolina Medicaid program spent around $525 million for diabetes-related medical care and prescription drugs for adults [17]. If the epidemic remains unchecked in the state, annual costs are predicted to exceed $17 billion by 2025 [18]. In her contribution to the policy forum, Reese [19] reviews innovative lifestyle interventions, as well as initiatives involving insurers and health professionals, that can reduce diabetes-associated costs in the state.

Diabetes Prevention

Although there appears to be little that people can do to avoid getting type 1 diabetes, there are clear risk factors for type 2 diabetes that are amenable to prevention efforts. Studies, some of which are summarized below, have shown that lifestyle modifications such dietary changes, increased physical activity, weight reduction, and antistress techniques, supported by a continuing education program, can reduce the incidence of diabetes and, among persons with diabetes, the need for treatment of the disease and its complications.

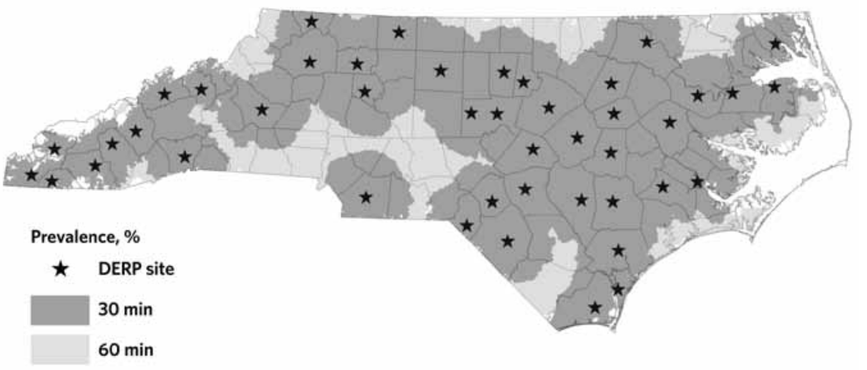
Diabetes Prevention Program (DPP). The DPP was a major clinical research study involving 3,234 participants who were overweight and had prediabetes at the time of enrollment [20]. Participants were randomized to receive a lifestyle intervention involving exercise and modifications of behavior and diet; to receive metformin; or to receive placebo. Forty-five percent of participants were from a minority group (ie, African American, Alaska Native, American Indian, Asian American, Hispanic/Latino, and Pacific Islander) associated with an increased risk of developing diabetes. The DPP study showed that people at risk for developing diabetes can prevent or delay disease onset by losing a modest amount of weight through diet and exercise. Participants in the lifestyle intervention group reduced their risk of developing diabetes by 58%. Participants who received metformin also had a reduced risk of developing diabetes, but the decrease was less than that observed in the lifestyle intervention group. Interventions in the DPP study emphasized the role of healthful dietary choices, increased physical activity, improved coping skills, and group support in helping participants lose 5%-7% of their body weight. Results from the study led the CDC to design the National Diabetes Prevention Program to bring evidence-based lifestyle interventions for preventing type 2 diabetes to communities [21]. The inaugural partners of the National Diabetes Prevention Program were the YMCA and UnitedHealth Group.

North Carolina activities. North Carolinians have benefitted from several successful prevention-related activities. Findings from a recently published research study at Wake Forest University (Winston-Salem, NC) are described by Katula and colleagues [22] in the policy forum. The study evaluated the Healthy Living Partnerships to Prevent Diabetes (HELP PD), a translational intervention based on the DPP but with modifications to improve logistical feasibility, cost, and sustainability. Twelve months after enrollment, values of several key risk factors were significantly lower among participants in the HELP PD intervention, compared with participants who received enhanced usual care. Paul and colleagues [23] complement the commentary by Mattson [14] with a discussion of the ENERGIZE! program, an intensive community-based program developed at WakeMed Health and Hospitals (Raleigh, NC) to educate overweight children with prediabetes or metabolic syndrome, as well as their families, about healthy eating, physical activity, and behavior change. A total of 535 children in Wake County have completed the program, and significant improvements in several diabetes-related risk factors have been observed between baseline and 6-month and 12-month follow-up visits. Bachar [24] adds to the discussion by Bell [13] by reviewing lessons from Cherokee Choices, a program based in Cherokee, North Carolina, that focuses on biological and environmental risk factors for diabetes among members of the Eastern Band of Cherokee Indians. The program, whose main components include elementary school mentoring, worksite wellness for adults, and church-based health promotion, corroborated the importance of factors such as community involvement and feedback, one-on-one support, and interagency collaboration in diabetes prevention efforts

Diabetes Care Through Education

Although significant progress has been seen in recent years with regard to clinical interventions that can control hemoglobin A_{1c} and cholesterol levels in persons with dia-

FIGURE 4.
Driving Time to Nearest North Carolina Diabetes Education Recognition Program (DERP) Site



Note. Driving times were derived by Paige Bennett (Heart Disease and Stroke Prevention Branch, North Carolina Division of Public Health), using the Network Analysis Tool of ArcGIS 9.3.1. Driving distances were estimated using the North Carolina Department of Transportation's Integrated Statewide Road Network, version II (available at: http://www.lib.ncsu.edu/gis/ncdot.html).

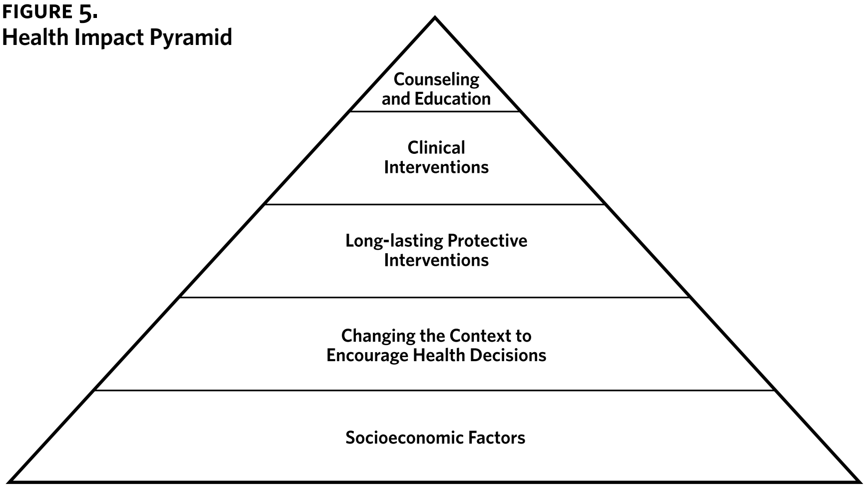
betes, <60% of all adults aged ≥40 years with diagnosed diabetes have their blood sugar level, cholesterol level, or blood pressure under optimal control [25]. Effective management of diabetes requires more than medicine. People with diabetes need education and steady support. Primary care physicians are the first line of defense against this epidemic, but face-to-face interactions with clinicians are just the start. Today, self-management education is such a critical part of diabetes care that medical treatment without it is considered inadequate.

Several commentaries in the policy forum describe diabetes-related educational programs and services in place around North Carolina. Rinker and colleagues [26] discuss the North Carolina Diabetes Education Recognition Program (NCDERP), created in 2006 to provide diabetes self-management education and thereby empower people with diabetes to take charge of their care. Although there are 42 NCDERP sites throughout the state, thousands of persons are more than a 30-minute drive from a program, and individuals in several counties with the highest prevalence must drive for >60 minutes to reach a program (Figure 4) [27]. Lengthy driving times are most common in eastern North Carolina, where health disparities and economic disadvantages are prominent. Unfortunately, problems with Medicare reimbursement may threaten this valuable program.

Two policy forum contributions highlight the delivery of self-management education in team-based settings to underserved populations in the state. In rural eastern North Carolina, the ECARE–DIABETES program places diabetes educators along primary care professionals to deliver diabetes-associated primary care and education during the same visit. Same-day delivery of integrated care has a number of advantages, including the elimination of transportation-related barriers that can keep patients from following up on referrals to off-site educators. Bray and colleagues [28] review ECARE-DIABETES and assert the need for changes in Centers for Medicare and Medicaid Services policy, which currently prohibits billing for primary care services and self-management education provided on the same day. The contribution from Sale [29] looks at the Diabetes Center, an American Diabetes Association–accredited program in western North Carolina. The center is part of the Health Education Center at Mission Hospital (Asheville, NC) and features a multidisciplinary team of health care professionals who work together to provide self-management education and a comprehensive array of additional diabetes-related services.

Three articles in this issue discuss programs in which community health workers help people with diabetes take better care of themselves. In the HELP PD intervention, reviewed by Katula and colleagues [22], community health workers with well-controlled type 2 diabetes conduct group sessions that educate attendees about weight loss, physical activity, nutrition. Page and Weisner [30] describe a successful partnership between the Division of Public Health and the Division of Aging and Adult Services in the North Carolina Department of Health and Human Services. The divisions collaborated to adopt an evidence-based self-management curriculum, Living Healthy in NC, that uses peer-to-peer learning to help persons manage diabetes and other diseases. Living Healthy in NC is based on Stanford University's Chronic Disease Self-Management Program and has been implemented throughout the state through the efforts of numerous partners. Finally, Bryant and Rocha-Goldberg [31] describe the work of El Centro Hispano, a grassroots organization with the mission of improving the quality of life among Latinos in and around Durham, Chapel Hill, and Carrboro, North Carolina. Since 2002, El Centro Hispano has offered diabetes education programs conducted by community health workers, referred to as promotores. During the first 6 months of 2011 alone, promotores provided diabetes education to 825 Latino adults.

FIGURE 5.
Health Impact Pyramid



Note. Adapted from [32].

North Carolina's Diabetes Strategic Plan

The North Carolina diabetes strategic plan for 2011-2015 reflects the most current thinking on how to prevent and manage diabetes at a population level, including policy changes needed in health care system and community settings. Strategies are to be implemented from 2011 to 2015 through the joint efforts of the North Carolina Diabetes Advisory Council, the Diabetes Prevention and Control Branch of the North Carolina Department of Health and Human Services, and numerous public and private collaborative partners. Strategies are grounded in evidence-based and best practices and were developed in accordance with the Health Impact Pyramid, created by Thomas Freiden, director of the CDC (Figure 5) [32]. The pyramid is a 5-tiered framework for developing public health strategies that reflects the impact of different public health interventions. Interventions on the lower levels tend to be more effective because they reach broader segments of society and require less individual effort [32]. The plan also reflects efforts to increase awareness among health care professionals about community resources, such as diabetes self-management education provided by local health departments, that are available for their patients. Another focus of the plan involves shifting away from addressing diabetes as an independent condition to addressing diabetes in conjunction with its comorbidities. For example, QuitlineNC (available at: http://www.quitlinenc.com/) is being promoted to reduce the risk of heart disease among diabetics who currently smoke.

Final Thoughts

The epidemic of diabetes is devastating, but we are hopeful. There is an astounding body of knowledge on the prevention of diabetes, the prevention or delay of complications, and the management of the disease. New medication and lifestyle interventions continuously become available, and techniques such as islet cell transplantation may one day be curative for significant numbers of persons afflicted with diabetes. In addition, new and powerful partnerships are being formed between public health workers, health care providers, and researchers, to ensure effective delivery of treatment by professionals and effective self-management by patients.

Despite the wealth of knowledge about the causes, prevention and treatment of diabetes, today there is still no cure. An effective response to the epidemic of diabetes will depend on improving access to health care; health education, promotion, and communication; community mobilization; and implementation of strategic plans. Together, these tools and efforts can lead to significant reductions in diabetes and its consequences. NCMJ

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References

1. Centers for Disease Control and Prevention (CDC). Number of Americans with diabetes projected to double or triple by 2050 [press release]. CDC Web site. http://www.cdc.gov/media/pressrel/2010/r101022.html. Released October 22, 2010. Accessed September 26, 2011.
2. Centers for Disease Control and Prevention (CDC). 2011 National Diabetes Fact Sheet. CDC Web site. http://www.cdc.gov/diabetes/pubs/pdf/ndfs_2011.pdf. Accessed January 9, 2012.
3. National Diabetes Information Clearinghouse (NDIC). National diabetes statistics, 2011. http://diabetes.niddk.nih.gov/DM/PUBS/statistics/. NDIC Web site. Accessed September 26, 2011.
4. Mount DL, Hairston KG, Charles SM. Diabetes and adverse mental health among African Americans. N C Med J. 2011;72(5):400-401 (in this issue).
5. Dowd KR. Could hearing loss be the link between diabetes and depression? N C Med J. 2011;72(5):402-404 (in this issue).
6. Centers for Disease Control and Prevention (CDC). North Carolina

—percentage of adults with diagnosed diabetes, 1994-2009. CDC Website. http://apps.nccd.cdc.gov/ddtstrs/Index.aspx?stateId=37&state=North_Carolina&cat=prevalence&Data=data&view=TO&trend=prevalence&id=1. Accessed September 26, 2011.

7. Centers for Disease Control and Prevention (CDC). Number (in millions) of civilian, noninstitutionalized persons with diagnosed diabetes, United States, 1980-2009. CDC Web site. http://www.cdc.gov/diabetes/statistics/prev/national/figpersons.htm. Modified March 29, 2011. Accessed October 27, 2011.
8. Centers for Disease Control and Prevention (CDC). County level estimates of diagnosed diabetes—state maps: North Carolina. CDC Web site. http://apps.nccd.cdc.gov/DDT_STRS2/CountyPrevalenceData.aspx?mode=DBT. Accessed January 9, 2012.
9. Centers for Disease Control and Prevention (CDC). 2011 National Diabetes Fact Sheet. Atlanta, GA: CDC; 2011. http://www.cdc.gov/diabetes/pubs/pdf/ndfs_2011.pdf. Accessed September 26, 2011
10. Diabetes Prevention and Control Branch, North Carolina Division of Public Health. The Burden of Diabetes in North Carolina 2010. Raleigh, NC: North Carolina Department of Health and Human Services; 2010. http://www.ncdiabetes.org/library/_pdf/Diabetes%20burden%20in%20North%20Carolina%202010%20Fact%20Sheet%20WEB.pdf. Accessed September 26, 2011.
11. Centers for Disease Control and Prevention (CDC). CDC identifies diabetes belt. CDC Web site. http://www.cdc.gov/diabetes/news/docs/diabetes_belt.htm. Accessed May 24, 2011.
12. Young LA, Potru P. Diabetes in North Carolina: descriptive epidemiology and meaningful use of electronic health records. N C Med J. 2011;72(5):383-386 (in this issue).
13. Bell RA. Barriers to diabetes prevention and control among American Indians. N C Med J. 2011;72(5):393-396 (in this issue).
14. Mattson GL. How does the Affordable Care Act support children at risk for or with diabetes? N C Med J. 2011;72(5):379-382 (in this issue).
15. Fradkin J, Rodgers GP, The economic imperative to conquer diabetes. Diabetes Care. 2008;31(3):624-625. http://care.diabetesjournals.org/content/31/3/624.full. Accessed September 13, 2011.
16. American Diabetes Association (ADA). The estimated prevalence and cost of diabetes in North Carolina. ADA Web site. http://www.diabetesarchive.net/advocacy-and-legalresources/cost-of-diabetes-results.jsp?state=North+Carolina&district=3713&DistName=Congressional+District+13. Accessed October 24, 2011.
17. Buescher PA, Whitmire JT, Pullen-Smith B. Medical care costs for diabetes associated with health disparities among adult enrolled in Medicaid in North Carolina. N C Med J. 2010;71(4):319-324.
18. Institute for Alternative Futures (IAF). Diabetes 2025 forecasts, 2011. IAF Web site. http://altfutures.org. Updated 2011. Accessed July 31, 2011.
19. Reese AB. Innovative approaches to reduce diabetes costs. N C Med J. 2011;72(5):409-412 (in this issue).
20. Knowler WC, Barrett-Connor E, Fowler SC, et al. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. N Engl J Med. 2002;346:393-403.
21. Centers for Disease Control and Prevention (CDC). National Diabetes Prevention Program. CDC Web site. http://www.cdc.gov/diabetes/projects/prevention_program.htm. Accessed September 9, 2011.
22. Katula JA, Blackwell CS, Rosenberger EL, Goff DC Jr. Translating diabetes prevention programs: implications for dissemination and policy. N C Med J. 2011;72(5):405-408 (in this issue).
23. Paul JH, Piehl MD, Lagarde WH. ENERGIZE! A community-based lifestyle intervention targeting at-risk, overweight children. N C Med J. 2011;72(5):381 (in this issue).
24. Bachar J. Cherokee Choices: a diabetes prevention program in Cherokee, North Carolina. N C Med J. 2011;72(5):394-395 (in this issue).
25. Agency for Healthcare Research and Quality (AHRQ), US Department of Health and Human Services. Chapter 2: effectiveness. In: National Healthcare Quality Report, 2008. AHRQ Web site. http://www.ahrq.gov/qual/nhqr08/Chap2.htm. Accessed September 9, 2011.
26. Rinker J, Edwards LE, Widener D. Facilitating self-management of diabetes through education: the North Carolina case. N C Med J. 2011;72(5):387-389 (in this issue).
27. Diabetes Prevention and Control Branch (DPCB), North Carolina Division of Public Health. North Carolina Diabetes Education Recognition Program. DPCB Website. http://www.ncdiabetes.org/programs/ADA.aspx. Accessed January 9, 2012.
28. Bray P, Cummings DM, Thompson DK. Use of integrated care delivery to improve the quality of diabetes management among African Americans. N C Med J. 2011;72(5):390-392 (in this issue).
29. Sale B. Hospital-based self-management of diabetes. N C Med J. 2011;72(5):388 (in this issue).
30. Page J, Weisner S. Peer-to-peer learning in the self-management of chronic disease. N C Med J. 2011;72(5):398 (in this issue).
31. Bryant CT, Rocha-Goldberg P. Community-based prevention and control of diabetes among North Carolina Latinos. N C Med J. 2011;72(5):397-399 (in this issue).
32. Frieden TR. A framework for public health action: the health impact pyramid. Am J Public Health. 2010;100(4):590-595.

How Does the Affordable Care Act Support Children at Risk for or With Diabetes?

Gerri L. Mattson

The Affordable Care Act (ACA) brings our nation closer to the goals of universal, continuous, adequate, and affordable coverage for all children. This commentary discusses the expected outcomes and the potential challenges in the ACA legislation that affect access, coverage, and use of health care services by North Carolina children with diabetes.

Nearly 215,000 US children and adolescents <20 years of age have diabetes [1]. Today, more children and youth in North Carolina are at risk for developing diabetes than ever before, because of increasing rates of obesity, physical inactivity, and poor nutrition in children. Approximately 4,300 North Carolina public school students have received a diagnosis of diabetes [2]. As children at risk for and with diabetes grow and transition into adult systems of care, they are likely to experience a lower quality of life, poorer performance at school, and higher health care costs. In 2009, North Carolina hospitalizations primarily for diabetes, for children, totaled almost $10 million (North Carolina State Center for Health Statistics, e-mail communication, July 20, 2011). It is concerning that >11% of North Carolina children were uninsured in 2009 [3], and one source reports that almost 40% of all North Carolina children did not have a medical home in 2007 [4].

The American Academy of Pediatrics defines a medical home as a team approach to providing preventive, acute, and chronic care for all children, especially children and youth with special health care needs (CYSHCN). National data show that children are more likely to receive preventive health care if they have a medical home and that more children have a medical home if they have insurance [5]. Access to health insurance, medical homes, and coordinated systems of care has a significant impact on improving health outcomes for CYSHCN. Prevention of chronic disease must also be supported through community partnerships, to address social, environmental, nutritional, and physical-activity policy changes.

Access and Coverage

By 2014, the Affordable Care Act (ACA) will require most children who are citizens and legal immigrants to have health insurance. If they are not covered, their families (and some employers) may be required to pay a federal tax. One major goal of the ACA is to help children meet this insurance requirement by increasing access to health insurance coverage for more children, especially CYSHCN, who have not been able to access coverage in the past. Several public and private insurance reforms are offered by the ACA and are discussed below.

As a result of the ACA, more low-income children with diabetes will be eligible for Medicaid. The North Carolina Medicaid program has been very successful at using a medical home approach to treat children with diabetes, through Community Care of North Carolina, a primary care case management program. In 2014, the Medicaid eligibility expansion in the ACA will cover children in families with incomes up to 133% of the federal poverty level. This expansion will allow more adolescents aged 19-20 years who previously did not qualify for Medicaid because of the stringent income requirements to become eligible. The ACA will also increase outreach and enrollment for children who are eligible but not currently enrolled in Medicaid and North Carolina Health Choice. In addition, when Medicaid reimbursement for primary care procedures increases to 100% of Medicare rates, in 2013 and 2014, provider participation in Medicaid will likely increase. Undocumented immigrants with diabetes will continue to be ineligible for public insurance plans [6].

The system created by the ACA seeks to increase and improve insurance coverage for many children who have not been eligible for private insurance plans, including those with diabetes. Many key insurance reform provisions became effective for private health plans issued after September 23, 2010. Six ACA reforms are described here. First, insurers cannot deny, rescind, or discontinue coverage to children or adolescents <19 years of age with preexisting conditions, such as diabetes. Individuals ≥19 years of age can still be excluded from insurance coverage if they have diabetes. However, insurers may charge higher premiums to children and adolescents <19 years of age with diabetes if the diabetes qualifies as a preexisting condition [6].

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Second, insurers cannot drop coverage of people when they get sick [6]. This applies to children of all ages and will help children who develop diabetes and children who develop complications from diabetes. Third, insurers cannot impose lifetime limits or caps on the amount of money the insurers pay out for a child with diabetes during the child's lifetime. However, currently existing restricted annual limits or caps will not be phased out until 2014 [6]. Fourth, insurers must offer coverage for eligible young adults <26 years of age through their parents' health plans [6]. This may help older adolescents who previously lost their health insurance when they graduated from high school or college. This does not apply if an individual has access to an employer-based plan. Fifth, all new private plans must cover preventive services, including Bright Futures preventive pediatric health care recommendations, with no cost sharing. Grandfathered plans are exempt from the requirement to cover these preventive services until 2014. Grandfathered plans are any employer-based and individual insurance plans that existed before March 23, 2010 [6]. Sixth, North Carolina has a temporary federal high-risk-pool insurance option for children and adults with preexisting conditions, such as diabetes, in place until 2014. ACA funding requires a national high-risk-pool option for people who have been uninsured for at least 6 months [6]. North Carolina offers this option through its established state high-risk pool, Inclusive Health. The federal option offers less restrictive coverage and better rates, compared with the state option [7].

