

Reducing Diabetes Disparities Through the Implementation of a Community Health Worker–Led Diabetes Self-Management Education Program

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Disparities in prevalence of type 2 diabetes and complications in underserved populations have been linked to poor quality of care including lack of access to diabetes management programs. Interventions utilizing community health workers (CHWs) to assist with diabetes management have demonstrated improvements in patient outcomes. Use of CHWs may be an effective model for providing care coordination and reducing disparities, but there is limited knowledge on how to implement this model on a large scale. This article describes how an integrated health care system implemented a CHW-led diabetes self-management education program targeting Hispanic patients and reports lessons learned from the first 18 months of operation. **Key words:** *care coordination, community health worker, diabetes management, vulnerable populations*

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TYPE 2 DIABETES is one of the most prevalent chronic diseases in the United States, and the burden of this epidemic falls disproportionately on minorities and persons of low socioeconomic status.¹ The prevalence of diabetes in adults in **Texas** is higher than the national average and is much higher in Hispanics (12.3%) than in white non-Hispanics (8.5%).² Despite major advances in medical care, technology, and services, Hispanics with diabetes continue to experience a 50% to 100% higher burden of diabetes-related illness and mortality than non-Hispanics.³ Common comorbidities include diabetic retinopathy, lower extremity amputation, and early-stage kidney disease.^{1,3,4} These complications generally can be avoided with proper management of diabetes. However, individuals of Hispanic descent are less likely to receive recommended processes of care for patients with diabetes.^{4,5} Hispanics are also

less likely to accomplish treatment goals such as glycemic control and lowering of cholesterol levels and blood pressure.^{4,6}

Observed disparities in diabetes health outcomes have been linked to lack of access to preventive care and diabetes management programs as well as poor quality of care.⁷ Hispanics report experiencing more barriers to diabetes care and self-management than non-Hispanic white adults and are less likely to have access to primary care and medical supplies such as glucometers and testing strips.⁸ Lack of trust in providers and difficulties in communication with clinicians are common problems cited by this population.⁸⁻¹¹ As a result of these trust and communication barriers, patients who do have access to care do not receive the information they need from visits with health care providers. Hispanic patients who have a diagnosis of diabetes often leave physician appointments without an understanding of hemoglobin A_{1c} (HbA_{1c}), the risks associated with diabetes, or how to manage their disease. Consequently, these patients do not know how to make the lifestyle changes needed to achieve control over their diabetes.^{8,12} In addition, cultural attitudes can negatively affect diabetes management. Hispanic patients are more likely to have a fatalistic attitude about diabetes and other chronic conditions, believing that there is nothing they can do to control their disease.^{13,14}

A systematic review of interventions to improve diabetes care in socially disadvantaged populations concluded that culturally tailoring interventions and using community health workers (CHWs) resulted in better diabetes-related outcomes in Hispanic and African American populations.¹⁵ Community health workers can provide time-intensive and community-based diabetes self-training and can serve as a bridge between patients and providers.^{11,16} Patients are more likely to trust a peer from a similar background who understands the patient's culture.¹⁶ This level of trust allows patients and CHWs to work together to improve diabetes-specific behaviors.⁴ Community health workers can

coach patients on effective communication with health care providers, explain concepts and answer questions, and provide emotional support and a level of care coordination. In addition to providing improved care for patients, CHWs can reduce the burden on other medical providers and reduce the cost of health care delivery by supporting patient needs that do not require the expertise of a clinician¹⁷ and helping patients avoid unnecessary hospitalizations and other expensive forms of acute care.¹⁸ Although there is increasing evidence regarding the effectiveness of CHW-led interventions on improving diabetes-related health outcomes, few studies have described the development and implementation of such programs in detail and their potential contribution to the health care delivery system.¹⁹⁻²¹

Baylor Health Care System (BHCS) in Dallas, Texas, created the Diabetes Equity Project (DEP) with funding from a Merck Company Foundation grant, with the goal of reducing observed disparities in diabetes care and diabetes outcomes in the predominantly Hispanic, medically underserved communities surrounding BHCS hospitals. The DEP represents a unique partnership between a private, nonprofit health care system and community clinics. The program features a specially trained, bilingual CHW (diabetes health promoter) who delivers a culturally relevant diabetes education curriculum targeting barriers to diabetes management that Hispanics commonly experience, including lack of knowledge about diabetes, lack of social support, poor diets, insufficient physical activity, and limited access to care. This article describes the development and implementation of the DEP within a large health care delivery system and reports preliminary findings and lessons learned over the first 18 months of the program's operation.

METHODS

Overview

The BHCS Office of Health Equity (OHE) developed the DEP and facilitated the

implementation of the program within 5 partnering community-based charity clinics. During the 6-month project planning phase, a program manager was hired to recruit and manage the CHWs and to implement strategic collaborations with the 5 clinics selected as DEP sites. These clinics were selected on the basis of geographic location, size of patient panel, and ability to provide support-ing clinical and care coordination services. All clinics were medical home partners in Project Access Dallas (PAD), a countywide network of providers and care coordination services for low-income, disadvantaged residents lacking health insurance. PAD's menu of support services included transportation, medication assistance, specialty physician care, health navigation, and access to low-cost medications. The DEP leadership team developed the DEP patient education curriculum on the basis of the evidence-based Community Diabetes Education (CoDE™) program.²² A diabetes registry, DiaWEB, was created by a local vendor to allow CHWs to collect data at patient visits and monitor patient progress over time. Institutional review board approval for the conduct of the project was obtained from the BHCS.

Development of program curriculum

The diabetes education curriculum for the DEP was adapted from CoDE™, a pilot program that was implemented in a Dallas clinic serving a largely uninsured Mexican American population.²² Patients who participated in CoDE™ for 12 months experienced a significant reduction in HbA_{1c}.^{22,23} The DEP curriculum consists of (1) 7 one-hour, one-on-one educational sessions designed to teach participants about diabetes and the importance of blood glucose control, medication adherence, diet, and exercise; (2) routine assessments of HbA_{1c}, blood pressure, weight, and foot condition (visual and monofilament assessment); and (3) routine assessments to ensure delivery of preventive services (dilated eye examination, dental examination, influenza and pneumonia vaccines, and provider foot examina-

tion). Community health workers assess self-management behaviors and facilitate goal setting at each visit. The educational intervention is grounded in the Adult Learning Theory of Knowles²⁴, which states that effective adult learning should be self-directed, experience-based, goal-oriented, practical and problem-centered, relevancy-oriented, and respect-oriented.

Hiring of community health workers

We created a CHW position within the BHCS OHE with the official title "diabetes health promoter" to acknowledge the specific role this employee would have in diabetes management. Position requirements included a high school diploma and fluency in Spanish, with a medical assistant background strongly preferred. The position was posted on the BHCS Web site and other Web-based recruiting sites and was also shared with clinic administrators to identify interested parties among their staff or volunteer base. Candidates were interviewed by the program manager and a medical assistant who had conducted self-management education as part of the CoDE™ program. Candidates were ranked on the behavioral traits of compassion, communication, self-motivation, capacity to learn, integrity, teamwork, and quality.

Training of community health workers

Once hired, CHWs were required to complete the 160-hour Texas Community Health Worker Training and Certification Program and an additional 50 hours of instruction pertaining to diabetes management and the DEP protocol. The Texas CHW curriculum focused on skill development in the following areas: communication, interpersonal skills, service coordination, capacity building, health advocacy, teaching, organizational skills, and chronic diseases. A state-certified CHW instructor from the Texas Public Health Training Center at the University of North Texas Health Science Center conducted the training as a series of twenty 8-hour workshop-style sessions. The 50 hours of additional

instruction included 12 hours of American Diabetes Association (ADA)-recognized group self-management training at the BHCS Ruth Collins Diabetes Center, 8 hours of didactic instruction provided by the consulting endocrinologist for the project and certified diabetes educators, and the 6-hour American Association of Diabetes Educators (AADE) Health Care Technician online course. The remaining 24 hours of instruction included BHCS and DEP orientation, protocol discussion, team-building exercises, clinical skills development, and DiaWEB software training. The CHWs completed a posttest to assess knowledge of the Texas CHW curriculum as well as a posttest developed by a BHCS-certified diabetes educator to assess knowledge gained pertaining to diabetes management and the DEP protocol.

Development of DiaWEB

The BHCS OHE worked with a local vendor, Chiron Data Systems, to create a custom HIPAA-compliant Web-based diabetes management system (DiaWEB) to enable CHWs and clinicians to record and monitor patient participation in the program and clinical indicators associated with diabetes management. The CHWs used DiaWEB's intuitively designed Web interface for the input of patient demographic information such as sex, ethnicity, primary language, grade level, and literacy level and clinical indicators such as patient blood pressure, body mass index (BMI), waist circumference, foot examination results, eye examination results, and receipt of influenza and pneumonia vaccines. The registry also allowed for the documentation of patient medications, patient clinical laboratory results, and patient symptoms. In addition, DiaWEB had customizable fields to allow for tracking of various outcome measures such as patient scores on diabetes knowledge tests, quality-of-life assessments, and patient satisfaction surveys; patient-reported level of physical activity; and patient-reported emergency department visits and hospital admissions. After each patient visit, CHWs generated a report from

DiaWEB containing key outcome and process measures for the patient, which was faxed or scanned to the patient's primary care provider for inclusion in the patient's medical record.