Additional ACA provisions will increase access to affordable private plan coverage by several methods. First, they will create more employer-based coverage insurance options. One option will be the requirement for insurers who offer qualified health plans in the health insurance exchange (HIE) to offer similar plans that cover only children, through "child-only" HIE plans. The HIE itself is a marketplace that will offer information and assistance to individuals and families about evaluation of, enrollment in, and purchase of private plans. Another option will be to offer catastrophic coverage to people <30 years of age [6]. Second, they will allow employers to offer insurance premium discounts for children who satisfy a health standard. For instance, a health standard for a child with diabetes could be to assure that the child has a medical home, to assist with diabetes management [8]. Third, they will assist some individuals and families with incomes <400% of the federal poverty level with insurance premium subsidies [6]. This will allow some children with diabetes to access individual plans that would have been unaffordable otherwise.

As more children and adults gain access to health insurance, the demands on the health care workforce and safety net systems will increase significantly. North Carolina already has secured millions of dollars in ACA funding to enhance the health care delivery infrastructure. North Carolina school health centers are important in the safety net system, to assist with meeting some health needs of students with diabetes. Both school health centers and school nurses partner with medical homes to fulfill the state requirement for schools to implement guidelines and care plans to support students with diabetes at school; however, most North Carolina schools do not have school health centers. In addition, in some North Carolina counties, school nurses are responsible for providing care and other services to >3,000 students, including children with diabetes [2].

Benefits and Quality

Most children will be required to have health insurance that offers certain essential benefits; however, children may stay with the insurance plans they had on March 23, 2010, if families are satisfied with the benefits. The ACA requires most health plans to offer the following essential benefits: all Bright Futures preventive health recommendations for children <21 years of age, with no cost sharing; pediatric oral health, vision, and hearing services; vaccinations and other preventive services; ambulatory care; emergency services and other hospital care; prescription drugs; laboratory services; rehabilitative and habilitative services; and substance abuse and mental health services, in parity with other benefits [6].

The secretary of the US Department of Health and Human Services has the authority to develop the specific required package of essential health benefits that must be offered by public plans and most private plans. Grandfathered plans will not have to offer these essential benefits until 2014 [6]. Both North Carolina Medicaid and North Carolina Health Choice are already required to offer certain essential benefits and core services to children, including those with diabetes.

Optimal health for children is easier to achieve through prevention than through treatment and management of diabetes. The ACA's focus on the prevention of chronic diseases for children and the use of the medical home to deliver preventive health care is significant. Numerous funding provisions support research, implementation, evaluation, and dissemination of evidence-based prevention strategies and programs. Specific provisions address childhood obesity, healthy behaviors, chronic disease, and health disparities [9].

There are several funding provisions in the ACA that can improve the quality of care for children with diabetes. Some provisions seek to improve health systems and require public reporting of data and quality measures, including specific diabetes measures [10]. Others support quality care management through the following: (1) use of the medical home approach and supportive community-based interdisciplinary teams in Medicaid, (2) medication management services for treatment of chronic diseases such as diabetes, and (3) use of accountable care organizations for the management of population health [9]. These provisions build upon efforts by Medicaid, Community Care of North Carolina, and other private insurers to use medical home and additional case management strategies for North Carolina children

ENERGIZE! A Community-Based Lifestyle Intervention Targeting At-Risk, Overweight Children

Julie H. Paul, Mark D. Piehl, William H. Lagarde

Twenty-eight percent of US adolescents are overweight or obese, and type 2 diabetes now accounts for >30% of all diabetes cases among adolescents. Although the Diabetes Prevention Program demonstrated that a healthy lifestyle could reduce the rate of progression to type 2 diabetes in adults, access to intensive yet affordable lifestyle intervention programs remains limited. To begin to address the epidemic of obesity in North Carolina children, WakeMed Health and Hospitals has developed ENERGIZE!, a healthy lifestyle intervention program targeting overweight children at greatest risk for type 2 diabetes.

The ENERGIZE! program was developed through a community collaboration of local physicians, fitness organizations, and WakeMed. The goals of the program are to (1) identify overweight children aged 6-18 years with prediabetes or metabolic syndrome, (2) provide access to an intensive community-based lifestyle program that targets the child and their family, and (3) prevent type 2 diabetes and other obesity-associated comorbidities through the adoption of a healthier lifestyle. Children are identified by their primary care professionals as high risk if they are overweight (defined as a body mass index [BMI] percentile of ≥85) and meet 2 of the following criteria: minority ethnicity and family history of type 2 diabetes, acanthosis, or hypertension. They are then referred to WakeMed for measurement of fasting glucose and lipid levels. If risk factors are present and results of laboratory tests lead to a diagnosis of metabolic syndrome, prediabetes, or type 2 diabetes, children are invited to participate in the program.

The ENERGIZE! program is an intensive community-based program held 3 days weekly over 12 weeks that is designed to educate families about healthy eating, physical activity, and behavior change. The program incorporates an interactive, age-appropriate curriculum to review healthy nutrition, physical activity, behavior change, positive body image, self-esteem, and role modeling. Each week, children engage in 3 hours of structured physical activity that incorporates progressive skill building with cooperative games. Families participate in a fun fitness activity each week to stress the importance of families being active together and to teach group game skills. After completion of the intervention phase of the program, participants proceed to a maintenance phase and are reevaluated every 6 months for 2 years. BMI, blood pressure, height, weight, fasting lipid levels, and fasting blood glucose level are assessed at baseline, 6 months, 12 months, 18 months, and 24 months. Fitness evaluations, including a flexibility test, an endurance test, and a muscular strength test, as well as health behavior questionnaires, are performed during follow-up.

Since 2005, 3,755 children have been screened for the program, and 1,386 (37%) have been shown to have prediabetes or metabolic syndrome. To date, in Wake County, 862 children have been enrolled, and 535 have completed the 12-week intervention. The ethnic distribution of participants is 35% African American, 34% white, and 26% Hispanic. There is a slight predominance of female participants. Significant reductions in mean BMI percentile (97.7 vs 98.5; $P < .05$), total cholesterol level (163.8 mg/dL vs 173.5 mg/dL; $P < .05$), low-density lipoprotein level (102.1 mg/dL vs 106.9 mg/dL; $P < .05$), triglyceride level (120.6 mg/dL vs 143.0 mg/dL; $P < .05$), systolic blood pressure (112.7 mm Hg vs 116.9 mm Hg; $P < .05$), and diastolic blood pressure (63.1 mm Hg vs 70.2 mm Hg; $P < .05$) were observed at 6 months, compared with baseline levels. Significant reductions in fasting glucose level (98.6 mg/dL vs 103.8 mg/dL; $P < .0001$) were observed at 6 months for participants with an impaired fasting glucose level at baseline, and a trend toward increased high-density lipoprotein (HDL) level (31.7 mg/dL vs 30.5 mg/dL; $P = .23$) was observed for participants with an HDL level of <35 mg/dL at baseline. Significant reductions in metabolic syndrome were observed at 6 months, compared with baseline levels (McNemar statistic, 15.70; degrees of freedom, 1; $P < .05$). Improvements in BMI, glucose level, lipid levels, and blood pressure were sustained at 12 months for participants who continued to participate in the program. ENERGIZE! program graduates demonstrated a 30% improvement in flexibility, an 84% improvement in muscular strength, and a 48% improvement in endurance. Children and families reported increased daily physical activity, decreased consumption of sweetened beverages, and decreased consumption of high-fat snacks.

Our results suggest that, by promoting healthy lifestyle changes, the ENERGIZE! program reduces prediabetes and metabolic syndrome in at-risk, overweight children and may prevent progression to type 2 diabetes. The program has been successfully replicated in 12 North Carolina counties through various health systems, including hospitals, outpatient clinics, and health departments. ENERGIZE! is currently implemented in Wake, Buncombe, Nash, Henderson, and Stanly counties. Further research is needed to assess the long-term effectiveness of the ENERGIZE! program. It will be important to demonstrate whether lifestyle intervention programs such as ENERGIZE! are effective in the long term, so that needed third-party-payer reimbursement can be secured and thereby improve access to such programs. NCMJ

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and adults with chronic health conditions. In addition, funding for comparative effectiveness research can help with the evaluation of medications, equipment, dietary regimens, and other treatments delivered to children with diabetes.

Summary and Challenges

The ACA is already increasing the number of North Carolina children at risk for or with diabetes who have access to private insurance coverage. The ACA will have an even greater impact during the next 3 years, by increasing access to Medicaid and private plans (especially for older adolescents), by improving benefits in private plans, and by lowering out-of-pocket costs for some families. Accessible, adequate, affordable, continuous insurance coverage could be in place for most children with diabetes by 2014.

As a result of the ACA, several challenges regarding the health care services, processes, and systems of care for children at risk for and with diabetes will remain. One key challenge is to ensure a medical home for all children with diabetes, despite primary care and specialty workforce shortages and the growing numbers of children with diabetes. Another challenge is to ensure that plan benefits are consistently adequate across all public and private plans. The scope of required essential benefits must be comprehensive and must include coverage for critical diabetes care services (ie, oral health, mental health, medical nutrition therapy, and certain supplies). Additional challenges are presented in the processes for the determination of plan eligibility and for enrollment. These processes should be automatic and seamless, to allow children to receive uninterrupted diabetes services regardless of insurance plan changes. It will be important to weigh in on state- and federal-level discussions about how to implement many ACA provisions.

The overall prevention of diabetes and the reduction of complications from diabetes can be supported by the ACA; however, a broad approach that addresses social determinants of health and health behavior change is required to effect real change. Social determinants that are key influences in diabetes prevalence are similar to those for other chronic diseases and include poverty, housing, educational and job opportunities, and social supports. Partnerships with families in care are critical. Resources must be devoted outside of health care settings, to assist with advancing diabetes prevention and management. For example, there is a critical need for increased capacity and funding to assist with the care of children with diabetes in schools. More school health centers and school nurses can enhance medical home efforts and help address social determinants of health.

Enhancing the quality of data that measure the need for and quality of diabetes care in multiple settings is critical. Many more measures exist that monitor the quality of chronic care received by adults, compared with those for children. Moving forward, multiple payers and programs should require more child-specific diabetes measures. Improvements in data and performance measurement will allow us to assess improvements that result from the ACA and to assess remaining needs. It will be important to demonstrate how access to care, insurance coverage, families, and health service systems work together to support optimal health for children at risk for and with diabetes. NCMJ

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References

1. 2011 national diabetes fact sheet: diagnosed and undiagnosed diabetes in the United States, all ages, 2010. Centers for Disease Control and Prevention Web site. www.cdc.gov/diabetes/pubs/estimates11.htm. Accessed June 26, 2011.
2. School Health Unit, North Carolina Department of Health and Human Services (DHHS). North Carolina Annual School Health Services Report: 2009-2010. Raleigh, NC: North Carolina DHHS; 2011. http://ncdhhs.gov/dph/wch/doc/stats/SchoolHealthServices AnnualReport-2009-2010.pdf. Accessed June 26, 2011.
3. Data by state: North Carolina. Kids Count Data Center Web site. http://www.datacenter.kidscount.org/Results.aspx?ind=2281&dtm=12956&tf=18%2c35%2c38&state=NC&cat=1458. Accessed July 14, 2011.
4. Medical home profile at a glance: North Carolina. Data Resource Center for Child and Adolescent Health Web site. http://medicalhomedata.org/ViewDocument.aspx?item=473. Accessed July 14, 2011.
5. Strickland BB, Jones JR, Ghandour RM, Kogan MD, Newacheck PW. The medical home: health care access and impact for children and youth in the United States. Pediatrics. 2011;127(4):604-611.
6. Silberman P, Liao CE, Ricketts TC. Understanding health reform: a work in progress. N C Med J. 2010;71(3):215-231.
7. Keough M. What does the temporary national high risk pool mean for North Carolina? N C Med J. 2010;71(3):240-241.
8. Engel J. Prevention in health care reform: the time has come. N C Med J. 2010;71(3):259-262.
9. Mandsager P. Health reform: funding provisions. N C Med J. 2010;71(3):274-301.
10. Wallenhaupt S. Reform speeds up an already accelerating transformation: the effect on health care quality. N C Med J. 2010;71(3):268-270.

Diabetes in North Carolina:
Descriptive Epidemiology and Meaningful Use of Electronic Health Records

Laura A. Young, Parvati Potru

Diabetes is a major public health problem in North Carolina, affecting all sociodemographic groups. This commentary examines diabetes incidence, prevalence, disparities, morbidity, mortality, and costs. It also facilitates discussion about how the meaningful use of electronic health records can create new opportunities for collaboration between public health and clinical care professionals and organizations.

It is no surprise to most health care providers in North Carolina that diabetes has become a major epidemic, threatening the health and well-being of the state's residents. North Carolina has recently been named the 10th fattest state in the nation and has the 13th highest prevalence of diabetes in the country [1, 2]. Given this public health concern, this issue of the NCMJ explores the current condition of diabetes in North Carolina. In this article, we present the most current estimates of the burden of diabetes in the state and suggest novel opportunities for improving the quality of diabetes care through the use of health information technology.

Incidence and Prevalence

The incidence and prevalence of diabetes have increased dramatically during the past 15 years. In North Carolina, the age-adjusted incidence of diabetes has increased by >80%, from 5.7 cases per 1,000 population in 1996 to 10.3 cases per 1,000 population in 2009 [3]. At the national level, the age-adjusted incidence has increased from 4.7 cases per 1,000 population in 1995 to 8.8 cases per 1,000 population in 2009. In North Carolina, the diabetes prevalence has more than doubled during the past decade, from 4.5% in 1995 to >9.6% in 2009 (Figure 1). In total, an estimated 1.27 million North Carolina adults have prediabetes or diabetes.

Diabetes and Disparities

Table 1 highlights the growing concern that the burden of diabetes disproportionately affects specific groups in the state. For the most part, these trends mirror those present at the national level. The diabetes prevalence is greatest among adults with the least education and the lowest socioeconomic background. This is reflected by the finding that the highest rates of diabetes are in eastern North Carolina, one of the poorest regions in the state, while the more prosperous Piedmont region has a much lower prevalence of diabetes. Regardless of income and education levels, the proportions of African Americans and Native Americans in the state who have diabetes are greater than the proportion among whites. One surprising finding is that the prevalence of diabetes within the North Carolina Hispanic population is quite lower than the national estimate (4.9% vs 12%) [4]. However, the lower prevalence is likely due to undersampling and underreporting. Elderly individuals make up another vulnerable population with an increased risk for developing diabetes. In North Carolina, 21.4% of adults aged ≥65 years have diabetes [3].

Diabetes-Related Morbidity and Mortality

Diabetes is the seventh leading cause of death in North Carolina, and in keeping with the racial disparity trend, it is the fourth leading cause of death among African Americans. Unpublished analysis of 2009 North Carolina death certificates data by the North Carolina State Center for Health Statistics revealed that diabetes was considered the primary cause of death in 2,107 deaths and was a contributor to another 6,029 deaths. Annual mortality rates among African Americans are 2.7 times those among whites (Figure 2). Higher mortality rates are generally attributed to greater morbidity related to diabetes-associated complications. In 2009, in North Carolina, the frequency of previous history of heart attack, angina, coronary heart disease, or stroke among people with diabetes was 3.7 times the frequency among people without diabetes (25.6% vs 7.0%) [3]. Among adults with diabetes, 69.4% and 66.4% had comorbid hypertension and hyperlipidemia, respectively. One of the fastest growing diabetes-related complications is chronic kidney disease, which can lead to renal failure and the need for dialysis. The number of people living in North Carolina who have initiated renal replacement therapy has increased

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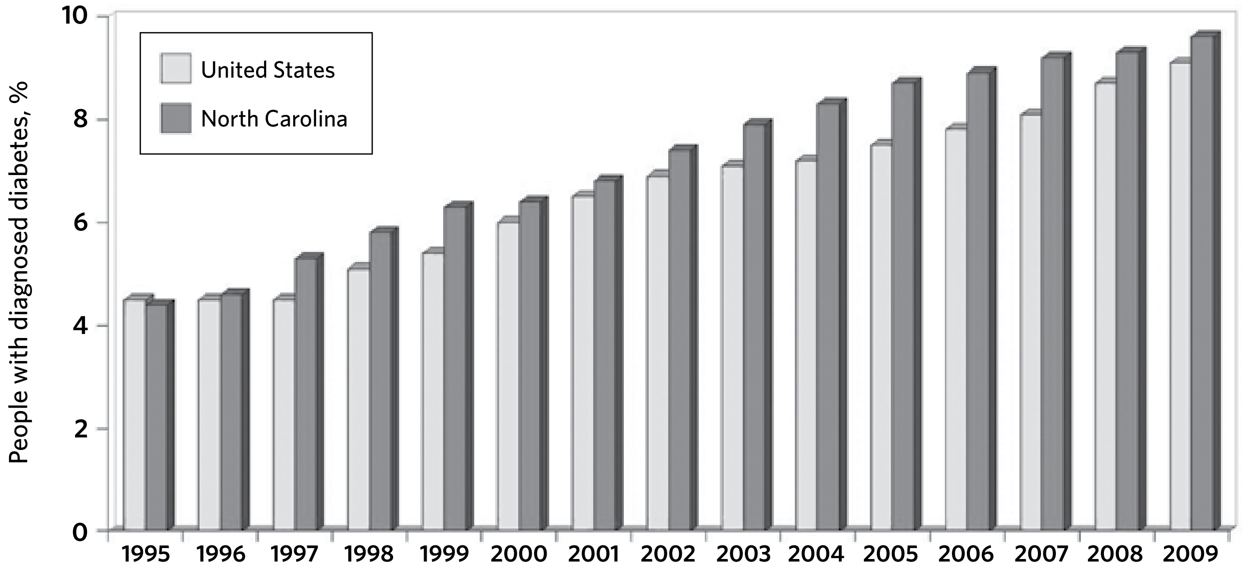
FIGURE 1.
Prevalence of Diagnosed Diabetes in the United States and North Carolina, 1995-2009



Note. Data are from [3].

by >80%, from 865 in 1995 to 1,519 in 2008 [5]. The prevalence of renal replacement therapy, secondary to diabetes, has increased by 147%, from 2,717 in 1995 to 6,715 in 2008. A devastating consequence of diabetic peripheral neuropathy is the loss of a limb. Unpublished analysis of 2009 North Carolina hospital discharge data by the North Carolina State Center for Health Statistics showed that, of the 3,994 lower-limb amputations in 2009, 2,409 (62%) were performed among people with diabetes.

Diabetes Self-Management

Consuming a healthy diet, exercising regularly, refraining from smoking, and taking medications consistently are the cornerstones of effective diabetes management. Engaging in these practices has been shown to lower diabetes-related morbidity and mortality. Unfortunately, many North Carolinians who are living with diabetes do not routinely practice these healthy habits. In 2009, only 18.7% of patients with diabetes reported consuming ≥5 servings of fruits and vegetables on a daily basis [3]. In 2009, only 1 in 3 North Carolina residents with diabetes reported moderate physical activity most days of the week, while 15.3% of all adults with diabetes smoked. Clearly, people who are living with diabetes in North Carolina have less than optimal health behaviors. Moving forward, efforts will need to focus not only on disease prevention, but also on optimizing the health status of individuals who are living with diabetes.

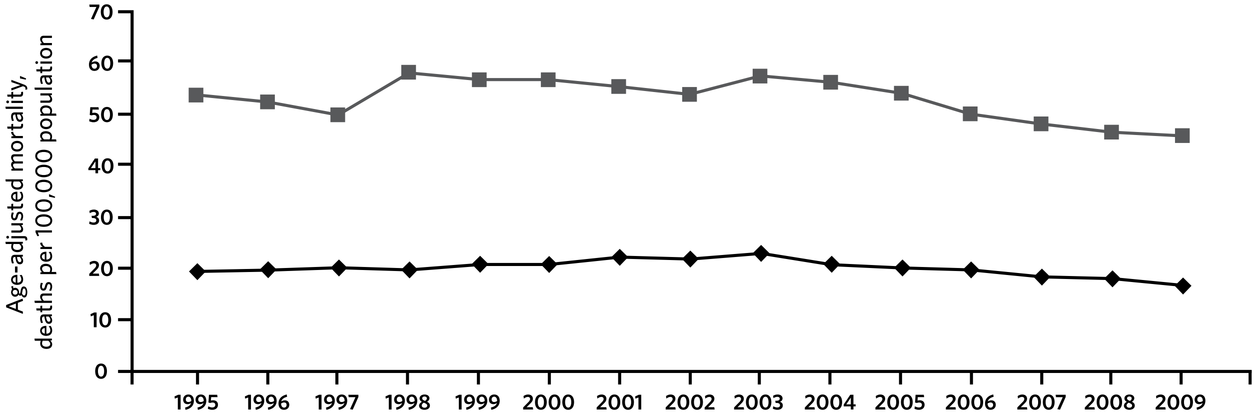
Diabetes Costs

The complications associated with diabetes result in significant costs to the health care system, especially for public insurance programs. In North Carolina, from July 2007 to June 2008, the state Medicaid program spent $525 million for diabetes-related medical care and prescription drugs for adults [6]. There were 127,991 adults with diabetes in this group, and their diabetes prevalence was 15.7%, which was 64% higher than the diagnosed diabetes prevalence of 9.6% among the general adult population in the state [3]. The average expenditure per adult with diabetes was $4,098. The greater per-person Medicaid expenditures for diabetes involved skilled and intermediate nursing care ($1,224), physician and other medical services ($1,192), hospital services ($868), and outpatient clinics ($326).