Deployment of the Diabetes Equity Project intervention

The DEP intervention was deployed in 5 collaborating charity clinics after physical space for the DEP program was established, DiaWEB was installed, and the CHWs completed training. Each CHW was matched with a community charity clinic on the basis of geographic location and "fit" with the clinic culture. Patients were referred to the DEP by providers at the 5 participating clinics and by clinicians at BHCS facilities following emergency department visits and hospitalizations related to uncontrolled diabetes. To participate in the DEP, patients had to be 18 years or older with a diagnosis of type 2 diabetes and be uninsured or underinsured. Although the program targeted Hispanic patients, all patients who met the inclusion criteria were eligible to participate regardless of ethnicity or race. Community health workers explained the program in detail before obtaining consent from patients who agreed to participate.

During the first 60- to 90-minute DEP visit, the CHW assessed baseline values of HbA_{1c}, blood pressure, BMI, foot condition, and self-management behaviors, and presented the first diabetes education module. The CHW also counseled the patient about social barriers, medication adherence, and diabetes preventive services at each visit. Depending upon urgency, communication with the patient's primary care physician about the visit occurred within 24 hours. A 1-page, user-friendly visit summary was faxed or scanned to the primary care provider for "routine" visits. If the patient was symptomatic or had critical blood glucose or blood pressure measurements as defined by program protocol, the physician was contacted immediately and patient instructions were relayed. The CHW scheduled follow-up visits for the patient, including 2 additional 60-minute visits over an

8-week period to continue the delivery of the DEP curriculum and 4 follow-up visits lasting 30 to 60 minutes at 3, 6, 9, and 12 months for assessment of HbA_{1c}, blood pressure, and BMI. The CHW provided the patient with feedback and coaching at all follow-up visits. Data from each DEP patient encounter were recorded in the DiaWEB diabetes registry by the CHW.

Community health workers were managed by the DEP registered nurse manager and received clinical support from the clinic primary care physicians and nurse practitioners. They also received 35 hours of continuing education delivered by certified diabetes educators, physicians, a dietician, and a CHW certified trainer. Topics included diabetes complications, relevant evidence-based standards (ADA and AADE-7), behavior change and motivational interviewing, and setting boundaries.

Statistical methods used for preliminary analysis of year 1 results

We performed a preliminary statistical analysis on a limited set of key outcome variables for patients who enrolled in the DEP during the first 18 months of operation to evaluate the initial impact of the program and to determine whether programmatic changes were needed to help patients achieve desired outcomes. All patients who enrolled in the program from September 2009 to March 2011 who had at least 2 visits with the CHW were included in the analysis. The outcome modeled in the analysis was change in mean HbA_{1c} levels from baseline. An analysis of covariance model was used to test whether certain factors including program enrollment date, visit number, clinic, age, ethnicity, sex, and baseline HbA_{1c} level were significantly associated with the change from baseline while adjusting for random variance in the model. These factors were tested at an α level of .0125 to control for the multiple analyses run over the course of the program.

RESULTS

Implementation activities of the DEP were completed over the course of 6 months. Five

CHWs were hired and became certified CHWs after completing the 160 hours of Texas CHW Training and Certification. In addition, all 5 CHWs completed the 50 hours of additional training in diabetes management and DEP implementation and passed a posttest on diabetes knowledge with an average score of 96.8%. Infrastructure for the DEP, including creation of DEP workspace and planning for the integration of the DEP into clinic workflow, was established. DiaWEB customization and testing was completed, and the program was installed on DEP computers.

Enrollment in the DEP began in the 5 clinics at the end of September 2009. Within the first 18 months of rolling enrollment, 806 patients enrolled in the program. The majority of patients were female (60%), between 40 and 59 years of age (64%), and Hispanic (70%) (Table 1). Participants took an average of 1.1 years to complete the program curriculum, and an attrition rate of 15% was calculated for the first 18 months. The mean HbA_{1c} value for patients at baseline was 8.7%. A preliminary analysis of the year 1 results revealed a statistically significant change in mean HbA_{1c} levels 1 year post-baseline, where the mean HbA_{1c} value dropped to 7.4%. Results from the analysis of covariance are described in Table 2. Baseline HbA_{1c} levels were significantly

Table 1. Demographics of Patients Enrolled in First 18 Months

Demographics	%
Gender	
Male	40
Female	60
Age, y	
Missing	1
<30	6
30-39	15
40-49	32
50-59	32
60+	14
Ethnicity	
Hispanic	70
Non-Hispanic	30

Table 2. Year 1 Preliminary Results (Analysis of Covariance)

Factors	<i>F</i>	<i>P</i>
Baseline hemoglobin A _{1c}	334.38	<.0001
Visit	0.74	.5322
Ethnicity	1.9	.1704
Age	0.48	.4885
Sex	0.3	.5854
Enrollment date	4.42	.0008
Clinic	1.77	.1361

associated with a decrease in HbA_{1c} from baseline. In addition, patients who enrolled in the program later in the year experienced a greater change in HbA_{1c} values than those who enrolled earlier in the year. All other factors tested in the model (number of visits with the CHW, age, sex, ethnicity, clinic) did not have a significant effect on the mean HbA_{1c} change from baseline. The analysis of patient satisfaction surveys revealed that more than 98% of DEP participants indicated the highest level of satisfaction with the care they received (4 on a 4-point Likert scale) in their answers to all 4 questions pertaining to service delivery posed after each visit with the CHW.