Moving Forward: Forging New Relationships Between Public Health Agencies and Health Care Providers

As the state struggles to creatively and effectively battle the growing diabetes epidemic facing its citizens, a new and potentially powerful partnership between public health workers and health care providers across the state is in its infancy. This relationship is a product of the American Recovery and Reinvestment Act of 2009 (ARRA). Under this act, billions of federal dollars have been committed to support the nationwide creation and adoption of electronic health records (EHRs) as a means to "reduce errors, bring down costs, ensure privacy, and save lives" [7]. Additionally, parts of the ARRA include the establishment of a system for health information exchange and the establishment of disease registries that include data on key variables associated with risk factors. This is particularly relevant in the case of chronic diseases, such as diabetes, for which many of these

FIGURE 2.
Trends in Diabetes Mortality Among African American and White North Carolina Residents, 1995-2009



Race	Deaths, no.														
African American	53.4	52.3	49.5	58	56.6	56.6	55.3	53.9	57.3	56.4	53.9	49.9	47.8	46.4	45.8
White	19.2	19.8	20	19.7	20.9	20.8	22.1	21.9	23	20.7	20.2	19.7	18.2	17.9	16.6

Note. Data are age adjusted on the basis of the US standard population from 2000. The line with squares denotes data for African Americans, and the line with diamonds denotes data for whites. Data are based on North Carolina death certificate data from the vital statistics database of the State Center for Health Statistics.

variables are tracked over time to monitor the progress and causal factors related to the disease. In the case of diabetes, the variables for which data must be reported include blood pressure, body mass index, and tobacco use status. Eventually, with the construction of a fully functional EHR, laboratory values will be a part of the aggregate data that are reported, among which will be data crucial for monitor diabetes disease status, such as glycosylated hemoglobin level, cholesterol level, and renal function. Having access to these variables will provide public health workers with a rich source of data that will guide further efforts to improve health status at the population level.

During the past year, the federal government has invested >$90 million in grants to North Carolina to build health information technology infrastructure and to encourage health care providers to use the new technology. As part of this initiative, health care providers, both nationally and across the state, are in various stages of converting from traditional paper medical charts to the EHR. The EHR has the potential to be an important public health tool. However, a focus on meaningful use is essential to ensure higher quality and safer patient care, at both the individual and the population levels. As the Centers for Medicare and Medicaid (CMS) notes, "providers need to show they're using certified EHR technology in ways that can be measured significantly in quality and in quantity" [8]. To highlight the importance of meaningful use, incentive payments from the CMS and North Carolina are now being tied to various measurements of meaningful use. An estimated $750 million will come to North Carolina in the form of incentive payments to eligible providers and hospitals in return for adopting and making meaningful use of EHRs during the next 5 years. The goal is for everyone in the nation to have an EHR by the year 2014. To qualify for these payments, health care providers are required to meet specified objectives for the use of EHRs, and in 2015 they will be financially penalized for noncompliance. It is beyond the scope of this commentary to review the specifics of the guidelines. However, detailed information can be found at the CMS and the North Carolina Department of Health and Human Services Health Information Technology Web sites [9, 10]. Although many providers are feeling the burden of meeting these new standards, it is important to highlight the benefits that will result from this large undertaking.

Health care systems in the United States have been slow to adopt EHRs, with the exception of several outstanding examples, including the US Veterans Administration, which boasts an extensively applied EHR system. Increasingly, larger hospital systems are following suit and converting to EHRs. However, many practitioners in North Carolina continue to use paper charts or paper systems supported in part by electronic systems, which severely limits the optimal exchange of medical records, laboratory results, and care plans with other health care providers, as well as with public health entities. The use of paper records simply does not support the type of open communication that improves patient care and minimizes unnecessary health care–related costs.

The use of the EHR and health information technology has the potential to improve the health of people with diabetes, not only at the level of the individual patient, but also at the level of the population. The majority of the incidence and prevalence data reported above has been gathered through personal interviews with a selection of individuals, under

TABLE 1.
Demographic Characteristics of Adults With Diagnosed Diabetes, North Carolina, 2009

Characteristic	Prevalence, %	Weighted no.
Sex		
Male	9.2	309,000
Female	10.0	365,000
Age		
18-44 y	2.9	101,000
45-64 y	13.6	320,000
≥65 y	21.4	250,000
Race		
White	8.4	419,000
African American	15.6	208,000
Native American	11.7	14,000
Hispanic	4.9	11,000
Education		
Less than high school	15.3	147,000
High school or GED	11.7	239,000
Some post–high school	9.0	163,000
College graduate	5.5	122,000
Household income		
<$15,000	14.6	98,000
$15,000-$24,999	11.5	120,000
$25,000-$34,999	10.0	66,000
$35,000-$49,999	9.8	81,000
$50,000-$74,999	8.7	86,000
≥$75,000	4.9	85,000
Region		
Eastern NC	12.7	253,000
Piedmont	8.2	339,000
Western NC	9.0	82,000
Overall	9.6	674,000

Note. For each characteristic, numbers do not sum to 674,000 because of rounding. Data are from [3]. GED, graduate equivalency degree.

the strict guidance of the Centers for Disease Control and Prevention. With this method, the potential for bias and confounding exists. Although aggregate data collected through the EHR on all patients with a diagnosis of diabetes are not perfect, these data have the potential to allow public health workers to generate more-accurate estimates. Furthermore, it will be much easier to track the success of larger public health initiatives and to gain better insight on the issue of disparities in diabetes. Through the use of the EHR, these trends can be tracked not only at the state level, but also down to the level of the county and even the community. Following trends such as these will allow for increased coordination and better use of public health resources. Through e-prescribing, another initiative within the larger ARRA, a computerized record of medications prescribed for diabetes will be available for individuals in North Carolina. Ultimately, the linking of claims information will give public health workers and providers a better picture of the adherence to medications among patients and of the prescribing habits of the providers.

While the possibilities of a fully functioning EHR are endless, the reality is that it will take some time for this to evolve. North Carolina has made a commitment to assist all providers throughout the state, including smaller, community-based practices and larger health care entities, in making this important leap to the EHR. This commitment has been made with a greater vision in mind: to improve the health of all North Carolinians. Although a fully functioning EHR is still far from a reality, change is underway. NCMJ

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References

1. Trust for America's Health. F as in Fat: How Obesity Threatens America's Future. http://healthyamercans.org/reports/obesity2010/Obesity2010Report.pdf. Updated 2010. Accessed July 27, 2011.
2. Centers for Disease Control and Prevention (CDC). Diabetes data and trends. CDC Web site. http://apps.nccd.cdc.gov/DDTSTRS/default.aspx. Accessed July 27, 2011.
3. Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System [database online]. http://apps.nccd.cdc.gov/DDTSTRS/default.aspx. Accessed July 27, 2011.
4. Centers for Disease Control and Prevention (CDC). National Diabetes Fact Sheet, 2011. CDC Web site. http://www.cdc.gov/diabetes/pubs/pdf/ndfs_2011.pdf. Accessed July 27, 2011.
5. US Renal Data System, National Institutes of Health. USRDS 2010 Annual Data Report: Atlas of Chronic Kidney Disease and End-Stage Renal Disease in the United States. 2010.
6. Buescher PA, Whitmire JT, Pullen-Smith B. Medical care costs for diabetes associated with health disparities among adults enrolled in Medicaid in North Carolina. SCHS Stud. 2009;(160):1-7. http://www.schs.state.nc.us/SCHS/pdf/SCHS160.pdf. Accessed October 24, 2011.
7. Remarks of President Barack Obama—as prepared for delivery address to Joint Session of Congress, Tuesday, February 24th, 2009. http://www.whitehouse.gov/the_press_office/Remarks-of-President-Barack-Obama-Address-to-Joint-Session-of-Congress/. Accessed November 16, 2011.
8. Centers for Medicare and Medicaid Services (CMS). CMS EHR meaningful use overview. CMS Web site. https://www.cms.gov/ehrincentiveprograms/30_Meaningful_Use.asp. Modified September 20, 2011. Accessed October 10, 2011.
9. North Carolina Department of Health and Human Services (DHHS). Health information technology. North Carolina DHHS Web site. http://www.ncdhhs.gov/healthIT/. Updated 2011. Accessed July 27, 2011.
10. Centers for Medicare and Medicaid Services (CMS) Electronic Health Record Incentive Program overview. CMS Web site. http://www.cms.gov/EHRIncentivePrograms/. Updated 2011. Accessed July 27, 2011.

Facilitating Self-Management of Diabetes Through Education:

The North Carolina Case

Joanne Rinker, Laura Emerson Edwards, Debbie Widener

Self-management education is such a critical part of diabetes care that medical treatment without it is considered inadequate. This article discusses the North Carolina Diabetes Education Recognition Program and calls for expansion of this program through local health departments.

Diabetes is a chronic disease that affects >25.8 million Americans—8.3% of the US population. While 18.8 million people have received a diabetes diagnosis, another 7 million individuals with diabetes have not received a diagnosis, and 79 million are estimated to have prediabetes. In 2010, 1.9 million new cases of diabetes were diagnosed in people aged ≥20 years. In the United States, the total annual economic cost of diabetes during 2007 was estimated to be $174 billion [1]. Diabetes-related health care expenses are up to 3.5 times the health care expenses for people who do not have diabetes. The first steps toward reducing the burden of diabetes involve determining people who are at risk for the disease and detecting the disease once it occurs.

North Carolina has the 13th highest prevalence of diabetes among adults in the nation, with diabetes diagnosed in >640,000 (9.6%). Diabetes is underdiagnosed in approximately 232,000 North Carolina adults, and prediabetes is present in 376,000. Diabetes is the seventh leading cause of death in North Carolina. Racial disparities are evident in the state: the prevalence of diabetes among African Americans is 15.6%; among American Indians, 11.7%; and among whites, 8.4% [2].

Poorly managed diabetes can lead to increased complications, such as blindness, amputations, and kidney disease. Today, self-management education is such a critical part of diabetes care that medical treatment without it is considered inadequate. Appropriate medical care, diabetes self-management education (DSME), and medication must be available to everyone with diabetes, to prevent complications. Yet in North Carolina, >46% of persons with diabetes have never taken a class in how to manage the disease [3]. A 2005 survey showed that, of the 85 local health departments statewide, only 58% reported having the capacity to provide health education services for persons with diabetes [4].

The Diabetes Prevention and Control Program in the North Carolina Division of Public Health established the North Carolina Diabetes Education Recognition Program (NCDERP) in 2006. The mission of the NCDERP is to provide quality, comprehensive DSME, to empower persons with diabetes. The purpose is to increase access to self-management training for people with diabetes across the state, while providing a mechanism for reimbursement to local health departments. To receive third-party reimbursement for DSME, a site must be recognized by the American Diabetes Association (ADA), the American Association of Diabetes Educators, or the Indian Health Service. The additional reimbursement builds capacity at the local level to provide self-management education for uninsured and underinsured individuals.

North Carolina is the first state to develop a statewide umbrella program in which the Division of Public Health is the sponsoring agency and local health departments are the sites where services are provided. The NCDERP works with local health departments across North Carolina, with particular emphasis on poor, rural counties with high rates of diabetes. The population served by North Carolina health departments is primarily uninsured or underinsured. Many local health departments provide care for uninsured individuals through the provision of clinical safety net services. All health departments provide health education and promotion programs for individuals who need disease management and healthy living services.

By increasing the infrastructure of local health departments, the program ensures that DSME is available to people who have no other resources for education. The program increases the quality of patient care by providing evidence-based guidelines for diabetes care and education. In addition, the program implements systems change, so that persons with diabetes receive adequate and vital education earlier and more consistently, to increase quality of life and decrease complications. When the NCDERP began, in 2006, there were only 82 ADA-recognized programs. At present,

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Hospital-Based Self-Management of Diabetes

Becky Sale

Mission Hospital is an 800-bed, not-for-profit, independent community hospital system located in Asheville, North Carolina. The Health Education Center, an outpatient program of Mission, includes the Diabetes Center, which is accredited through the American Diabetes Association. The Diabetes Center has a sister diabetes program at McDowell Hospital, in Marion, North Carolina, that provides diabetes education for adults in that region.

For patients with or at risk for diabetes, one of the advantages conferred by the Diabetes Center's relationship with Mission Hospital is that the center shares the hospital's mission of serving all individuals in western North Carolina and the surrounding region. A second advantage is that the Health Education Center has the financial backing to conduct yearly community programs to reach underserved and minority populations, with no charge to the participants. The events serve 100-300 people each year and include screening for hyperglycemia, measurement of high blood pressure, and calculation of body mass index. Education in the areas of basic diabetes pathophysiology, nutrition, and exercise is provided by certified diabetes educators and physicians. Participants also receive healthy snacks and recipes and are given blood glucose meters and taught how to use them.

Mission sees value in educating health professionals about diabetes. Since 2000, Mission, along with the Mountain Area Health Education Center and other community and regional organizations, has planned and held an annual professional diabetes clinical workshop for medical, nursing, pharmacy, and nutrition professionals. This workshop reaches 180-250 health professionals per year and covers the most up-to-date research and trends in diabetes care.

Twenty-four percent of inpatients discharged from Mission have a diagnosis of diabetes or hyperglycemia. Two years ago, Mission started a diabetes-resource program for nurses. This is a comprehensive diabetes education program for bedside nurses, who, by expanding their knowledge base, are thus better equipped to provide education about diabetes-associated survival skills to inpatients with diabetes. Part of this training is to reinforce the importance of ensuring that patients receive a referral to outpatient diabetes self-management training at the time of discharge, either at one of Mission's diabetes centers or at another outpatient education center in the region.

Another advantage of being based in a hospital system is that patients can receive care and services from a multidisciplinary team of professionals. Our outpatient diabetes education team includes an endocrinologist, who serves as our medical director, and 10 certified diabetes educators from the nursing, nutrition, and pharmacy professions. Our team also includes an exercise specialist and a clinical social worker. The ability to refer patients for multiple types of services within the same program is convenient for both patients and clinicians. Also, having professionals with multiple backgrounds available to discuss issues such as treatments, disease cases, and patient-related challenges is a tremendous advantage for the clinicians/educators.

Having such a large team also enables us to offer comprehensive services, including diabetes self-care classes, an insulin pump course, a gestational diabetes course, medical nutrition therapy, initiation of continuous glucose monitoring, a program on pediatric diabetes, individual consultations for diabetes and nutrition education, diabetes support groups, and employer-sponsored disease management programs. Of note, patients participating in the disease management programs undergo long-term follow-up by our clinicians and are seen quarterly for clinical assessment, goal setting, monitoring, and drug therapy review. In this population, we have seen significant improvements in hemoglobin A_{1c} and lipid levels, decreased per-patient medical costs, and reduced numbers of sick days.

These services are not a significant source of revenue for Mission. Their value is instead found in the community-level health and wellness benefits they yield, as well as in the satisfaction exhibited by the patients who visit us and by the team of professionals available to care for them. NCMJ

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North Carolina has 122 ADA-recognized programs, with 200 sites in total; >30% are health departments. The NCDERP has 42 programs, with a total of 51 sites.

DSME significantly affects the complications of diabetes in the target population, and it has been shown that providing DSME to vulnerable populations has an effect on participants' health and quality of life. Studies have found that improved glycemic control benefits people who have type 1 or type 2 diabetes: in general, each percentage point decrease in a person's hemoglobin A_{1c} level can reduce their risk of microvascular complications (ie, eye, kidney, and nerve diseases) by 40% [1]. NCDERP sites have seen almost 3,000 patients since the program's inception. Unpublished data from December 2010 show that the average hemoglobin A_{1c} level for patients beginning the program is 7.98% and that the average level for those who complete the program is 7.0%. More than 62% of patients who complete the program have a hemoglobin A_{1c} level of ≤7.0%.

While the program clearly increases the quality of life and decreases diabetes-related complications for participants, the reimbursement issues for local health departments remain a source of frustration. The Centers for Medicare and Medicaid Services made an online manual change, effective April 19, 2010, stating that health departments can no longer enroll as Part B providers. Enrollment as Medicare Part B providers allows health departments to bill and be reimbursed for the DSME services. At present, only a credentialed provider or a registered dietitian can bill for services through Medicare. But with this change, even if the registered dietitians are credentialed with Medicare, they cannot reassign their benefits to the health department unless the health department is already an established Medicare provider. That means that no new registered dietitians can be credentialed with Medicare if they work for the health department. This is an issue for all new DSME sites that are not already enrolled in Medicare Part B. For the >40 local health departments that offer DSME, Medicare recipients make up 19%-53% of the patient population. Very few of these 40 sites are already Medicare Part B providers; as a result, many sites still need to enroll but cannot do so because of this change. The changes to Medicare Part B were added in April 2010 and did not affect health departments already enrolled in Medicare Part B.

Health departments that are credentialed with Medicaid and third-party insurers have the ability to bill patients with these insurance carriers. Because all patients must be billed consistently, without Medicare Part B allowing this to be a billable service, Medicare recipients would have to pay out of pocket or choose from a limited availability of private providers or hospitals offering the service in the area. Choices are limited because private providers and hospitals may not have access to interpreters or other resources provided by local health departments. This service is also a revenue-generating program for local health departments, unlike many other educational services they offer. In addition, patients who are referred to the health department for DSME can potentially be referred to the registered dietitian for medical nutritional therapy, which is an additional billable service for Medicare Part B recipients with a diagnosis of diabetes. Without the ability to bill for DSME, these patients are not coming through the local health department, causing local health departments to lose the potential to provide and bill for 2 services.

For a health department's DSME program to be self-sustaining, it must have a payer mix that compensates for the cost of treating patients who are uninsured or indigent. On the basis of geographic area, the percentage of the patients with Medicare can be extremely high (53%), preventing many patients from receiving this service, because of cost. At the time of writing, in June 2011, the reimbursement rate for a patient who completed the full 10-hour program is $106.46 for the 1-hour one-on-one initial visit ($53.23 per 30 minutes) and then $327.24 for 9 hours of group education ($18.18 per 30 minutes). The total billable amount per patient is $433.70.

Recently, Palmetto GBA replaced Cigna as the North Carolina contractor for Medicare. This may yield a change in perspective that allows public health departments to become Part B providers, which, in our view, should be the case because health departments are not public health services. Public health departments have been grouped with the Public Health Service, the Department of Veterans Affairs, the Department of Defense, and TRICARE [3]. This grouping is not appropriate, because while the other providers receive federal funding for these services, public health departments do not. We believe the public health service exception was intended to apply to the US Public Health Service Commission Corps and has been incorrectly interpreted to include local public health departments. North Carolina is working to clarify this issue.

Diabetes self-management programs should remain in the public health sector, so that vulnerable populations who are unable to access services in the private sector can receive critical education and support in the management of diabetes. NCDERP has served >3,000 patients during the past 4 years. Continuing and expanding the program through local health departments is the most effective way to reach individuals most in need and thereby decrease their diabetes-related complications and improve their overall quality of life. NCMJ

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References

1. Centers for Disease Control and Prevention. 2011 national diabetes fact sheet. http://www.cdc.gov/diabetes/pubs/factsheet11.htm. Accessed June 17, 2011.
2. Diabetes Prevention and Control Branch, North Carolina Division of Public Health. The Burden of Diabetes in North Carolina 2010. Raleigh, NC: North Carolina Department of Health and Human Services; 2010. http://www.ncdiabetes.org/library/_pdf/Diabetes%20burden%20in%20North%20Carolina%202010%20Fact%20Sheet%20WEB.pdf. Accessed June 17, 2011.
3. North Carolina State Center for Health Statistics. 2009 BRFSS survey results, North Carolina: diabetes.http://www.schs.state.nc.us/SCHS/brfss/2009/nc/all/diabedu.html. Accessed June 17, 2011.
4. Porterfield DS, Reaves J, Konrad TR, et al. Assessing local health department performance in diabetes prevention and control—North Carolina, 2005. Prev Chronic Dis. 2009;6(3):A87.

Use of Integrated Care Delivery to Improve the Quality of Diabetes Management Among African Americans

Paul Bray, Doyle M. Cummings, Debra K. Thompson

The prevalence of type 2 diabetes is increasing, and racial disparities in that prevalence persist. Reimbursement policies do not match the innovative care delivery systems that have been developed. One key policy goal involves reimbursement for diabetes care delivered by physician and nonphysician health care professionals on the same day. Our evidence suggests that this integrated care improves outcomes among patients.

Ten years ago, articles were published showing that hyperglycemia among patients in rural eastern North Carolina who had type 2 diabetes was poorly controlled and that, among African Americans, the incidence of diabetes-associated death substantially exceeded the incidence among whites [1, 2]. A small group of clinicians, diabetes educators, and practice managers began meeting to study ways to improve these clinical outcomes. They were encouraged by a national movement of chronic disease collaboratives, sponsored by the Health Resources and Services Administration, that centered on a new model by Wagner and colleagues [3] called the chronic care model. This quality-improvement team began experimenting with methods to redesign delivery of care in rural eastern North Carolina clinics that primarily served low-income African American patients with type 2 diabetes. The team included staff from the University Health System and the East Carolina University Department of Family Medicine. The model for improving diabetes care generated by these investigators grew out of a process of continuous quality improvement.

The group formed project teams at 7 rural eastern North Carolina clinics. The project teams collected data on clinical outcomes, including hemoglobin A_{1c} level, lipid levels (ie, total level, low-density lipoprotein cholesterol level, and high-density lipoprotein cholesterol level), and blood pressure, as well as process measures, as part of initial efforts to redesign delivery of care. All changes in process and patient flow were measured by improvements in the clinical outcomes of patients. The goal was to identify the best clinical outcomes and then work to achieve these for patients in all participating clinics. The group published their pilot results in 2005 [4]. This article was followed by a second publication in 2005 [5] and a third in 2009 [6].

With funding from the Robert Wood Johnson Foundation in 2008, this team undertook a major study to test the new methods of clinic design in a random sample of African American patients with type 2 diabetes. In this study, the redesign and care management strategy was tested in 8 clinics with 727 randomly selected African American patients with type 2 diabetes. Half of the patients received care in clinics in which the improved model of care delivery had been implemented. The other half received usual care in otherwise similar control clinics in nearby communities. Patients receiving care in the intervention clinics showed a significant reduction in hemoglobin A_{1c} level, significant improvements in low-density and high-density lipoprotein cholesterol levels, and a trend toward significantly reduced blood pressure, compared with patients in the control clinics. The results of this study have been submitted elsewhere for review and possible publication. In 2008, the Eastern Carolina Association for Research and Education (ECARE) was formed, and the improved model is now referred to as ECARE-DIABETES. The ECARE-DIABETES Web site (available at: http://ecarediabetes.org) presents the model of diabetes care developed over these 10 years.

ECARE-DIABETES

The ECARE-DIABETES program is designed to improve the outcomes of diabetes care for rural and minority families. In the program, an educator-coach works alongside a primary care physician to deliver patient self-management coaching, to coordinate medication by use of the treatment-intensification principle, and to provide diabetes education. Education with coaching from a nonphysician health care professional during the same visit is the primary tool to achieve improved outcomes. The program involves the rede-

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sign of care provided in the clinic, including expanded roles for nurses, pharmacists, nutritionists, and front-desk staff. The physicians and educator-coaches form a care team, with the physician playing a key leadership role.

Model components. The ECARE-DIABETES model has 6 components. The first component involves delivery of education-coaching by trained nonphysician diabetes care professionals, using a culturally relevant curriculum and strategies. The second component is a treatment-intensification approach in which nonphysician providers of diabetes care work closely with medical providers to intensify medication regimens and reach targeted clinical outcomes. The third component is a point-of-care design that delivers education-coaching and care management during the same visit in which the patient is seeing their primary care professional. The fourth component involves expanded roles for office nurses, medical office assistants, and front-desk staff to facilitate comprehensive patient evaluation, patient recall, and management on a regular basis. The fifth component is a team-care approach that emphasizes frequent interprofessional communication and collaboration. The final component is medical professional leadership, which is critical to ensure ongoing evaluation and improvement in care delivery measured by specific evidence-based outcomes.

Education and coaching during primary care visits. The ECARE-DIABETES program delivers diabetes education and coaching as part of the primary care visit. The extra care components are education, coaching, and treatment intensification and are provided on the same day and at the same location as when the patient sees their primary care physician or health care professional. This is an extremely important component of this program and was informed by the growing interest in and implementation of patient-centered medical homes and integrated care models. The project's data indicates that providing enhanced care during the visit to the primary care professional is essential. These conclusions are similar to the findings from the IMPACT project [7, 8] and from other studies [9]. The IMPACT project is a behavioral health program whose focus is on depression and diabetes. The IMPACT project's most significant contribution is the excellent evidence it provides in support of integrating, during the primary care visit with a physician, care from nonphysician health care professionals who are skilled in treating depression and diabetes [10].

These examples of redesigned delivery of health care are part of the transformation of health care from separated care interventions to integrated medical homes, as described by the Improving Chronic Illness Care program [11]. This program has worked for more than a decade with national partners toward the goal of improving the health of chronically ill patients by helping health systems, especially those that serve low-income populations, implement the chronic care model.

Research involving the ECARE-DIABETES program has identified 5 reasons why a single, same-day visit that involves care from an educator-coach and the primary care professional is superior to multiple visits during which care from both professionals is provided separately. First, the program eliminates dual scheduling and dual transportation. This is important because, according to our data, there is a substantially high frequency of no-shows, sometimes involving >30% of scheduled visits, among patients who are referred to receive ancillary services provided on different days and at different locations. This is particularly true in populations with major transportation challenges, such as those in rural communities. Second, strategic placement of expanded care services such as education-coaching in the clinic ensures that patients who might otherwise have only renewed their prescriptions or received acute care are also exposed to these additional services. Third, because a patient's bond with their primary care professional can extend to other care professionals who work in the same clinical setting, the impact of education-coaching can be greatly enhanced when received from a team member who works with the patient's physician in the clinic, rather than from one who works in another location. Fourth, the model extends the duration of patient-professional interaction and enhances opportunities for dynamic exchanges about patient care between physicians and educator-coaches. Primary care professionals have only about 15 minutes to provide care to a patient, whereas educator-coaches have 30-45 minutes to care for a patient, during which they are often able to gain an understanding about family-related, economic, and/or motivational barriers to the patient's diabetes management. Subsequent interprofessional communication facilitates improved understanding of a patient's information and more-rapid development and implementation of appropriate treatment plans. Fifth, a diabetes educator-coach provides specialized care to diabetic patients that focuses on achieving diabetes-related target outcomes in the areas of blood chemistry, medication management, and patient behavioral changes [12].

Need for a New Reimbursement Policy for Self-Management Education

The current reimbursement policy for diabetes self-management education financially limits the development of care strategies that integrate primary care and education-coaching on the same day and in the same location. Instead, it rewards delivery of separate service programs delivered on separate days and, often, at different locations. Though unintended, the present reimbursement policy nearly eliminates the exchange of actionable treatment changes that are informed by the consultation between a primary care professional and a diabetes educator-coach. Current federal health insurance policy prohibits billing for primary care activities involving evaluation and management and for providing self-management diabetes education if they are performed on the same day. This policy therefore limits the formation of patient-centered medical homes that can provide optimal care to patients with diabetes.

To understand the negative impact of this policy, one must understand how ambulatory primary care clinic delivery systems are designed. Treatment of patients, including the steps associated with changing treatment, are based on real-time data. These data must be available to and recognized by a physician during the 15-minute clinic visit to ensure that they are among the factors considered in care-related decisions. Data such as laboratory findings and specialist recommendations, unless involving acute clinical conditions, are collected for the patient's next or follow-up visit. Such visits are likely to be 3 months later. A written or verbal recommendation from a diabetes educator-coach, who is seen on another day, is also collected for the 3-month visit. However, for diabetic patients, corrections to diet, exercise, and especially medication must be measured and, often, readjusted in a shorter time frame. The capacity to achieve these clinical changes can best occur with the assistance of a diabetes educator-coach who works at the primary care clinic and sees the patient alongside the primary care professional. Because current policy does not provide reimbursement for such services on the same day, it therefore limits the development of a business plan for optimal care. We therefore recommend a change in this policy that encourages integrated diabetes care as part of a patient-centered medical home. NCMJ

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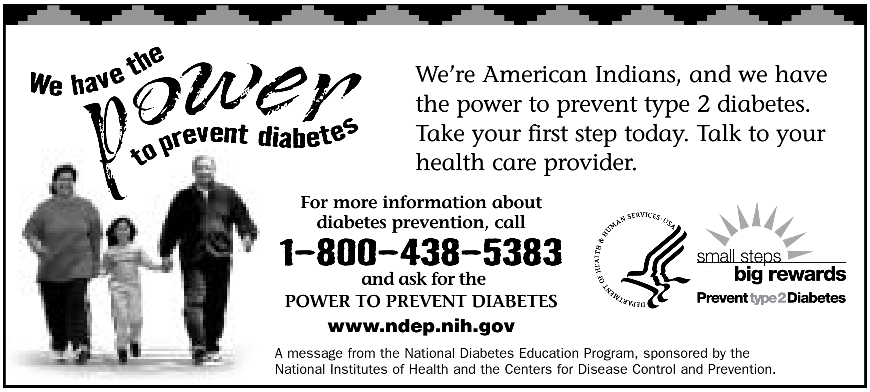
References

1. Heisler M, Smith DM, Hayward RA, Krein SL, Kerr EA. Racial disparities in diabetes care processes, outcomes, and treatment intensity. Med Care. 2003;41(11):1221-1232.
2. Dagogo-Jack S. Ethnic disparities in type 2 diabetes: Pathophysiology and implications for prevention and management. J Natl Med Assoc. 2003;95(9):774, 779-789.
3. Wagner EH. Chronic disease management: what will it take to improve care for chronic illness? Eff Clin Pract. 1998;1(1):2-4.
4. Bray P, Thompson D, Wynn JD, Cummings DM, Whetstone L. Confronting disparities in diabetes care: the clinical effectiveness of redesigning care management for minority patients in rural primary care practices. J Rural Health. 2005;21(4):317-321.
5. Bray P, Roupe M, Young S, Harrell J, Cummings DM, Whetstone LM. Feasibility and effectiveness of system redesign for diabetes care management in rural areas: the eastern North Carolina experience. Diabetes Educ. 2005;31(5):712-718.
6. Bray P, Cummings DM, Wolf M, Massing MW, Reaves J. After the collaborative is over: what sustains quality improvement initiatives in primary care practices? Jt Comm J Qual Patient Saf. 2009;35(1):502-508.
7. Unützer J, Katon WJ, Callahan CM, et al. Collaborative care management of late-life depression in the primary care setting: a randomized controlled trial. JAMA. 2002;288(22):2836-2845.
8. Unützer J, Powers D, Katon W, Langston C. From establishing an evidence-based practice to implementation in real-world settings: IMPACT as a case study. Psychiatr Clin North Am. 2005;28(4):1079-1092.
9. Norris SL, Nichols PJ, Caspersen CJ, et al. The effectiveness of disease and case management for people with diabetes. Am J Prev Med. 2002;22(4 Suppl):15-38.
10. Gilmer TP, Walker C, Johnson ED, Philis-Tsimikas A, Unützer J. Improving treatment of depression among Latinos with diabetes using project Dulce and IMPACT. Diabetes Care. 2008;31(7):1324-1326.
11. Care coordination. Improving Chronic Illness Care Web site. http://www.improvingchroniccare.org/index.php?p=Care_Coordination&s=326. Accessed January 19, 2012.
12. Riddle MC, Rosenstock J, Gerich J. The treat-to-target trial: randomized addition of glargine or human NPH insulin to oral therapy of type 2 diabetic patients. Diabetes Care. 2003;26(11):3080-3086.



INVITED COMMENTARY

Barriers to Diabetes Prevention and Control Among American Indians

Ronny A. Bell

North Carolina's American Indian population experiences a disproportionate diabetes burden, in terms of both a high prevalence of the disease and excess diabetes-related death and disability. Concerted efforts need to be made to provide culturally appropriate and easily accessible education, health care, and health-promoting resources in these vulnerable communities.

American Indians and Alaska Natives have the highest rates of diabetes of any racial/ethnic group in the United States [1]. The diabetes burden in American Indian and Alaska Native communities has been referred to as an "epidemic" [2], a term that is generally reserved for infectious illnesses. Moreover, the physical and economic toll associated with complications of diabetes in these communities is devastating [3, 4]. The prevalence of type 2 diabetes, the most common form of diabetes and a condition once thought to be limited to adults, is alarmingly high among American Indian youths [5]. In fact, much of the early evidence of type 2 diabetes in youths was generated from studies in American Indian populations [6].

North Carolina has the largest American Indian population east of the Mississippi River, with >100,000 residents [7]. Evidence indicates that the diabetes burden facing American Indians across the nation is similarly shared by our state's first peoples [7]. Data from the 2006-2008 Behavioral Risk Factor Surveillance System indicated that the prevalence of self-reported diabetes among North Carolina's American Indian population was 13.3%, a value >40% higher than that for non-Hispanic whites (9.4%) [7]. During 2004-2008, the frequency of death due to diabetes, the fifth leading cause of death for North Carolina's American Indians, was 45.0 cases per 100,000 population, a value more than double that for the non-Hispanic white population in the state (Table 1) [7]. Data from the Eastern Band of Cherokee Indians (ECBI), the only fully federally recognized tribe among the 8 organized tribes in North Carolina, indicate that approximately 1 in 3 ECBI men and approximately 1 in 4 ECBI women self-reported having received a diagnosis of diabetes [8].

The reasons for the high frequencies of diabetes and associated sequelae among American Indians remain elusive but are likely multifactorial. One strong factor contributing to this disparity is the excess socioeconomic burden in most American Indian communities. Evidence from across the globe has consistently shown an inverse association between indicators of socioeconomic status and prevalence of diabetes [9]. Persons with a high level of economic means and formal education are more likely to have access to resources that promote healthy lifestyles to prevent disease and to adequate health care to treat disease. Buescher and colleagues [10] recently estimated that $225 million in diabetes-related expenditures could be saved each year by the North Carolina Medicaid program if diabetes-related racial and economic disparities were eliminated.

TABLE 1.
Diabetes Prevalence, Diabetes Mortality, and Indicators of Socioeconomic Status in North Carolina, by Race

Indicator	American Indian	African American	White
Diabetes prevalence, individuals, %	13.3	14.8	9.4
Diabetes mortality, deaths per 100,000 population	45.0	51.0	19.5
Living below FPL, families, %	21.2	21.3	6.7
No health insurance, individuals, %	28.3	23.1	14.2
No formal education beyond high school, adults,[a] %	58	...	40

Note. Data are from [7]. FPL, federal poverty level.
[a] Defined as individuals aged ≥25 y.

Unfortunately, American Indians do not fare well with regard to access to these resources. The poverty prevalence for North Carolina's American Indian population (21.2%) is more than 3 times that for the non-Hispanic white population (6.7%). More than 58% of American Indian adults ≥25 years of age have no formal education beyond high school, compared with 40% for whites (Table 1) [7].

What solutions are available to American Indian communities to eliminate the disparities associated with diabetes? Community-level and community-driven efforts are most

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effective in ensuring that culturally relevant approaches are developed. A critical first step is increasing awareness of the behaviors associated with diabetes prevention and control. This is the goal of the American Indian and Alaska Native Workgroup of the National Diabetes Education Program, with initiatives such at the Move It and the Power to Prevent campaigns. These initiatives focus on encouraging increased exercise, healthy eating, and maintenance of healthy body weight by American Indian youths and adults, lifestyle behaviors that were shown by the Diabetes Prevention Program to reduce the risk of diabetes [11].

Furthermore, community-level policies need to encourage access to healthy foods and safe and affordable venues to exercise. A 2009 study showed that residents who lived in neighborhoods with more of these resources had a 38% lower risk of developing diabetes, compared with those in neighborhoods with fewer resources [12]. Given that many of the state's American Indians live in rural areas, this presents some challenges. However, community-based organizations that are important in American Indian communities, such as faith-based institutions, can play an important role in disseminating health education information and in providing places to exercise and share healthy foods. The training and support of lay health educators has been shown to be a cost-effective approach to impart this education [13].

Another important component in reducing diabetes-related disparities in American Indian communities involves ensuring that culturally competent health care professionals with particular expertise in diabetes management are available. Again, since many of the state's American Indians live in rural populations with limited means for transportation, this is a major challenge. An additional complicating factor is that many in the state's American Indian populations have limited or no health insurance, making access to diabetes specialty care even more difficult [14]. Even among members of the EBCI, who have access to health care through the Indian Health Service, resources for treating the large number of residents with diabetes, many of whom live long distances from health care facilities, are limited.

Finally, researchers need to work with American Indian communities to translate findings from diabetes prevention and control research studies in order to generate the broadest impact. As an example, Katula and colleagues [15] recently demonstrated promising results in translating the Diabetes Prevention Program intervention for use by low-income African Americans in Forsyth County, North Carolina. This collaborative approach requires a high level of trust and a mutual respect among partners.

Cherokee Choices:
A Diabetes Prevention Program in Cherokee, North Carolina

Jeff Bachar

In 1999, Cherokee Choices received funds from the Centers for Disease Control and Prevention to prevent diabetes among members of the Eastern Band of Cherokee Indians. Cherokee Choices' 3 primary components—a mentoring program for elementary school students, a worksite wellness program for adults working in tribal offices, and a wellness program for church members [1]—provide a bottom-up approach to diabetes prevention by mobilizing community members to play an active role in their well-being [2]. The intervention has resulted in several beneficial changes in the community and has revealed several lessons and keys to which the program's success can be attributed.

According to teachers at Cherokee Elementary School, the elementary school mentoring component has yielded changes in the culture of the school, such as the creation of a School Health Advisory Council, and changes in the learning environment, including a greater emphasis on health-promoting events and lessons. These changes extend beyond the activities implemented directly by Cherokee Choices. For example, teachers are incorporating more lessons that involve physical activity and are urging parents to supply healthy food for classroom events. Surveys conducted before and after implementation of this component show that elementary school students who participated in in-class and after-school activities sponsored by Cherokee Choices had better attendance and were more likely to look forward to being at school, compared with students who did not participate.

The workplace-wellness component of Cherokee Choices has resulted in many improvements in working conditions for tribal employees. For instance, a major policy change that allows employees time off to participate in Cherokee Choices–sponsored events was achieved. In addition, the tribal human resources program received education about best practices for achieving worksite wellness, which contributed to the implementation of health risk appraisals (including evaluation of lipid profile and calculation of body mass index) for all tribal employees. There is now substantial demand among employees for these and related services provided by Cherokee Choices, such as exercise classes, lifestyle coaching, and cooking demonstrations.

In the church-wellness component, health professionals such as nutritionists, dieticians, and fitness experts lead activities to promote healthy eating, physical activity, and awareness of health services available to tribal members [1]. Pastors have complemented these efforts with sermons that promote the cultivation of healthy physical and spiritual lives. The Walk to Jerusalem program, in which 150 church members each walked a distance equivalent to that between Cherokee and Jerusalem, is one of the components' highlights.

Cherokee Choices has revealed several lessons about the implementation of interventions and the keys to their success. First, political astuteness among intervention leadership can help navigate the intervention through policy-related challenges. Policy change might be best approached in phases, by initially building buy-in among stakeholders and then acting in full force once a foundation of support has been laid.

Second, fearlessness and prudence are useful for overcoming the view that the current way of doing things is the best. One must be willing to try new approaches yet to hold back until opportunities for more-assertive actions arise. As with policy change, one path toward success involves implementation of the intervention in phases.

Third, regular receipt of feedback from community members allows the intervention to be sensitive to cultural needs, can mitigate problems early during the intervention's existence, and can serve as an incubator for new ideas and solutions to problems. Listening to community members during the design phase can be time-consuming, however, owing to the need to convince people that their feedback will be used. People might not be accustomed to being involved in intervention design, and their initial input can be hard to obtain and of low quality. Trust must therefore be established, and intervention leadership must remain patient and persistent until individuals feel sufficiently comfortable to share their thoughts.

Fourth, one-on-one support, in terms of establishing and sustaining relationships, enables the intervention to delve below the surface of health issues and address, directly or through an effective referral system, underlying causes of adverse health, such as past trauma, racism, and abuse.

Fifth, collaborative activities have made partners outside of the health system, such as transit agencies, city planners, and businesses, relevant to the health of the community. Wellness, when framed as an economic issue, resonates with these organizations, and Cherokee Choices has capitalized on this message by working with these organizations and other tribal programs on initiatives to increase the number of greenways, sidewalks, and parks in Cherokee.

Finally, even a minimal amount of contact with stakeholders can promote continuity in the intervention and lead to its long-term sustainability. Cherokee Choices uses multiple channels of communication, including group meetings, telephone calls, and social marketing, to reinforce messages and maintain a link to clients.

Cherokee Choices has shown that beneficial health-related changes can be achieved community wide through targeted, hands-on programs in multiple settings. The intervention has demonstrated the importance of involving a variety of stakeholders from multiple levels of the community stratum and can serve as an example for the creation and implementation of interventions that address other health conditions. NCMJ

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References

1. Bachar JJ, Lefler LJ, Reed L, McCoy T, Bailey R, Bell R. Cherokee Choices: a diabetes prevention program for American Indians. Prev Chronic Dis. 2006;3(3):A103. http://www.cdc.gov/pcd/issues/2006/jul/05_0221.htm. Accessed December 4, 2012.
2. Cherokee Choices/REACH: diabetes prevention education. http://cherokee-hmd.com/cherokee-choices/index.html. Accessed December 4, 2011.

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Diabetes disparities are persistent in American Indian communities in North Carolina and across the United States. The factors that contribute to these disparities may largely be driven by the limited socioeconomic means in American Indian communities. The ability to address these disparities is largely dependent on the development of community-driven approaches that are culturally sensitive and accessible and have the widest reach. Health care professionals, policymakers, researchers, and the community at large need to develop a concerted approach to addressing these disparities. NCMJ

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References

1. Barnes PM, Adams PF, Powell-Griner E. Health Characteristics of the American Indian or Alaska Native Adult Population: United States, 2004-2008. National Health Statistics Reports. No. 20. Hyattsville, MD: National Center for Health Statistics, Centers for Disease Control and Prevention; 2010.
2. National Diabetes Education Program. The Diabetes Epidemic Among American Indians and Alaska Natives. http://www.ndep.nih.gov/media/FS_AmIndian.pdf. Accessed August 15, 2011.
3. O'Connell J, Yi R, Wilson C, Manson SM, Acton KJ. Racial disparities in health status: a comparison of the morbidity among American Indian and US adults with diabetes. Diabetes Care. 2010;33:1463-1470.
4. Egede LE, Dagogo-Jack S. Epidemiology of type 2 diabetes: focus on ethnic minorities. Med Clin North Am. 2005;89:949-975.
5. Moore K. Youth-onset type 2 diabetes among American Indians and Alaska Natives. J Public Health Manag Pract. 2010;16:388-393.
6. Fagot-Campagna A, Pettitt DJ, Engelgau MM, et al. Type 2 diabetes among North American children and adolescents: an epidemiologic review and a public health perspective. J Pediatr. 2000;136:664-672.
7. State Center for Health Statistics, North Carolina Office of Minority Health. North Carolina Minority Facts: American Indians. http://www.schs.state.nc.us/SCHS/pdf/AmerIndian_MHFS_WEB_072210.pdf. Accessed August 15, 2011.
8. Liao Y, Bang D, Cosgrove S, et al. Surveillance of health status in minority communities—Racial and Ethnic Approaches to Community Health Across the US (REACH US) Risk Factor Survey, United States, 2009. MMWR Surveill Summ. 2011;60:1-44.
9. Agardh E, Allebeck P, Hallqvist J, Moradi T, Sidorchuk A. Type 2 diabetes incidence and socioeconomic position: a systematic review and meta-analysis. Int J Epidemiol. 2011;40:804-818.
10. Buescher PA, Whitmire JT, Pullen-Smith B. Medical care costs for diabetes associated with health disparities among adult Medicaid enrollees in North Carolina. N C Med J. 2010;71:319-324.
11. Knowler WC, Barrett-Connor E, Fowler SE, et al. Diabetes Prevention Program Research Group. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. N Engl J Med. 2002;346:393-403.
12. Auchincloss AH, Diez-Roux AV, Mujahid MS, Shen M, Bertoni AG,

Carnethon MR. Neighborhood resources for physical activity and healthy foods and incidence of type 2 diabetes mellitus: the Multi-Ethnic Study of Atherosclerosis. Arch Intern Med. 2009;169:1698-1704.

13. Massey CN, Appel SJ, Buchanan KL, Chernington AL. Improving diabetes care in rural communities: an overview of current initiatives and a call for renewed efforts. Clin Diabetes. 2010;28:20-27.
14. Bell RA, Quandt SA, Arcury TA, et al. Primary and specialty medical care among ethnically diverse, older rural adults with type 2 diabetes: The ELDER Diabetes Study. J Rural Health. 2005;21:198-205.
15. Katula JA, Vitolins MZ, Rosenberger EL, et al. One year results of a community-based translation of the Diabetes Prevention Program: Healthy-Living Partnerships to Prevent Diabetes (HELP PD) Project. Diabetes Care. 2011;34:1451-1457.

INVITED COMMENTARY

Community-Based Prevention and Control of Diabetes Among North Carolina Latinos

Christopher T. Bryant, Pilar Rocha-Goldberg

El Centro Hispano is a grassroots community-based organization dedicated to strengthening the Latino community and to improving the quality of life among Latino residents in central North Carolina. This article discusses El Centro Hispano's role in providing culturally and linguistically appropriate education, outreach, and referrals to prevent and control diabetes among Latinos.

El Centro Hispano, a 501(c)(3) grassroots community-based organization, is dedicated to strengthening the Latino community and to improving the quality of life of Latino residents in the areas of Durham, Carrboro, and Chapel Hill, North Carolina. The organization was founded in 1992 as the Hispanic Resource Center, a joint project of the Catholic and Episcopal churches in Durham County. Currently, the organization provides programs and services to >10,000 community members annually.

In 2002, El Centro Hispano applied for funds to prevent diabetes in the Durham Latino community because of the high prevalence of overweight and obesity and the lack of physical activity—major risk factors for diabetes—in this population. Since then, El Centro Hispano has implemented diabetes prevention programs for local Latinos, including training and support of diabetes prevention *promotores*. Promotores are community health workers in the Latino community who promote or advance specific health messages. In Durham, these individuals provide community members with culturally and linguistically appropriate information and social support to implement behavior change (Figure 1). To retain promotores in its programs, El Centro Hispano compensates them with gift cards and other amenities. El Centro Hispano also invites promotores to participate in other activities at the center, such as providing individuals with referrals to its direct support program and assisting them with employment searches.

The El Centro Hispano diabetes prevention program is funded by the North Carolina Office of Minority Health and Health Disparities, and activities include a 20-session diabetes and obesity prevention program called PESA (*Promoviendo Estado Saludable* [Promoting Healthy Habits]) and program to train community leaders to become diabetes prevention promotores. The PESA program was originally developed by the Duke Hypertension Center in collaboration with El Centro Hispano. PESA includes weekly group sessions led by trained promotores who have completed the PESA program at El Centro Hispano, a medically trained health specialist from El Centro Hispano, and certified physical activity instructors. Sessions are conducted in Spanish and include guided physical activity, nutrition classes, food demonstrations, and self-esteem workshops. Promotores help participants complete registration and evaluation forms, measure participants' anthropometric characteristics, and provide one-on-one make-up sessions for individuals who enter the PESA program late. One of the benefits of the program is the provision of free child care and snacks during sessions. From August 2010 through March 2011, 56 women aged 19-60 years participated in the program. Participants lost an average of 4 pounds, with an average reduction in body mass index (calculated as the weight in kilograms divided by the square of the height in meters) of 0.5.

In 2011, El Centro Hispano identified and recruited 30 Latino community leaders from among people in the PESA program and those in other El Centro Hispano programs to participate in promotores training and, after completion, provide diabetes prevention education, outreach, and referral to local Latinos. A representative from the Office of Minority Health and Health Disparities and a medically trained health specialist from El Centro Hispano facilitated the training in Spanish at El Centro Hispano. Eighteen participants completed the training, and 13 signed a pledge to continue with the program as promotores. The promotores included 2 men and 11 women aged 18-52 years. Nine were from Mexico, 3 were from Peru, and 1 was from Colombia. The trained promotores worked with the support and guidance of the health specialist to organize and facilitate 24 community workshops, conduct community outreach at 17 community events, and provide 427 glucose screenings and 68 referrals. From January through May 2011, the promotores educated 547 Latino women and 278 Latino men aged 18-60 years.

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Peer-to-Peer Learning in the Self-Management of Chronic Disease

Joyce Page, Serena Weisner

The North Carolina Department of Health and Human Services, through the Division of Public Health and the Division of Aging and Adult Services, has adopted an evidence-based self-management curriculum called Living Healthy in NC that uses peer-to-peer learning to improve the ability of persons to manage their diseases, including diabetes, and to prevent or slow the progression of chronic conditions. The program is based on Stanford University's Chronic Disease Self-Management Program (CDSMP) and is being implemented in North Carolina through broad and diverse partnerships within and between multiple systems.

Kate Lorig and colleagues at the Stanford Patient Education Research Center created and evaluated the CDSMP in the early 1990s, recognizing that physician care is only part of the disease-management process and that persons with chronic conditions must be good self-managers 24 hours a day, 7 days a week. Workshop sessions with a duration of 2.5 hours take place in community settings once each week for 6 weeks and provide tools and support for becoming positive self-managers. The CDSMP is based on years of research addressing patient self-efficacy and is built on several underlying assumptions, including the following: (1) people can learn skills needed to better manage their diseases; (2) people with chronic conditions have similar challenges, regardless of the type of condition; (3) people with chronic conditions deal not only with their disease(s), but also the impact it has on their lives; (4) laypeople with chronic conditions can, when given a detailed leader's manual, teach the CDSMP as and perhaps more effectively than can health professionals; and (5) the way in which the CDSMP is taught is as important as the subject matter being conveyed.

Research has shown the CDSMP to be effective across socioeconomic and education levels, settings, populations, and chronic conditions. The CDSMP results in statistically significant and measurable improvements in physical and emotional outcomes and in self-rated overall health and health-related quality of life. Whereas people with chronic illnesses are generally expected to make more trips to the emergency department and to have more hospital admissions as their condition worsens, this is not the case for those who have participated in the CDSMP. Participation in CDSMP has been shown to result in reductions in health care expenditures. Many of these health benefits persist over a 3-year period [1].

One or preferably both of the peer leaders who facilitate each workshop have chronic conditions and act as "models" for participants, because participants tend to have a greater sense of trust and understanding when workshops are led by people facing similar challenges and problems. Topics covered include techniques to deal with problems such as frustration, fatigue, pain, and isolation; appropriate exercise for maintaining and improving strength, flexibility, and endurance; appropriate use of medications; communicating effectively with family, friends, and health professionals; nutrition; and how to evaluate new treatments.

The peer-to-peer characteristic of the CDSMP was one of the primary reasons the Division of Public Health adopted the program in 2005 as part of an effort to improve disease self-management. At that time, the CDSMP complemented existing programs that used community health workers through the Division of Public Health's Diabetes Prevention and Control Program.

In 2007 and 2010, the Division of Aging and Adult Services received grants from the US Administration on Aging to further disseminate the CDSMP statewide. These grants also made it possible to expand Stanford University's Diabetes Self-Management Program (known in North Carolina as Living Healthy with Diabetes), the CDSMP's "sister" program that targets individuals with type 2 diabetes.

Together, Living Healthy and Living Healthy with Diabetes are the leading providers of chronic disease self-management services in North Carolina. These programs are supported by 17 regional coordinators in the state's Area Agencies on Aging, local health departments, Community Care of North Carolina, the North Carolina Cooperative Extension, the University of North Carolina–Chapel Hill Institute on Aging, the American Association of Retired Persons, faith-based organizations, the Associations of the General Baptist State Convention of North Carolina, Strengthening the Black Family, the Eastern Band of Cherokee Indians, and dozens of local community-based organizations. Since 2005, >3,000 people have taken part in one or both of the programs, and >1,500 of those persons have participated in the past 15 months. NCMJ

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Reference

1. Stanford University School of Medicine. Chronic Disease Self-Management Program Web site. http://patienteducation.stanford.edu/programs/cdsmp.html. Accessed July 8, 2011.

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FIGURE 1.
Promotores From El Centro Hispano, Durham, North Carolina

Workshops, outreach, screenings, and referrals took place in churches, participants' homes, flea markets, laundry mats, grocery stores, Mexican *tiendas* (small stores), health fairs, and the El Centro Hispano office. During workshops, promotores used visual displays to describe the types and symptoms of diabetes, the risk factors for diabetes, and the health care resources for people living with or at risk for diabetes During workshops, outreach, and screenings, promotores gave participants brochures related to diabetes prevention and treatment, nutrition, and physical activity, as well as a list of local diabetes-related resources. Promotores conducted individualized home visits for 58 people with or at high risk for diabetes. During home visits, promotores assessed family history of diabetes, habits related to physical activity and nutrition, access to medical care, and physician-prescribed treatment regimens. For participants without a medical home, promotores provided a referral to the local federally qualified health center. Individuals were also instructed to select a personal goal to prevent or help manage their diabetes. Personal goals included improving nutritional habits, keeping medical appointments, and taking medications as prescribed.

The promotores worked as a team, organized activities in their respective churches, and participated together in groups. For example, at a church event, 4 promotores worked together to educate >60 community members. Also, promotores organized themselves into teams to visit the local flea market, offering diabetes screening every weekend for 2 months.

The health education specialist brought together a focus group at the end of the promotores program to capture the reactions of the promotores. The promotores reported that the Latino community was very receptive to the diabetes prevention information and that the majority of people contacted by the promotores had either diabetes or family members living with the disease; many of the contacted individuals wanted to know how to prevent or manage diabetes through lifestyle changes. The promotores also acknowledged that participation in the promotores program had enriched their lives by allowing them to help and learn from the community. One promotor explained that "the aspect of [the program] that had the greatest impact on me was that I could serve my community with this information, especially helping those who needed it most." Another reflected on the personal impact of their realization that, before contact with promotores, "people had very little information and didn't know where to find treatment or found it hard to pay for treatment for their diabetes." A third promotor remarked that the training received through the program helped them minimize their stress and frustration, adding that it "not only helped me a lot but also [helped] those with diabetes."

It is apparent that engaging key community members is critical when it comes to improving the health and well-being of Latinos in and around Durham and Chapel Hill. Recruiting, compensating, and sustaining the number of promotores, as evidenced through many successful programs, is proving to be an effective strategy for reducing common health risks and enhancing overall quality of life in this population. NCMJ

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Diabetes and Adverse Mental Health Among African Americans

David L. Mount, Kristen G. Hairston, Shelton M. Charles

This article reviews the connection between diabetes and adverse mental health among African Americans. Concern about safe insulin prescribing and administration is raised, and the importance of integrated physical and mental health care in the prevention and control of diabetes is highlighted.

North Carolina stands in the eye of a storm for type 2 diabetes and associated complications, such as chronic kidney disease, stroke, and neurocognitive diseases, with annual health care costs estimated to be $100 billion [1]. North Carolina has the 14th worst health status among US states, a ranking heavily influenced by the relatively poor quality of health among African Americans and individuals in other minority populations [2]. A 2009 report from the North Carolina Office of Minority Health and Health Disparities and State Center for Health Statistics [2] found that, among deaths due to diabetes, stroke, and kidney disease, African Americans had a higher burden than any other racial/ethnic group [2].

Although North Carolina law requires that diabetes supplies and education be covered by insurance [3], integrated programs on neurocognitive health promotion, screening, monitoring, risk reduction, and treatment for adults with type 2 diabetes are often inaccessible. Lack of access to medical care has been linked to the prevalence of dementia in the African American community [4]. Chances are that African Americans will receive critical neurological attention too late and miss the window for therapeutic interventions. Moreover, compared with other groups, African Americans have a higher rate of vascular diseases such as type 2 diabetes, a condition thought to increase brain dysfunction in higher cortical abilities. In addition, African Americans with Alzheimer disease receive a diagnosis in later stages of the disease, demonstrate greater cognitive impairment at the time of diagnosis, and receive less adequate treatment following diagnosis, compared with other individuals [5, 6]. As the major public health emphasis for African Americans with diabetes remains focused around physical diseases (eg, heart disease, lower limb amputation, and kidney disease), there is growing concern that health care professionals and the patients for whom they provide care may be missing opportunities for connecting integrative programs that concurrently address mental and physical health.

The social realities for the growing population of individuals with type 2 diabetes are informed through the structure and function of the built environments in which they live, which often involve problematic housing conditions with poor indoor air quality, unsafe neighborhoods with excessive noise, overcrowding, poverty, poor proximity to grocery stores and nutritious food options, and inadequate amounts of physical activity. It is generally accepted that chronic stress and physical disease accelerate physiological changes in multiple organ systems, including the brain, independent of age [7, 8]. Although more-systemic research has elucidated the relationship between type 2 diabetes management and social markers, there is a growing body of knowledge showing that emotional instability stimulates the release of various hormones that can alter metabolic activity, affects blood pressure control, increases cardiovascular symptoms, and increases the risk for elevated blood glucose levels.

Brain health and psychosocial function can also negatively influence medication adherence among individuals with type 2 diabetes [9]. The use of medication, particularly insulin, as the primary intervention in type 2 diabetes care is increasing, and self-management of medication can be disrupted in persons with adverse neurocognitive health [10, 11]. The morbidity associated with insulin therapy is multifactorial, with contributions from health professionals and patients. Accurate prescribing of insulin and education of patients about its use is required among health professionals, whereas comprehension of the mechanism of insulin activity, appropriate administration (via syringe or pen), and knowledge of signs, symptoms, and treatment of hypoglycemia is required among patients. For patients with neurocognitive deficits, navigation of these components can not only be challenging but also dangerous. Agencies such as the Institute for Safe Medication Practices have repeatedly ranked insulin therapy among the top 5 causes of near fatal/fatal medical events and associated health care costs [12].

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With the advent of new insulin preparations, health professionals have a larger selection of agents to choose from and may need to be more deliberate about which medication will be best for the patient. Although the more physiologic preparations are intended to improve glycemic control, the increased number of required injections associated with such preparations can present serious dangers to cognitively impaired patients. One of the most important adverse consequences of more-frequent injections is an increased risk of hypoglycemia. Although this marked increase in risk is seen among all patients regardless of cognitive status, patients with standing cognitive impairment and decreased neurological reserve are at even greater risk because of the additional functional loss due to neuroglycopenia. To effectively minimize the millions of dollars spent and lives affected by insulin-related errors, future regulations should focus on the competency of the patient in addition to that of the health professional.

Development of drug therapies is essential, but drugs will not achieve their therapeutic intent if patients are not able to take them as prescribed. As the inordinate number of deaths among African Americans with type 2 diabetes is exacerbated by unmet mental health needs, it is critical that we address the factors associated with adverse mental health in this population. With an eye toward protection, prevention, and neurocognitive promotion, we must start to unpack the biopsychosocial dimension of health that increases the risk for adverse neurocognitive health and provides clues to potential strategies for risk-factor modification.

Our research team is focused on developing, testing, and implementing community outreach and health-promotion activities. This work addresses the underrepresentation of African Americans in dementia-related clinical research in urban and rural communities. Some of our objectives include identifying barriers to recruitment and addressing factors associated with lower participation rates in clinical research. The use of community-based participatory engagement as a strategy for addressing barriers to recruitment and retention is at the heart of our work.

We hope that this commentary is a vehicle for the exploration and discussion of integrated diabetes-mental health policy issues by stakeholders concerned with developing, implementing, and analyzing health policy to reduce and/or eliminate brain health disparities among persons living with type 2 diabetes and its associated complications. In particular, we hope to heighten public health urgency to secure funds for supporting research, treatment, education, and community outreach to reduce the risk of adverse mental health among African Americans. NCMJ

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References

1. O'Connor PJ. Improving medication adherence: challenges for physicians, payers, and policy makers. Arch Intern Med. 2006;166(17):1802-1804.
2. North Carolina Office of Minority Health and Health Disparities, State Center for Health Statistics. Racial and Ethnic Health Disparities in North Carolina, Report Card, 2010. Raleigh, NC: North Carolina Department of Health and Human Services; 2010. http://www.schs.state.nc.us/SCHS/pdf/MinRptCard_WEB_062210.pdf. Accessed June 3, 2011.
3. NC Gen Stat §58-51-61, §58-65-91, §58-67-74. http://www.ncleg.net/enactedlegislation/statutes/pdf/bychapter/chapter_58.pdf. Accessed December 4, 2011.
4. Alzheimer's Association. African-Americans and Alzheimer's Disease: The Silent Epidemic. Chicago, IL: Alzheimer's Association; 2002.
5. Hughes T, Tyler K, Danner D, Carter A. African American caregivers: an exploration of pathways and barriers to a diagnosis of Alzheimer's disease for a family member with dementia. Dementia. 2009;8(1):95-116.
6. Chin AL, Negash S, Hamilton R. Diversity and disparity in dementia: the impact of ethnoracial differences in Alzheimer disease. Alzheimer Dis Assoc Disord. 2011;25(3):187-195.
7. Sieck GC. Physiology of aging. J Appl Physiol. 2003;95(4):1333-1334.
8. Roth GS, Mattison JA, Ottinger MA, Chachich ME, Lane MA, Ingram DK. Aging in rhesus monkeys: relevance to human health interventions. Science. 2004;305(5689):1423-1426.
9. Mount DL. Does cognition influence type 2 diabetes–related adherence? In: Shumaker SA, Ockene JK, Riekert KA, eds. The Handbook of Health Behavior Change. 3rd ed. New York, NY: Springer; 2009:693-708.
10. Ingersoll KS, Cohen J. The impact of medication regimen factors on adherence to chronic treatment: a review of literature. J Behav Med. 2008;31(3):213-224.
11. Katon WJ. The comorbidity of diabetes mellitus and depression. Am J Med 2008;121(11 Suppl 2):S8-S15.
12. Budnitz DS, Pollock DA, Weidenbach KN, Mendelsohn AB, Schroeder TJ, Annest JL. National surveillance of emergency department visits for outpatient adverse drug events. JAMA. 2006;296:1858-1866.

Could Hearing Loss Be the Link Between Diabetes and Depression?

Kathryn R. Dowd

Hearing loss is isolating and embarrassing and can cause or exacerbate depression. This article advocates that diabetes educators receive training from an audiologist so that they can screen for hearing loss in people with diabetes and refer individuals with suspected hearing loss to audiologists for treatment.

Diabetes educators have long been aware and concerned about the effect of diabetes on vision. In terms of cost, vision problems from retinopathy are an expensive complication, requiring laser treatment(s) to seal the leaking vessels, multiple ophthalmology visits, and testing.

The effects of hearing loss are not well-known but should be just as concerning for diabetic patients and diabetes educators. Delays in the identification of hearing loss may have costly ramifications for job performance and for relationships at home and in social settings, owing to its affects on the functional and psychosocial abilities of hearing-impaired individuals. Given the increased sense of isolation, anxiety, and confusion among many with hearing loss, it is not surprising that the risk for depression is higher among hearing-impaired individuals.

The costs associated with hearing loss are incurred throughout life. A set of hearing aids may cost $4,000-$6,000 and are usually replaced every 5-7 years. Hearing loss can affect marketability, job success, and earning potential [1]. Hearing-impaired people in the workplace lose as much as $12,000 annually, depending on the severity of hearing loss, according to a MarketTrak VII publication. This translates to a loss of income for people with untreated hearing loss of $100 billion [1].

Demographic Characteristics of Disease

Diabetes and hearing loss affect a significant numbers of persons. Diabetes patients make up 8% of the overall population, while hearing loss affects 5%-7%. Among Americans aged >60 years, 18% have diabetes, and 17% have hearing loss [2].

National Institutes of Health researchers analyzed data from hearing tests administered to 5,140 NHANES (National Health and Nutrition Examination Survey) participants between 1999 and 2004 [3]. Investigators discovered that hearing loss was twice as common among people with diabetes as it was among those without the disease. More than 40% of the participants had some hearing damage.

Physiologic Link Between Diabetes and Hearing Loss

Diabetes causes changes in microvasculature and sensory nerves, leading to retinopathy, nephropathy, and peripheral neuropathy [4]. Elevated blood glucose levels have been shown to have permanent adverse effects on hearing, regardless of whether the etiology is angiopathic (ie, associated with the vascular system) or neuropathic (ie, associated with the nervous system). Changes to the vasculature and nerve supply of the ear lead to thickening of the capillaries in the stria vascularies (ie, the blood supply to the inner ear mechanism) and the basilar membrane (ie, the structural membrane in the inner ear that shears hair cells to produce a nerve impulse to the brain), atrophy of the spiral ganglion (ie, the bundle of nerves exiting the inner ear that sends the sound representation to the brain), and demyelization of the eighth cranial nerve (ie, the main auditory nerve to the brain).

The association between chronic kidney disease and hearing loss has been known for decades. The kidney and stria vascularies share physiologic, ultrastructural, and antigenic similarities. These structural and functional similarities explain the correlation of tissues in the inner ear and in the kidney. Toxins that accumulate during kidney failure can damage nerves, including those in the inner ear.

Diabetes often results in chronic renal disease [5]. Therefore, the link between diabetes and hearing loss surfaces with chronic kidney disease. One large study at the VA Maryland Health Care System by Kakarlapudi and colleagues [6], involving 12,575 diabetic patients and 53,461 nondiabetic patients, examined the association between serum creatinine levels, which are usually elevated in diabetic patients, and kidney function to determine whether

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diabetes control was associated with severity of hearing loss. The study's findings indicated that increased creatinine levels were correlated with increased hearing loss [6].

Effects of Untreated Hearing Loss

Hearing loss, which is usually gradual, is an invisible handicap that tends to isolate people from friends and family, owing to a decreased ability to communicate as the loss becomes more severe. Some cases of hearing loss affect select pitches of speech, and most cases are not apparent in quiet places or in one-on-one conversations, so the problem can be confounded by the patient's knowledge that they can hear some things very well. The Better Hearing Institute [7] lists several sequelae of untreated hearing loss (Table 1).

Depression and Hearing Loss

Hearing loss that is not identified and treated can lead to depression. People with hearing loss may lack insight into the hearing problem, while their close contacts observe the condition clearly. As a result, the hearing-impaired person may experience frustration, anger, anxiety, and worry, knowing that family and friends are concerned with the lack of clear communication or the need to repeat everything that is said at a family gathering.

Lack of insight about or denial of hearing loss turns the focus away from the person with the hearing problem. This lack of insight could be related to the individual's tendency to quickly react to perceived threats or criticism, or it could be a manifestation of the individual's reaction to the stigma that can accompany hearing loss. Another explanation may involve anosognosia, defined as an individual's inability to know they have a sensory problem [8]. Regardless of the cause, the lack of insight confounds and delays action by the hearing-impaired person to take the first steps to correct the hearing loss. Depression can follow the isolation and communication-associated difficulties arising from hearing loss. It is easier for a person with a hearing loss to withdraw from social settings, such as church or family gatherings, than to experience personal frustration and the frustration that arises among their close contacts from poor communication.

TABLE 1.
Sequelae of Hearing Loss

Sequela(e)
Embarrassment, fatigue, irritability
Tension/stress
Avoidance of social activities
Withdrawal from personal relationships
Depression, negativism
Danger to personal safety
Social rejection by others
Impaired memory and ability to learn new tasks
Reduced job performance and earning power
Diminished psychological and overall health

Note. Data are from [7].

A survey published in 2008 by Australian Hearing, an organization within the Australia Department of Human Services, found that people with hearing loss are at an increased risk of developing depression [9]. Sixty percent of individuals with hearing loss have some of the symptoms found in depression: 52% displayed increased irritability and frustration, 22% had trouble sleeping or experienced restlessness, and 18% showed a loss of interest or pleasure in most activities.

The Solution

Because of the high prevalence of diabetes in North Carolina, the adverse effects of hearing loss, and the connection between diabetes and hearing loss, the North Carolina Diabetes Prevention and Control Branch has added hearing screening to its 2011 strategic plan for diabetes educators in North Carolina. April Reese, branch head, has worked to include the screen for hearing problems among diabetic patients, in the diabetes educators' curriculum. The new plan calls for improved screening for and management of diabetes, by encouraging health care providers to follow American Diabetes Association guidelines and to include oral health and auditory screening as part of baseline assessments for people with diabetes. The North Carolina plan calls for increased awareness about uncommon comorbidities associated with diabetes, including hearing loss and sleep apnea.

One easy hearing-screening tool that can be used by diabetes educators is the Hearing Handicap Inventory for the Elderly—Screening Version (HHIE) [10]. This short questionnaire has 10 questions about hearing problems, with patients given the option of answering "yes," "no," or "sometimes" to each question. The answers are weighted by assigning points to the responses ("yes," "no," or "maybe") to each question in the screening tool, and patients are referred to an audiologist for a follow-up hearing evaluation if the total score is >10 points.

Of note, the HHIE tool reports the patient's insight or awareness about a hearing problem. If the patient is in denial or lacks insight, the responses may be skewed and may not produce a referral for further hearing testing. The HHIE is a subjective tool for screening and should accompany an objective tool, such as pure-tone or word-recognition screening. Pure-tone screening uses a calibrated tone of a measured intensity (ie, loudness) and frequency (ie, pitch). There are models available for desktop computers and handheld devices that a professional can use to produce the tone and allow the patient to raise their hand or press a button when they perceive a soft beep. Audiologists train professionals and supervise screening programs to ensure that the tool is used correctly to assess whether hearing impairment is present. The pure-tone screening tool is objective and does not rely on the patient's awareness of the hearing problem in determining whether the problem is present.

The real work of implementing this new plan will require collaboration between the North Carolina Diabetes Prevention and Control Branch and diabetes educators and audiologists throughout the state. North Carolina audiologists are ready to work with the state's diabetes educators to develop a simple program for screening, training, and referral and thereby facilitate early identification of hearing problems and reduce the risk of adverse sequelae. NCMJ

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References

1. Kochkin S. The Impact of Untreated Hearing Loss on Household Income. Washington, DC: Better Hearing Institute; 2007. http://www.betterhearing.org/pdfs/M7_Hearing_aids_and_income_2006.pdf. Accessed January 6, 2012.
2. Cunningham L, Friesen L. Diabetes and hearing loss. Audiol Today. 2006;18(2):38.
3. Presbycusis. National Institute on Deafness and Other Communication Disorders Web site. http://www.nided.nih.gov/health/hearing/presbycusis.asp. Updated February 2002. Accessed January 6, 2012.
4. Bainbridge KE, Hoffman HJ, Cowie CC. Diabetes and hearing impairment in the United States: audiometric evidence from the National Health and Nutrition Examination Survey, 1999 to 2004. Ann Intern Med. 2008;149(1):1-10.
5. Bainbridge KE, Cheng YJ, Cowie CC. Potential mediators of diabetes-related hearing impairment in the US population. Diabetes Care. 2010;33(4):811-816.
6. Kakarlapudi V, Sawyer R, Staecker H. The effects of diabetes on sensorineural hearing loss. Otol Neurotol. 2003;24(3):382-386.
7. Kochkin S. Consequences of hearing loss. Better Hearing Institute Web site. http://www.betterhearing.org/hearing_loss/consequences_of_hearing_loss/index.cfm. Accessed January 6, 2012.
8. Amador XF. The root of the problem: anosognosia. In: I Am Not Sick I Don't Need Help: How to Help Someone With Mental Illness Accept Treatment. Peconic, NY: Vida Press; 2007:21-25.
9. Australian Hearing. Connecting Australia: Annual Report 2008. Chatswood, Australia: Australian Hearing; 2008. http://www.hearing.com.au/digitalAssets/8439_1225432802863_AH_AR2008-Part1.pdf. Accessed January 6, 2012.
10. Newman CW, Sandridge SA. Hearing loss is often undiscovered, but screening is easy. Cleve Clin J Med. 2004;71(3):225-232.

INVITED COMMENTARY

Translating Diabetes Prevention Programs:
Implications for Dissemination and Policy

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Numerous studies have translated the Diabetes Prevention Program (DPP) for community-based settings, and the results are encouraging. This commentary discusses one community-based DPP translational study, Healthy Living Partnerships to Prevent Diabetes, in detail, as well as the implications of DPP translational studies for public policy.

Although the Diabetes Prevention Program (DPP) and the Finnish Diabetes Prevention Study were landmark studies demonstrating that the incidence of type 2 diabetes could be reduced by almost 60% in patients with prediabetes, through lifestyle weight loss programs involving changes in diet and physical activity [1, 2], the prevalence of type 2 diabetes and its corresponding disease burden continue to increase [3, 4]. Translation of diabetes prevention programs has been challenging, and it has been suggested that the lack of large-scale implementation of effective diabetes prevention programs is due to a general lack of understanding of translational research [5].

Recently, a number of researchers have tested a variety of methods for translating the DPP lifestyle weight loss intervention to increase access and cost-effectiveness [6-14]. The DPP lifestyle intervention has been translated into primary care settings [10, 12], cardiac rehabilitation programs [14], churches [9], YMCAs [7], health care facilities [8], and community-based facilities (eg, parks and recreation centers) [13]. The personnel employed to deliver the interventions have included public health nurses [6], nurse practitioners [11], volunteer medical personnel [9], YMCA trainers [7], and community health workers (CHWs) [13]. Taken together, these interventions typically yield weight losses of approximately 6% at 1 year of follow up. More importantly, one study reported significant decreases in fasting blood glucose level, insulin level, insulin resistance, and adiposity that were comparable to those observed in the DPP [13]. Therefore, the cumulative evidence suggests that translations of the DPP can be successfully implemented across a variety of settings and with diverse personnel.

However, numerous barriers to the widespread translation of effective diabetes prevention programs still exist, from conflicting conceptual models of health care to more-practical issues, such as fiscal and logistical feasibility. The purpose of this commentary is to describe 2 successful translational models of diabetes prevention and to discuss the implications of these models for overcoming barriers to the large-scale implementation of diabetes prevention interventions.

Healthy Living Partnerships to Prevent Diabetes (HELP PD)

HELP PD was designed to translate the methods of the DPP to the community setting by incorporating the following key modifications to enhance logistical and fiscal feasibility and long-term dissemination: the partnering of an existing community-based diabetes education program with empowered CHWs in the implementation and administration of a group-based lifestyle weight loss intervention [13, 15]. Our goal was to develop and test a model of diabetes prevention that could be translated to any community that has a diabetes education program and that could be implemented and administered with existing community resources and independent of research-based resources. We randomly assigned 301 overweight and obese volunteers (body mass index [BMI; calculated as the weight in kilograms divided by the square of the height in meters], 25-40) with a fasting blood glucose level of 95-125 mg/dL to participate in a 24-month group-based translation of the DPP lifestyle weight loss intervention that was administered through a local diabetes education program and delivered by CHWs or to receive an enhanced usual care condition. The main outcome of the study was fasting blood glucose level, and secondary outcomes included adiposity (determined on the basis of body weight, BMI, and waist circumference), insulin level, and insulin resistance (as assessed by the homeostasis index ratio [calculated as the fasting insulin level times the fasting glucose level, divided by 22.5]). We also assessed numerous psychosocial variables, derived from social cognitive theory, to examine predictors of adherence and mediators of study outcomes. Outcomes

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were assessed at baseline and at 6, 12, and 24 months thereafter. The details of this study have been published elsewhere [13, 15].

Because HELP PD was designed as a translational intervention to prevent type 2 diabetes, the eligibility criteria were chosen to target a sample of individuals at risk for diabetes (referred to as prediabetes) that was representative of the local community. As such, participants were required to have a BMI of 25.0-39.9, as well as evidence of prediabetes on at least 2 occasions. Prediabetes on the first occasion was defined as a fasting blood glucose level of 95-125 mg/dL or a random blood glucose level of 120-199 mg/dL (inclusive) that was recorded during the previous 3 months at the participant's usual source of care, at a community-based screening event, or at a study screening visit. Prediabetes on the second occasion was defined as a fasting blood glucose level of 95-125 mg/dL that was recorded during a visit to the study center.

Community-based implementation. Key features of our translation of the DPP lifestyle weight loss intervention included (1) administration of the DPP through a local diabetes education program, (2) implementation of the intervention at community-based sites, and (3) performance of intervention-related tasks by CHWs. Study investigators and staff conducted study administration and evaluation (eg, clinical assessments), but registered dietitians and certified diabetes educators employed by the diabetes education program managed the day-to-day operations of the intervention, as well as the training and monitoring of the CHWs. CHWs were lay community members with type 2 diabetes, a well-controlled hemoglobin A_{1c} level, and a history of healthy eating and physical activity. CHWs were recruited through our diabetes education program by the study investigators and registered dieticians and were responsible for conducting the intervention group sessions, managing participants, and entering data on participants' body weight, which was measured during group sessions. CHWs were compensated $100/week during the first 6 months for weekly sessions and $200/month for the rest of the study. CHW training consisted of a 36-hour program conducted over 6-9 weeks and involved experiential learning, didactic instruction, peer mentoring, and observation. Ten CHWs were trained in 2 groups of 5; one group started before recruitment started, and the other started 4 months after recruitment began.

Lifestyle weight loss intervention. The 24-month lifestyle weight loss intervention was designed to induce a total weight loss of 5%-7% during the first 6 months of treatment, through decreased caloric intake (goal, 1,200-1,800 kcal/day) and increased caloric expenditure through moderate physical activity (goal, ≥180 minutes/week). During the subsequent 18 months, participants were encouraged to continue to meet or maintain their weight loss goals as long as their BMI did not decrease to <20. Participants met weekly for CHW-led group sessions during the first 6 months. Fourteen different lifestyle weight loss groups of 8-12 participants met at various community sites (eg, parks and recreation centers) throughout Winston-Salem, North Carolina. Participants also met with the registered dietician during months 1, 3, and 6. During months 7-24, participants met for group sessions once per month and were also contacted via telephone by the CHW once per month. We standardized the intervention content by creating a DVD series that covered basic concepts in nutrition and physical activity, energy balance, healthy eating, goal setting, and problem solving. We also included presentations by experts from businesses in the local community (eg, the YMCA, local grocery stores, and specialty athletic footwear stores) to enhance awareness of existing community resources.

Enhanced usual care. The enhanced usual care condition was designed to exceed the usual care provided to patients with prediabetes and to enhance participant retention. Enhanced usual care consisted of 2 individual sessions with a nutritionist during the first 3 months, who provided education about healthy eating and physical activity to support weight loss. Participants who received enhanced usual care also received a monthly newsletter that included topics related to healthy lifestyles and information about community resources.

Findings. At 12 months of follow up, participants in the lifestyle weight loss intervention experienced statistically significantly greater changes from baseline for fasting blood glucose level (−4.3 mg/dL), insulin level (−6.5 μU/mL), insulin resistance (homeostasis index ratio, −1.9), body weight (−7.2 kg [−7.34%]), BMI (−2.1), and waist circumference (−5.8 cm) than those achieved by participants in the enhanced usual care group ($P < .001$ for all comparisons) (Table 1). Importantly, HELP PD had effects very similar to those of the DPP. Therefore, HELP PD, which used a community-based model of diabetes prevention that included local community resources and CHWs, appears to be equally effective as the landmark Diabetes Prevention Program, which used an individualized, professional interventionist-based model. What remains to be determined, however, is whether HELP PD proves to be more cost-effective than DPP. We have collected cost data and will publish our analyses in the upcoming months. However, our preliminary analyses indicate that the HELP PD model cost per participant is approximately half that of the DPP.

Dissemination of HELP PD. To inform future dissemination efforts, we collected data on the capacity and interest of diabetes education programs in North Carolina and other states in implementing the HELP PD intervention. We collected data on staffing, patient load and service area, funding and reimbursement policies, resources, perceived ability to implement the intervention, and interest. Results from both the state and national samples indicate that most existing programs are not only confident in their abilities to implement a group-based diabetes prevention intervention but are also interested in programs like HELP PD. Programs expressed less confidence in their abilities to

TABLE 1.
Twelve-Month Changes in Adiposity and Metabolic Indicators Among 301 Individuals Randomized to a Lifestyle Weight Loss Intervention Group or to an Enhanced Usual Care Group

Variable	Lifestyle weight loss group	Enhanced usual care group
Glucose level, mg/dL	−4.3	−0.4
Insulin level, μU/mL	−6.5	−2.7
HOMA IR[a]	−1.9	−0.8
Body weight, kg	−7.2	−1.4
Weight lost, percentage	−7.3	−1.3
Waist circumference, cm	−5.8	−0.8
Body mass index[b]	−2.1	−0.3

Note. Values represent within-group differences that were based on analysis of covariance, controlling for baseline values. All between-group differences in change are statistically significant (ie, $P < .001$ for all comparisons). HOMA IR, homeostasis index ratio.
[a] Calculated as the fasting insulin level times the fasting glucose level, divided by 22.5.
[b] Calculated as the weight in kilograms divided by the square of the height in meters.

recruit and retain CHWs and participants and to provide staff for training. While analysis of these data is ongoing and will be published in the coming months, these preliminary findings confirm that, while there may be logistical and operational hurdles in the implementation of a program like HELP PD, community interest is high. Diabetes education programs represent a major dissemination channel for diabetes prevention, as there are >3,000 American Diabetes Association–recognized diabetes education programs in the United States. Moreover, several states (eg, Massachusetts and Minnesota) have adopted reimbursement policies for CHWs, demonstrating the potential for long-term sustainability of CHW-led programs.

Diabetes Education and Prevention With a Lifestyle Intervention Offered at the YMCA (DEPLOY)

The DEPLOY study translated the DPP lifestyle weight loss intervention by partnering with the YMCA in Indianapolis, Indiana [7]. Ninety-two participants with prediabetes were randomized to a 12-month, group-based DPP lifestyle weight loss program or to a control condition involving brief counseling. The intervention was delivered through 2 local YMCAs by YMCA staff. At 12 months, mean body weight among participants in the DPP lifestyle weight loss program had decreased by 6%, compared with a mean decrease of 1.8% among control participants; the mean total cholesterol level in the intervention group also decreased significantly. There were no significant between-group differences in other cardiometabolic outcomes (eg, hemoglobin A_{1c} level). The DEPLOY study demonstrates that the DPP lifestyle weight loss intervention can be delivered through YMCAs and can achieve weight loss comparable to the DPP. YMCAs offer tremendous potential for widespread dissemination of this intervention, as there are approximately 2,600 YMCAs in the United States.

Implications of Successful Diabetes Prevention Translation

Lack of reimbursement for diabetes prevention services is a major barrier to implementation and dissemination of programs like HELP PD and DEPLOY. At present, no viable reimbursement models exist to fund either type of program. Fortunately, the Division of Diabetes Translation at the Centers for Disease Control and Prevention has established the National Diabetes Prevention Program (NDPP). Development of reimbursement policy is a major pillar of the NDPP strategic plan. Already, 2 major insurance companies have agreed to reimburse for diabetes prevention services delivered by NDPP-certified sites. The processes and criteria for certification are under development, and it seems likely that other insurance companies will follow suit. It is notable that the Centers for Medicare and Medicaid Services has also recognized the need to develop reimbursement policies for diabetes prevention services and has announced plans to fund demonstration programs in this area. Reimbursement policies cannot come fast enough for the >70 million US adults with prediabetes.

Future Directions

In light of the success of HELP PD, our research group has developed a partnership with the North Carolina Division of Public Health's Diabetes Prevention and Control Branch to disseminate diabetes prevention programs throughout the state. Our plan is to implement the HELP PD lifestyle intervention through county health departments in association with Diabetes Today and the Diabetes Education Recognition Program. Diabetes educators will be trained by the HELP PD research team at Wake Forest School of Medicine and will then recruit and train CHWs from their respective counties to deliver the lifestyle weight loss program to residents at risk for diabetes or cardiovascular disease. We intend to collaborate with 6 counties in our initial efforts and to expand the program throughout the state. We are confident that this partnership will provide additional evidence as to the importance of community-based diabetes prevention efforts that harness the innate capabilities of community members and use existing resources.

The success of HELP PD and the other DPP translational studies indicates that new models of diabetes prevention can be effective at improving the primary factors associated with type 2 diabetes. Ultimately, however, significant public health impact cannot be achieved until such models are disseminated at the state and national level. Of the numerous barriers to large-scale, upstream, community-participatory interventions, reimbursement schedules for program implementation, and administration represent the most significant challenges to widespread dissemination and public health impact. NCMJ

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References

1. Knowler WC, Barrett-Connor E, Fowler SE, et al. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. N Engl J Med. 2002;346(6):393-403.
2. Tuomilehto J, Lindstrom J, Eriksson JG, et al. Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. N Engl J Med. 2001;344(18):1343-1350.
3. Cowie CC, Rust KF, Byrd-Holt DD, et al. Prevalence of diabetes and impaired fasting glucose in adults in the US population: National Health And Nutrition Examination Survey 1999-2002. Diabetes Care. 2006;29(6):1263-1268.
4. Sloan FA, Bethel MA, Ruiz D Jr, Shea AH, Feinglos MN. The growing burden of diabetes mellitus in the US elderly population. Arch Intern Med. 2008;168(2):192-199.
5. Vinicor F. Translating diabetes research. Arch Intern Med. 2008; 168:199.
6. Absetz P, Valve R, Oldenburg B, et al. Type 2 diabetes prevention in the "real world": one-year results of the GOAL Implementation Trial. Diabetes Care. 2007;30(10):2465-2470.
7. Ackermann RT, Finch EA, Brizendine E, Zhou H, Marrero DG. Translating the Diabetes Prevention Program into the community. The DEPLOY Pilot Study. Am J Prev Med. 2008;35(4):357-363.
8. Amundson HA, Butcher MK, Gohdes D, et al. Translating the diabetes prevention program into practice in the general community: findings from the Montana Cardiovascular Disease and Diabetes Prevention Program. Diabetes Educ. 2009;35(2):209-204,216.
9. Boltri JM, Davis-Smith YM, Seale JP, Shellenberger S, Okosun IS, Cornelius ME. Diabetes prevention in a faith-based setting: results of translational research. J Public Health Manag Pract. 2008;14(1):29-32.
10. McTigue KM, Conroy MB, Bigi L, Murphy C, McNeil M. Weight loss through living well: translating an effective lifestyle intervention into clinical practice. Diabetes Educ. 2009;35(2):199-204,208.
11. Whittemore R, Melkus G, Wagner J, Dziura J, Northrup V, Grey M. Translating the diabetes prevention program to primary care: a pilot study. Nurs Res. 2009;58(1):2-12.
12. Kramer MK, Kriska AM, Venditti EM, et al. Translating the Diabetes Prevention Program: a comprehensive model for prevention training and program delivery. Am J Prev Med. 2009;37(6):505-511.
13. Katula JA, Vitolins MZ, Rosenberger EL, et al. One-year results of a community-based translation of the Diabetes Prevention Program: Healthy-Living Partnerships to Prevent Diabetes (HELP PD) Project. Diabetes Care. 2011;34(7):1451-1457.
14. McBride PE, Einerson JA, Grant H, et al. Putting the Diabetes Prevention Program into practice: a program for weight loss and cardiovascular risk reduction for patients with metabolic syndrome or type 2 diabetes mellitus. J Nutr Health Aging. 2008;12(10):745S-749S.
15. Katula JA, Vitolins MZ, Rosenberger EL, et al. Healthy Living Partnerships to Prevent Diabetes (HELP PD): design and methods. Contemp Clin Trials. 2010;31(1):71-81.

Innovative Approaches to Reduce Diabetes Costs

April B. Reese

According to the American Diabetes Association, the cost of treating diabetes in North Carolina was approximately $5.3 billion in 2006. Reigning in diabetes-related costs requires collaboration between third-party payers, health care professionals, and people with diabetes. This article reviews innovative policy changes that affect all 3 groups and are intended to improve diabetes-associated care and costs.

In 2010, North Carolina had the 13th highest diabetes prevalence in the United States among adults. The diabetes prevalence in the state has more than doubled between 1995 and 2009, from 4.5% to 9.6% [1]. Diabetes has a substantial burden in North Carolina, not only in terms of lives lost but also with regard to health care costs. The total cost of diabetes in the state during 2006 was $5.3 billion, based on excess medical costs ($3.6 billion) and lost productivity ($1.7 billion) [2].

Without effective interventions and collaborations, North Carolina is predicted to be a diabetes "hot spot" in 2025, with diabetes-related costs soaring to >$17 billion [3]. Since diabetes costs and diabetes care are intertwined, reductions in costs will result in better care, and improved care will yield decreased costs. This article reviews lifestyle-based interventions, summarizes initiatives undertaken by insurers and health care professionals, and recommends policies to prevent, control, and reduce the costs of diabetes.

Lifestyle Interventions

Primary prevention. In 2007, the annual costs associated with type 2 diabetes in the United States were estimated to be $159.5 billion [4]. According to the National Institutes of Health, 90%-95% of people with diabetes have type 2 diabetes [5]. The Diabetes Prevention Program showed that lifestyle changes such as modest weight loss (ie, a decrease of 5%-7% from baseline weight), changes in eating habits, and increased physical activity could delay or prevent diabetes [6]. The program tested intensive lifestyle changes, daily doses of a diabetes drug (metformin), and a placebo. The lifestyle group had the lowest frequency of conversion from prediabetes to type 2 diabetes. However, the Diabetes Prevention Program was expensive. Each participant received intense lifestyle coaching from highly qualified instructors, professional help with exercise, and incentives, such as pedometers, water bottles, and exercise shoes. The average cost per participant for the lifestyle change was $3,540 over 3 years. While the cost of this type of program decreases over time and is ultimately less expensive than the cost of managing diabetes-related complications, it is still excessive. The challenge for public health professionals has been to replicate the results in a less expensive manner.

In North Carolina, the Wake Forest School of Medicine (WFSM) has developed a lifestyle weight loss program for diabetes prevention that has substantially lower costs than the Diabetes Prevention Program. This is achieved by delivering the program through community health workers, as opposed to health care staff, and to groups, rather than to individuals. There are plans to roll out the WFSM lifestyle program in several North Carolina counties in early 2012. Adoption of this or similar lifestyle programs has the potential to prevent nearly 100,000 cases of diabetes in North Carolina over the next 10 years, according to analyses of 2010 US Census data and 2009 Behavioral and Risk Factor Surveillance Survey data (North Carolina State Center for Health Statistics, unpublished data, 2011).

Self-management education. In 1986, the American Diabetes Association (ADA) established a national diabetes education recognition program to ensure quality education for people with diabetes. This voluntary process ensures that approved education programs have met the national standards for diabetes self-management education [7]. Since the establishment of this process, diabetes self-management education has been shown to reduce diabetes costs, particularly in people with poor glycemic control, defined as a hemoglobin A_{1c} level of ≥10% [8]. Lower starting values are associated with a lower reduction in costs; generally, among participants who receive self-management education, cost savings of $400-$4,000 can be expected for each 1 percentage point drop in hemoglobin A_{1c} level [8]. North Carolina is one of many states that require third-party reimbursement for self-management education from Medicare, Medicaid, and private insurance. This is a benefit that faces sporadic

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threats by proposed legislation that could permit employers that operate in multiple states to offer health plan benefits that are not necessarily subject to regulations of the North Carolina Department of Insurance, which could mean higher deductibles and reduced coverage for North Carolinians with diabetes.

Approximately one-third of American Diabetes Association–sponsored programs that offer diabetes self-management education in North Carolina are affiliated with the state's Diabetes Education Recognition Program. This is an innovative partnership involving the North Carolina Division of Public Health and 39 local health departments. Local health departments provide the education, and the Division of Public Health provides administrative coordination, training, and technical assistance to the local health departments. A recent program evaluation showed that hemoglobin A_{1c} levels decreased among individuals who received education from participating health departments (E. Preston-Roedder, University of North Carolina–Chapel Hill, unpublished data, 2011).

A national model for diabetes self-management education and care originated in North Carolina. The Asheville Project was initiated in 1996 by the city of Asheville, which is self-insured, to manage the health care costs of its employees. Employees with diabetes received self-management education at a nearby hospital, assistance from their local pharmacists in monitoring their condition, and a waiver of copays for diabetes medications and supplies. Medication adherence was a key component of this project, which yielded long-term glycemic and lipid control, cost shifts from health care professional– and hospital-associated services to pharmacological services, decreases in employee sick days, and increases in productivity. The project resulted in annual savings of nearly $18,000 for the city [8]. Such results are encouraging and have been replicated by other self-insured companies and the North Carolina cities of Rocky Mount and Fayetteville.

Weight-management programs. Weight management is an important component to controlling diabetes, and exercise has been shown to be a strong predictor of successful weight control [9]. Generally, adults with diabetes who participate in ≥150 minutes of structured physical activity each week are able to achieve better control of their diabetes, as evidence by lower hemoglobin A_{1c} levels [9].

SilverSneakers is a program that helps older adults get recommended levels of physical activity and provides social support. In North Carolina, SilverSneakers is covered by many major insurance carriers. This program provides a membership to participating fitness centers and many related benefits, including access to a trained program advisor to help the client get started in the program, customized classes for older adults, health education seminars, and online support to help with weight loss, smoking cessation, and stress reduction. In a 2-year study, people with diabetes who participated in the program lowered their total health care costs by >$1,000 [10].

Eat Smart, Move More, Weigh Less is an adult weight-management program that is delivered through the North Carolina Cooperative Extension and the Division of Public Health. The program was offered in 48 counties from January 2008 through June 2009. This evidence-based curriculum consists of 15 hours of instruction on physical activity, mindful eating, reducing television time, and other healthy living concepts. Participants lost an average of 8.4 pounds, and most reported increased self-confidence in their ability to consume a healthful diet [11]. In the fall of 2011, 4 North Carolina counties began piloting this program for people with and at risk for diabetes. Evaluation results will drive the decision about whether to expand the pilot.

Insurer and Health Professional Initiatives

Insurers. In North Carolina, there are many successful policy options being implemented by insurance providers. For example, the State Health Plan for Teachers and State Employees instituted a pharmacy copay for diabetes test strips a few years ago to lower costs for members who choose to use their pharmacy benefit to purchase strips. Test strips under the pharmacy benefit are no longer subject to deductibles, which is an important change as some people must undergo testing ≥4 times per day. Additionally, the State Health Plan provides 100% coverage for 6 nutrition-related visits during each benefit year for members with diabetes, as well as comprehensive health coaching services for members with chronic conditions, including diabetes. Another insurer, United Healthcare, announced a diabetes plan, in 2009, that provides health care saving of approximately $500 per year to members with diagnosed diabetes and prediabetes who comply with evidence-based guidelines. Finally, in 2011, Blue Cross and Blue Shield of North Carolina began reimbursing registered dieticians separately for diabetes self-management education and nutrition advice. As a result, policy holders with diabetes can receive 10 hours of diabetes self-management education and 6 hours of nutrition advice from registered dieticians annually.

Health professionals. Most people with diabetes are seen by primary care professionals [12]. Improving the quality of health care delivery could reduce diabetes hospitalization costs exponentially. Many of the costs related to diabetes are associated with expensive long-term care and hospitalizations resulting from kidney failure, heart attack, lower-limb amputation, and blindness. The majority of these costs are preventable with proper diabetes care [13]. The National Committee for Quality Assurance rewards practices that follow diabetes care guidelines by acknowledging their efforts publicly, through the Diabetes Recognition Program; in the future, this recognition may translate into higher reimbursement levels. In North Carolina, practices can receive education about the National Committee for Quality Assurance programs and any available incentive programs through the North Carolina Area Health Education Centers (AHEC) program. The North Carolina AHEC provides practice-related support services to >900 practices, to assist with training and coaching on the use of technology to deliver evidence-based care to people with diabetes and other chronic conditions [14].

Policy Recommendations

North Carolina is making strides to address the prevalence of diabetes and related risk factors, and this article closes with a review of several recommendations to improve cost savings with respect to access to care, treatment, and prevention.

Of fundamental importance is the recommendation to eliminate health disparities. In North Carolina, as in the United States, the prevalence of diabetes is higher among ethnic minorities than among whites. In 2008, the prevalence of diabetes among persons enrolled in North Carolina Medicaid was 15.7%, a relative increase of 42% from the prevalence of 9.1% observed in the general population [15]. It is notable that the prevalence among African American enrollees was even higher, at 17.5%. The reasons for these differences ranged from delayed disease identification, which results in more complications sooner after diagnosis, to a lack of funds to pay for medications and supplies. Interventions addressing social determinants of health are difficult to execute and require commitments from multiple nontraditional public health partners. Yet the possibility of great savings warrants further consideration by the Division of Public Health and its multiple partners in diabetes prevention and control. In 2009, the State Center for Health Statistics released a report asserting that the state's Medicaid system could save >$100 million each year by eliminating racial and economic disparities in the care of people with diabetes [15].

A second recommendation is to implement lifestyle interventions to prevent diabetes. In 2010, as part of the Affordable Care Act, Congress passed legislation authorizing the Centers for Disease Control and Prevention (CDC) to manage the National Diabetes Prevention Program. In April 2010, Dr. Ann Albright (director, Division of Diabetes Translation, CDC) rolled out a national model for reimbursable care. Select YMCAs provide lifestyle coaching and physical activity training, reimbursed by United HealthCare, to people who have diagnosed prediabetes and multiple risk factors for the disease. The legislation also includes a provision for recognizing evidence-based diabetes prevention programs. Programs like the one at the WFSM will be eligible to apply for recognition. Third-party reimbursement for diabetes prevention would ensure that such programs are sustainable and would likely help lower the diabetes incidence.

Additional recommendations include expanding the Diabetes Education Recognition Program to more local health departments, increasing reimbursement to health care professionals who achieve recognition from the National Committee for Quality Assurance Diabetes Recognition Program, adoption of medication adherence programs like that of the Asheville Project, and appropriations to evaluate programs such as the Eat Smart, Move More, Weigh Less diabetes pilot.

Conclusion

Decreasing diabetes-related costs is a challenge. Many of the solutions presented here are innovative in nature, but some of them have not been subjected to rigorous economic analysis. There is a cost to decreasing costs. However, as Warren Buffet noted, "Cost is what you pay, [and] value is what you get." Because findings from programs for which evidence is available suggest that increasing the scope of and access to diabetes care may yield value (ie, savings) over the long term, continued investment in such programs appears to be warranted. NCMJ

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References

1. 2010 diabetes fact sheet. Diabetes Prevention and Control Branch, North Carolina Division of Public Health Web site. http://www.ncdiabetes.org. Accessed August 4, 2011.
2. The estimated prevalence and cost of diabetes in North Carolina. American Diabetes Association Web site. http://www.diabetesarchive.net/advocacy-and-legalresources/cost-of-diabetesresults.jsp?state=North+Carolina&district=0&DistName=North+Carolina+%28Entire+State%29. Accessed October 24, 2011.
3. Diabetes 2025 forecasts, 2011. Institute for Alternative Futures Web site. http://altfutures.org. Updated 2011. Accessed July 31, 2011.
4. Dall TM, Zhang Y, Chen YJ, Quick WW, Yang WG, Fogli J. The economic burden of diabetes. Health Aff (Millwood). 2010;29(2):297-303.
5. Centers for Disease Control and Prevention (CDC). National Diabetes Fact Sheet: National Estimates and General Information on Diabetes and Prediabetes in the United States, 2011. Atlanta, GA: CDC, US Department of Health and Human Services. http://diabetes.niddk.nih.gov/DM/PUBS/statistics/#fast. Accessed November 6, 2011. Posted February 2011.
6. Hernan WH, Brandle M, Zhang P, et al. Costs associated with the primary prevention of type 2 diabetes mellitus in the Diabetes Prevention Program. Diabetes Care. 2003;26(1):36-47.
7. Mensing C. Comparing the processes: accreditation and recognition. Diabetes Spectr. 2010;23(1):65-77.
8. Cranor C, Bunting B, Christensen D. The Asheville Project: long-term clinical and economic outcomes of a community pharmacy diabetes care program. J Am Pharm Assoc (Wash). 2003;43(2):173-184.
9. Jeffrey RW, Wing RR, Thorson C, Burton LR. Use of personal trainers and financial incentives to increase exercise in a behavioral weight-loss program. J Consult Clin Psychol. 1998;66(5):777-783.
10. Nguyen HQ, Maciejewski ML, Gao S, Lin E, Williams B, Logerfo JP. Health care use and costs associated with use of a health club membership benefit in older adults with diabetes. Diabetes Care. 2008;31(8):1562-1567.
11. Whetstone LM, Kolasa KM, Dunn C, et al. Effects of a behavior-based weight management program delivered through a state cooperative extension and local public health department network, North Carolina, 2008-2009. Prev Chronic Dis. 2011;8(4):A81.

12. Woodwell DA, Cherry DK. National Ambulatory Medical Care Survey: 2002 summary. Adv Data. 2004;Aug(346):1-44.
13. Fraze T, Jiang HJ, Burgess J. Hospital Stays for Patients With Diabetes, 2008: Statistical brief no. 93. Rockville, MD: Agency for Healthcare Research and Quality; 2010. http://www.nlm.nih.gov/books/NBK52658/. Accessed October 24, 2011.
14. Newton WP, Lefebvre A, Donahue KE, Bacon T, Dobson A. Infrastructure for large-scale quality-improvement projects: early lessons from North Carolina Improving Performance in Practice. J Contin Educ Health Prof. 2010;30(2):106-113.
15. Buescher PA, Whitmire JT, Pullen-Smith B. Medical care costs for diabetes associated with health disparities among adults enrolled in Medicaid in North Carolina. SCHS Stud. 2009;(160):1-7. http://www.schs.state.nc.us/SCHS/pdf/SCHS160.pdf. Accessed October 24, 2011.

Running the Numbers

A Periodic Feature to Inform North Carolina Health Care Professionals
About Current Topics in Health Statistics

Prevalence of Diabetes-Related Eye Disease in North Carolina: Findings From the North Carolina Behavioral Risk Factor Surveillance System

Diabetes affects approximately 9.8% of North Carolinians (nearly 700,000 people) aged ≥18 years. Hyperglycemia in individuals with diabetes can cause a variety of adverse effects, involving both microvascular and macrovascular complications. Macrovascular diabetic complications include coronary artery disease, stroke, and peripheral vascular damage. Major microvascular complications include diabetic neuropathy, renal disease, and ocular complications, such as cataracts, glaucoma, and, most commonly, diabetic retinopathy [1]. Diabetic eye complications, if not caught early and appropriately managed, can result in permanent damage and blindness.

Diabetic retinopathy is the leading cause of new cases of blindness among adults in the United States [2]. Diabetic retinopathy is progressive microvascular damage to the retina caused by long-standing diabetes. The most common form, nonproliferative retinopathy, is characterized by swelling of the capillaries in the back of the eye, which gradually become damaged and occluded. In the advanced stage, referred to as proliferative retinopathy, damaged blood vessels in the basement membrane close off, leading to neovascular proliferation and development of microaneurysms, which eventually rupture and allow serum lipids, proteins, and other deposits to accumulate on the retinal surface. Visual damage from diabetic retinopathy may result from macular edema, vitreous hemorrhage, or retinal detachment.

Current data on the prevalence of diabetic retinopathy are limited. A recent report using 2005-2008 data from the National Health and Nutrition Examination Survey (NHANES) reported that 28.5% of individuals aged ≥40 years with diabetes had received a diagnosis of diabetic retinopathy [3]. That study found that the prevalence was highest among males and among non-Hispanic black individuals. Data from the 2005 North Carolina Behavioral Risk Factor Surveillance System (NCBRFSS) found that 26.4% of individuals aged ≥18 years with diabetes reported having retinopathy or other diabetes-related eye complications [4]. The following report is an update on the prevalence of diabetic retinopathy in North Carolina.

The NCBRFSS is an ongoing population-based survey of a representative sample of noninstitutionalized North Carolina residents aged ≥18 years. NCBRFSS employs a random-digit-dialed telephone survey of North Carolina households. The survey is funded by the Centers for Disease Control and Prevention (CDC) and is conducted by the Survey Operations Unit in the State Center for Health Statistics. This report uses data from the CDC module on diabetes, obtained from the 2006-2010 NCBRFSS surveys. Data for these 5 years were aggregated to ensure a sufficient sample size to provide stable estimates. The results are weighted to reflect the North Carolina population aged ≥18 years. The results presented here are derived from 71,610 individuals who responded to the diabetes module.

The overall prevalence of diabetes among persons aged ≥18 years in North Carolina was 9.4% (95% confidence interval, 9.1%-9.7%) (Table 1). The prevalence was highest among blacks (14.6%) and Native Americans (11.5%) and lowest among Hispanics and Asians (4.7% and 3.7%, respectively). The prevalence of diabetes increased with increasing age: the prevalence among persons ages ≥65 years was 10 times that among persons aged 18-34 years. Higher frequencies of diabetes were also associated with lower education level and lower family income. Persons who reported being disabled were 3 times as likely as persons without disabilities to report having diabetes.

Among persons with diabetes, 19.5% reported having received a diagnosis of diabetic retinopathy or another diabetes-related eye disease (Table 1). Diabetic retinopathy was more common among men than women (22.5% vs 16.7%) and more common among blacks (22.2%), Hispanics (27.5%), and Native Americans (27.5%), compared with whites (17.2%). Numbers for other racial/ethnic groups were

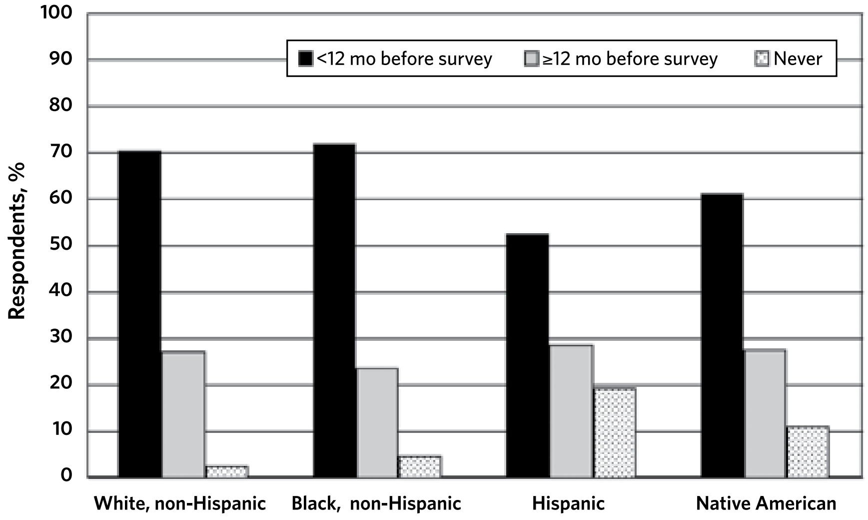
TABLE 1.
Characteristics of Survey Respondents Who Received a Diagnosis of Diabetes and Diabetic Retinopathy

	Diabetes diagnosis		Diabetic retinopathy diagnosis	
Characteristic	**No. (%[a])**	**95% CI**	**No. (%[a])**	**95% CI**
Overall	9,088 (9.4)	9.1-9.7	1,751 (19.5)	18.3-20.7
Sex				
Male	3,537 (9.2)	8.8-9.6	783 (22.5)	20.5-24.4
Female	5,551 (9.6)	9.2-10.0	968 (16.7)	15.3-18.2
Race				
White, non-Hispanic	6,309 (8.7)	8.4-9.0	1,099 (17.2)	15.9-18.5
Black, non-Hispanic	2,118 (14.6)	13.6-15.5	485 (22.2)	19.7-24.8
Hispanic	211 (4.7)	3.8-5.7	61 (27.5)	19.5-35.4
Asian	25 (3.7)	1.7-5.6	5 (15.8)	0.3-31.3
Native American	278 (11.5)	9.6-13.5	67 (27.5)	19.9-35.1
Other	70 (6.2)	3.7-8.6	18 (35.8)	11.7-60.0
Age				
18-24 y	30 (1.3)	0.6-2.0	7 (22.9)	2.2-43.5
25-34 y	165 (2.1)	1.7-2.5	22 (11.2)	5.6-16.7
35-44 y	547 (4.8)	4.2-5.3	94 (18.1)	14.0-22.2
45-54 y	1,372 (9.7)	9.0-10.4	283 (20.3)	17.4-23.2
55-64 y	2,567 (17.8)	16.9-18.7	521 (20.9)	18.6-23.2
65-74 y	2,587 (22.0)	21.0-23.0	501 (20.4)	18.2-22.5
≥75 y	1,774 (20.3)	19.1-21.5	315 (17.5)	15.1-19.9
Education level				
Less than high school	2,142 (14.7)	13.8-15.7	499 (23.9)	21.0-26.7
High school graduate or equivalent	3,017 (10.5)	9.9-11.0	590 (20.1)	18.0-22.2
Some college	2,196 (9.2)	8.7-9.8	386 (17.6)	15.4-19.9
College graduate	1,709 (6.0)	5.6-6.3	268 (15.7)	13.2-18.1
Household income				
<$15,000	1,774 (17.2)	16.0-18.4	434 (26.3)	22.9-29.6
$15,000-$24,999	1,918 (11.9)	11.2-12.7	402 (20.7)	18.2-23.2
$25,000-$34,999	1,048 (10.3)	9.4-11.1	193 (18.4)	15.2-21.5
$35,000-$49,999	1,105 (9.2)	8.4-9.9	183 (18.6)	15.4-21.9
$50,000-$74,999	884 (7.6)	7.0-8.3	136 (14.5)	11.5-17.5
≥$75,000	883 (5.0)	4.6-5.5	124 (13.1)	10.3-15.9
Disability status				
Disability	5,386 (18.3)	17.6-18.9	1,211 (22.4)	20.9-24.0
No disability	2,655 (5.7)	5.3-6.0	374 (14.9)	12.7-17.0

Note. Data are for 71,610 individuals who responded to North Carolina Behavioral Risk Factor Surveillance System surveys during 2006-2010. Data do not include women who received a diagnosis of gestational diabetes or individuals who received a diagnosis of prediabetes. CI, confidence interval.

[a] Percentages are weighted to reflect the entire population of North Carolinians aged ≥18 years.

FIGURE 1.
Timing of the Most Recent Eye Examination Among Survey Respondents With Diabetes, by Race/Ethnicity



Note. Data are for 71,610 individuals who responded to North Carolina Behavioral Risk Factor Surveillance System surveys during 2006-2010.

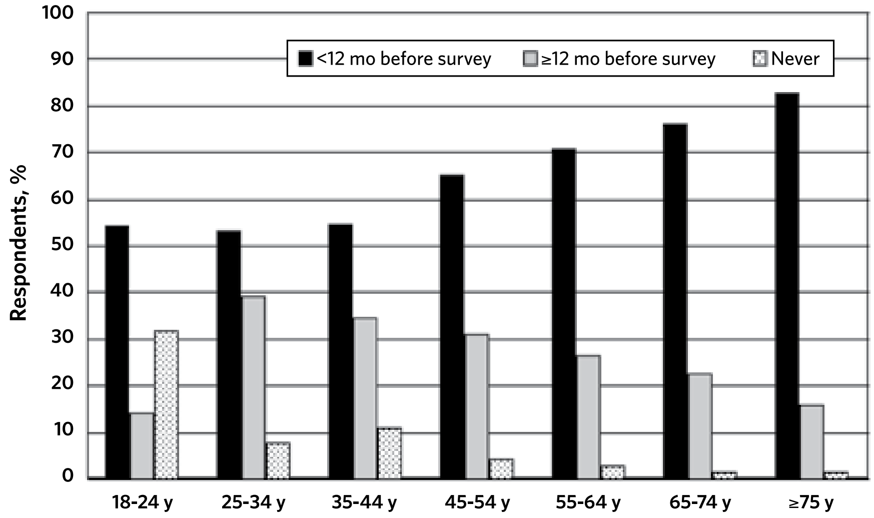
too small for meaningful interpretation. The prevalence of diabetic retinopathy increased with decreasing levels of education and family income. Persons with disabilities also reported a higher prevalence of diabetic retinopathy, compared with their counterparts with no disability.

The percentage of individuals with diabetes who received a recommended annual eye examination also varied by certain demographic characteristics. Only approximately 61% of Native Americans and 52% of Hispanics received an eye examination during the 12-month period before the survey, compared with approximately 70% for non-Hispanic whites and blacks (Figure 1). Nearly 20% of Hispanic respondents reported never having had an eye examination. The percentage of diabetics who had an eye examination within the past year increased with increasing age (Figure 2). More than 80% of diabetics aged ≥75 years reported having had an examination within the past 12 months, compared with <60% of persons <45 years old.

These data from the 2006-2010 NCBRFSS surveys show that approximately 1 of 5 adults with diabetes in North Carolina has received a diagnosis of diabetes-related eye disease. The prevalence of diabetic eye disease in North Carolina, as reported on the NCBRFSS, has declined slightly over previous years. During the previous 5-year period (ie, 2001-2005), the combined prevalence was approximately 26%, which is more in line with the NHANES findings of 28.5% [3]. When less severe forms of vision problems are included, the prevalence is even higher. A 2006 NCBRFSS vision module for people aged ≥40 years in North Carolina found that, among individuals with diabetes, 41.4% reported having any degree of visual impairment, including difficulty reading, compared with 31.6% of all adults in that survey [5]. The finding in this study that males and minority populations were at increased risk for developing diabetic eye disease is consistent with the findings by Zhang and colleagues [3].

Diabetes-related eye disease is a common complication among persons with diabetes. Almost all individuals with type 1 diabetes will eventually develop nonproliferative retinopathy, as will the majority of persons with long-standing type 2 diabetes. The likelihood that a person with diabetes will develop eye problems depends on several factors, but maintaining optimal blood pressure and glucose control are of key importance in preventing or minimizing the severity of visual problems. Individuals with dia-

FIGURE 2.
Timing of the Most Recent Eye Examination Among Survey Respondents With Diabetes, by Age



Note. Data are for 71,610 individuals who responded to North Carolina Behavioral Risk Factor Surveillance System surveys during 2006-2010.

betes should have a comprehensive eye examination within 3-5 years after their initial diagnosis, and they should receive an eye examination annually thereafter [6]. Physicians caring for diabetic patients should be mindful of these recommendations, paying particular attention to minorities and other high-risk populations. NCMJ

References

1. Fowler MJ. Microvascular and macrovascular complications of diabetes. Clin Diabetes. 2008;26(2):77-82.
2. Centers for Disease Control and Prevention (CDC). National diabetes fact sheet: national estimates and general information on diabetes and prediabetes in the United States, 2011. Atlanta, GA: CDC, US Department of Health and Human Services; 2011. http://www.cdc.gov/diabetes/pubs/factsheet11.htm. Accessed October 27, 2011.
3. Zhang X, Saaddine JB, Chou CF, et al. Prevalence of diabetic retinopathy in the United States, 2005-2008. JAMA. 2010;304(6):649-656.
4. Herrick H, Roberts B. Health Risks Among North Carolina Adults: 2005. Raleigh, NC: State Center for Health Statistics, Division of Public Health, North Carolina Department of Health and Human Services; 2006. http://www.epi.state.nc.us/SCHS/pdf/BRFSSReport2005.pdf. Accessed October 27, 2011.
5. North Carolina Risk Factor Surveillance System. Visual impairment and eye care among North Carolina adults: results from the new vision module questionnaire in the 2006 BRFSS survey. SCHS Stud. 2007;(155):1-5. http://www.epi.state.nc.us/SCHS/pdf/SCHS155.pdf. Accessed October 27, 2011.
6. American Diabetes Association. Standards of medical care in diabetes—2007. Diabetes Care. 2007;30:S4-S41.

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The Role of Allied Health in Health Care Reform

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The wide-ranging and significant disciplines representing allied health constitute the largest and one of the most rapidly growing health care workforces in North Carolina. With anticipated increases in patients' access to care, allied health professionals will need to call on their full scope of practice as part of a comprehensive health care team.

Full appreciation of the role allied health can play in national and state health care reform first requires an understanding of the diversity of disciplines within the allied health alliance, the many levels of educational preparation required for practice in the field, and workforce supply and demand. The goal of increasing access through the Affordable Care Act requires a large and varied workforce that includes the full range of allied health disciplines. This commentary describes the wide variety of interprofessional roles that the allied health workforce can effectively contribute to health care reform.

Defining "Allied Health"

The term "allied health" is used to refer to >100 classifications of health care professionals. These practitioners provide a range of critical health care functions, including delivering preventive and rehabilitative therapies and conducting an increasingly complex array of diagnostic procedures. A few examples of allied health professions include audiology, clinical laboratory science, cytotechnology, dental hygiene, diagnostic imaging (radiography), occupational therapy, physical therapy, radiation therapy, polysomnography, respiratory therapy, health information management, and speech-language pathology. Allied health professionals work in widely diverse settings, including clinics, hospitals, rehabilitation centers, laboratories, schools, long-term care facilities, medical homes, and home health agencies.

According to federal regulations, the term "allied health professional" is defined as "a health professional (other than a registered nurse or physician assistant) who has received a certificate, an associate's degree, a bachelor's degree, a master's degree, a doctoral degree, or postbaccalaureate training, in a science relating to health care; who shares in the responsibility for the delivery of health care services or related services...and who [is not a physician, dentist, veterinarian, podiatrist, pharmacist, chiropractor, clinical psychologist, counselor, health administrator, or public health professional]" [1]. Perhaps a more meaningful way to understand the broad grouping of "allied health" disciplines is as an *alliance* of many essential health care professionals who serve as critical partners, or *allies*, to the more commonly identified physicians and nurses on the health care team. In many instances, physician assistants, health managers/administrators, and counselors can be found in allied health colleges and schools that can provide leverage in funding and the acquisition of facilities and other resources that affiliation with a larger academic unit can offer.

The very broad definition of allied health and the frequent changes in health care technology and professional standards make it virtually impossible to come up with an all inclusive list of every allied health discipline practicing in North Carolina (or the nation) at any one point in time. In 2010, the US Department of Labor Bureau of Labor Statistics provided employment data for 41 distinct employment titles that clearly meet the definition of allied health, plus a broad category of "all other healthcare practitioners and technical workers" [2].

Workforce Supply and Demand

The disparate job titles, employment settings, and licensure regulations for these many different allied health disciplines make it very difficult to project the degree to which our colleges and universities will be able to meet future allied health workforce demand. In terms of employment growth and job opportunities, the North Carolina Health Professions Data System showed that employment in allied health positions grew by 67% during 1999-2009, a time when general state employment grew by only 3% [3]. Clearly, this is a large and growing part of the health care workforce. Projecting the supply of and demand for qualified professionals in all the different allied health disciplines will be critical to the ability of the North Carolina health care system to meet the state's health care needs. The Council for Allied Health in North Carolina (CAHNC) was formed in 1991, with support from the North Carolina Area Health Education Centers

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program, to bring together allied health practitioners, educators, and employers from across the state to provide a forum for these groups to exchange information about the allied health workforce and to coordinate educational planning with predicted labor demands. Today, the CAHNC continues to pursue this goal and has contracted with the University of North Carolina–Chapel Hill Sheps Center for Health Services Research to produce a series of reports on the ever-changing allied health workforce picture in North Carolina.

Allied health education is offered in almost every type of postsecondary educational institution. By 2006, in >60 allied health occupations in >2,500 institutions, there were approximately 7,000 programs with >225,000 enrolled students and nearly 100,000 graduates. In North Carolina, allied health programs can be found in state-supported universities, community colleges, private institutions, proprietary schools, correspondence schools, hospital-based programs, and on-the-job training programs. North Carolina has followed the national trends in educational growth for allied health professionals.

North Carolina public postsecondary educational institutions (consisting of 2-year community colleges and 4-year colleges and universities) offer a variety of allied health programs and are supplying large numbers of qualified allied health care professionals to the state. In times of economic uncertainty, fiscal constraints, changes in the health industry, emphasis on cost efficient solutions to health care delivery, and changing demographic characteristics, public institutions must strategically plan for the future to meet increased health care needs with fewer resources.

According to Renee Batts, education consultant for Health Sciences Academic Programs in the North Carolina Community College System, "allied health programs are overwhelmingly among the most popular at community colleges" and waiting lists are among the longest for programs at community colleges. Over the past 5 years, there has been a 21.8% growth in associate degree programs and a 17.4% increase in diploma programs. One important reason for this success is the success graduates have in finding work in these professions." Approximately 85% of individuals enrolled in allied health education programs in the state are in the North Carolina Community College System. Community colleges educate a large proportion of all allied health professionals who are necessary to ensure effective health care delivery in all parts of the state.

Data describing the number of allied health educational programs in North Carolina are somewhat fragmented. In the allied health area, North Carolina offers >75 different programs at all levels from area vocational technical schools to 2- and 4-year schools. There are approximately 30 public and private universities that offer roughly 114 baccalaureate, Master's and doctoral level allied health degree programs, and a draft inventory of these degree programs is accessible via the CAHNC Web site (available at: http://www.med.unc.edu/ahs/cahnc). In the community college system, there are >50 health care programs offered. The 2-year community college listing is specified on the North Carolina Community College System Web site (available at://www.nccommunitycolleges.edu).

According to recent data distributed by the Council for Allied Health in North Carolina, allied health professionals made up the largest proportion of the health care workforce in the state, at 35% (128,150 of 364,000 health care jobs) [3, 4]. In contrast, nurses occupied 24% of all health care jobs; nurse aides, orderlies, and attendants, 28%; and physicians, 5%.

The Evolving Role for Allied Health

The allied health professional is an integral member of the health care team and makes a significant contribution to health care services. These professionals are highly skilled and share in the delivery of health care services, including services related to the identification, evaluation and prevention of disease and disorders; dietary and nutritional services; health promotion services; rehabilitation services; and health system management services. Under health care reform, there is decreased emphasis on individual professions in the delivery of health care; rather, care will be about an interprofessional team working together to address the needs of the patient. By 2019, the health care reform laws will expand insurance coverage to >32 million Americans (resulting in coverage for 94% of nonelderly uninsured US citizens), and allied health will see a dramatic demand for new and existing professionals and disciplines.

Health care reform legislation has challenged states such as North Carolina to find cost-effective ways to ensure the efficient delivery of quality health care to a significantly larger, culturally and geographically diverse patient population. Regardless of what is ultimately implemented, one of the primary goals will be to increase access for uninsured and underinsured individuals and families, which will place a considerable burden on today's medical and health care workforce. Expansion of public access to health care requires increased numbers and types of allied health professionals and technicians prepared at the university, community college, diploma, certificate, and on-the-job training levels, to address a broad range of health challenges. Major challenges in North Carolina include the prevalence of chronic health conditions, health disparities, and delivery of health services to rural areas.

New occupations that are described in health care reform legislation, such as patient navigators, may already exist in some allied health professions or in curriculums within these disciplines that can be expanded or modified to provide the workforce needed to offer services such as medical case management. Community health educators typically employed in public health centers and public schools can apply their skills to meeting health reform mandates for prevention and health promotion services. Nutrition counselors, mental health counselors, and substance abuse counselors have routinely provided health promotion services. Traditional allied health positions that offer hands-on services (eg, occupational therapists, physical therapists, audiologists, respiratory therapists, and dental hygienists) have the ability to increase their involvement in health promotion activities related to their patients' particular health needs. Health information administrators have explored the concept of instructing patients (and their families) in how to use personal electronic health records in managing and taking responsibility for their own health.

Incorporating discipline-specific prevention and health promotion activities into the scope of practice and educational curriculums of existing allied health professions emphasizes the importance of this aspect of the clinical role that may already be performed with patients but not to a discernible degree. Simply modifying or tweaking existing curriculums to include related prevention and health promotion activities will ensure that they become a routine part of the health care delivery process. Scope of practice defines what a professional can and cannot do with a patient. The details of the various allied health professions' scope of practice are not always known by other health professionals and, as a result, may not always be fully appreciated or used.

In large clinics or hospitals where a wide range of health professionals are employed, allied health practitioners may not be called on to use the full extent of their scope of practice skills, since they may overlap with those of other professionals. However, in small clinics and rural environments where there are fewer health team members, use of the full scope of practice takes on greater importance, and these settings will need to rely on the professional's use of existing skills to fill in the service gaps. For example, a part of the scope of practice and state licensure of physical therapists is wound care. Taking advantage of this skill set in settings where other wound care providers may not be available expands services of physical therapists beyond what is sometimes expected of that profession.

Allied health professionals in rehabilitation centers have often worked together as a team to bring about the best possible functional outcomes of the patient in a reasonable period. Even today, this concept of interprofessional education and service delivery has not been practiced to the patient's fullest benefit. Cost containment and the delivery of high-quality services are essential to the success of health care reform efforts. Interprofessional service delivery will be vital to curbing rising costs and improving outcomes, and patient-centered medical homes are an excellent example of this successful team approach. Over time, allied health professionals will find greater opportunities in medical homes and within new models of care as their unique skills are recognized and tapped. Whether in response to the goals of health care reform or to the needs of traditional health care delivery systems, allied health services are crucial to the patient's overall health, well-being, and quality of life.

Allied health professions are an integral part of an interprofessional approach to cost-effective and high-quality health care delivery. Innovative settings that offer a team approach will be able to address the intent of health care reform and the challenges facing North Carolina. The allied health community must partner with state medical and health care organizations, such as the North Carolina Institute of Medicine, to plan a coordinated effort to successfully address statewide access, health delivery, and workforce development issues.

Additional information about allied health is accessible via the Web sites of the following organizations: the Association of Schools of Allied Health Professions (available at: http://www.asahp.org), the Council for Allied Health in North Carolina (available at: http://www.med.unc.edu/ahs/cahnc), the Health Professions Network (available at: http://www.healthpronet.org/about/), and the National Network of Health Career Programs in Two-Year Colleges (http://www.nn2.org/). NCMJ

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References

1. 42 USC §295p (2010).
2. Bureau of Labor Statistics, US Department of Labor. May 2010 state occupational employment and wage estimates: North Carolina. Bureau of Labor Statistics Web site. http://www.bls.gov/oes/current/oes_nc.htm. Modified May 17, 2011. Accessed August 2011.
3. North Carolina Health Professions Data System [database online]. Chapel Hill, NC: Sheps Center for Health Services Research, University of North Carolina–Chapel Hill; 2009. http://www.shepscenter.unc.edu/hp/index.html. Accessed August 2011.
4. Kimball M, Fraher E, Gaul K, Lyons J. Allied Health Job Vacancy Tracking Report. Chapel Hill, NC: Sheps Center for Health Services Research, University of North Carolina–Chapel Hill; 2011.

Moving Medicine Forward in North Carolina

Peter W. Carmel

To the Editor—As the nation's largest physician organization, the American Medical Association (AMA) is uniquely positioned to help physicians thrive in medical practice during all stages of their careers. The AMA is the only organization in the United States that represents all physicians across all specialties in every state and is the physicians' voice as lawmakers work on issues critical to the future of medicine. In North Carolina, the AMA is proud to support and work alongside the North Carolina Medical Society on a variety of issues important to physicians, including medical liability reform. The AMA is pleased to have contributed to a big win for North Carolina physicians in 2011, as Governor Beverly Purdue's veto of medical liability reform legislation was successfully overridden.

While the AMA continues to pursue medical liability reform at the federal level, liability reforms at the state level are essential to ensuring that physicians can do what they do best—care for patients. The AMA Advocacy Resource Center works closely with state medical associations to support legislative efforts in their respective states, and the AMA Litigation Center collaborates with state medical associations to assist them when the liability battle shifts to the courts. In North Carolina, the AMA contributed $100,000 to the North Carolina Medical Society's successful liability reform marketing efforts in 2011 to help fix the broken medical liability system for both patients and physicians.

The AMA is working with the North Carolina Medical Society on other issues, as well. North Carolina has faced steep Medicare payment cuts every year since 2002 because of the failed Medicare payment formula for physicians, and each year the AMA has been able to secure congressional action to prevent these cuts. Most recently, at the urging of the AMA and its partners in the Federation of Medicine, Congress passed legislation to provide stable Medicare payments for all of 2011. This legislation is worth an average of $29,000 to each North Carolina physician.

The AMA also offers North Carolina physicians the opportunity to participate in webinars and seminars on topics that affect their daily practice of medicine, such as how physicians can succeed with new payment models such as medical homes and accountable care organizations. Physicians can also take advantage of resources designed to help them adopt health information technology and qualify for federal incentives, like the free resource *A Clinician's Guide to Electronic Prescribing*. The AMA will continue to provide resources and support to help physicians in North Carolina help their patients.

As the voice of American medicine, the AMA will continue to work with all states and specialties to advocate for policies that will help physicians thrive as we move medicine forward together. Together, we truly are stronger. NCMJ

Peter W. Carmel, MD, DMSc president, American Medical Association, and chairman, Department of Neurological Surgery, and co–medical director, Neurological Institute of New Jersey, UMDNJ–New Jersey Medical School, Newark, New Jersey.

Acknowledgment

A version of this letter was posted on the North Carolina Medical Society Web site (available at: http://www.ncmedsoc.org/blog/index.php/archives/12551) on July 21, 2011.

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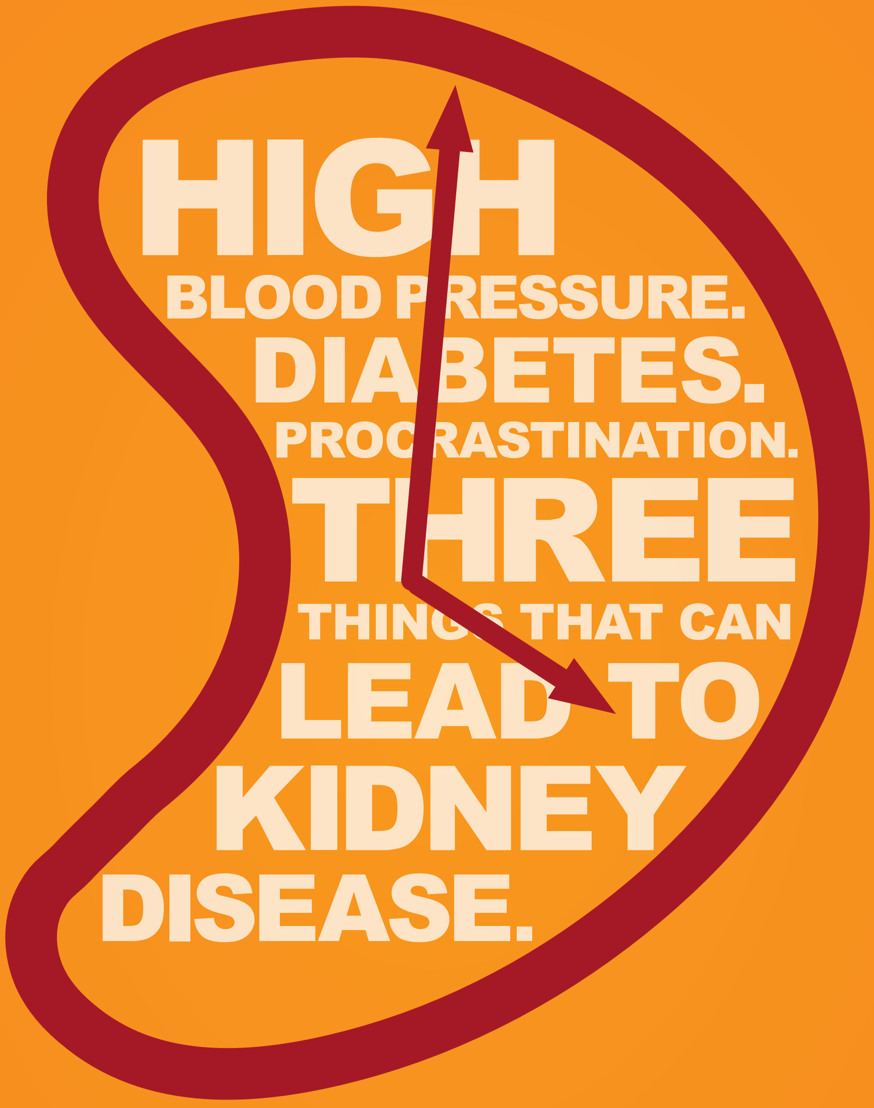

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