DISCUSSION

Results from the first 18 months of the DEP demonstrated the value of integrating a CHW-led diabetes self-management education program for low-income, historically underserved, Hispanic patients with diabetes into a health care delivery system. We successfully implemented this model of care coordination, based on the CoDE™ pilot program, in 5 community clinics, providing patients with a structured, systematic approach to managing diabetes. Similar to the findings observed with CoDE™, DEP patients achieved significant improvements in the primary outcome measure, glycemic control (HbA_{1c}). The mean HbA_{1c} for DEP patients decreased from 8.7% at baseline to 7.4%, approaching the ADA's guide-

line of HbA_{1c} level less than 7%, the point at which risk of diabetes-related comorbidities is believed to be significantly reduced.²⁵ These findings indicate that this CHW-led model of care is an effective model for diabetes management and can be successfully replicated in clinics serving low-income, Hispanic populations.

The finding that baseline HbA_{1c} levels were significantly associated with the decrease in HbA_{1c} from baseline is not unexpected because patients who had better control of their diabetes from the beginning of the study did not need significant reductions in HbA_{1c} to meet the ADA guideline of HbA_{1c} level less than 7%. The observation that the change in HbA_{1c} was greater for patients who enrolled in the program at a later date suggests that the CHWs became better at delivering the DEP intervention over time. A number of factors may explain why the number of visits with the CHW was not significantly associated with HbA_{1c} reduction. Improved access to medications and understanding of the importance of medication adherence may have been the greatest contributor to observed decreases in HbA_{1c} levels from baseline. Patients who attended more visits with the CHW may have done so because they had a more difficult time managing their diabetes. The fact that age, sex, ethnicity, and clinic were not significantly associated with changes in mean HbA_{1c} levels from baseline indicate that the program was equally effective for all patients, even those who were not Hispanic, and at different clinic sites across Dallas. Patients also reported a high level of satisfaction with the care they received, indicating that the DEP met their health needs.

Although many interventions utilizing CHWs have been linked to improved health outcomes, questions remain regarding how to best incorporate the CHW into a health care delivery team to optimize delivery of care.^{19,20} Few studies have provided guidance for the implementation of CHW-led interventions or described the support, training, and resources that should be provided to CHWs to maximize the success of the intervention.¹⁹

We designed the DEP to be responsive to previously identified patient-reported needs for CHW interventions (education, communication and respect, removal of financial constraints, and access to medication and transportation)²⁶ by (1) placing an emphasis on CHW recruitment and training; (2) building on existing community infrastructure through partnerships with local clinics; (3) integrating the CHW role within a health care system's care coordination strategy; and (4) developing an electronic diabetes registry that tracked patient metrics and facilitated communication between CHWs and primary care clinicians.

Community health worker recruitment and training

Because the crux of CHW-led interventions centers on the interaction between the CHW and the patient, the hiring of the right people to fill CHW roles is crucial to the success of these programs.¹⁶ Patients with chronic disease have reported that they need to better understand their condition in order to appropriately manage it and that CHWs need to be effective communicators and respectful of the patient.²⁷ The DEP leadership sought to meet these patient needs through focused recruitment of CHWs within the targeted communities and extensive team-based training. We recruited individuals who had excellent interpersonal skills, the ability to work independently, and an aptitude for learning about chronic disease management.

A prime function of CHWs is to educate patients about diabetes and other health issues. Thus, it was important that CHWs be educated in a manner that would provide them with the appropriate level of knowledge and the ability to confidently and accurately relay health information to patients. Studies have shown that standardized education for CHWs is important to CHW acceptance, use, and professional development²⁷ and that adequate training enhances CHWs' competence, confidence, and overall contribution.²⁸ Texas is one of the few states requiring certification (or 1000 hours of previous experience) for CHWs who receive

compensation. We required all CHWs to complete the Texas State Certification program as a group. This training provided them with a uniform foundation necessary to perform daily tasks, including skills in communication, relationship building, service coordination, advocacy, teaching, and organization, as well as a knowledge base in health education. The interactive workshop format engaged the CHWs in problem solving for likely patient scenarios. The CHWs received an additional 50 hours of training specific to DEP implementation and were taught about diabetes-specific self-management knowledge as if they were patients. Our preliminary results indicate that this education strategy enabled each CHW to effectively transfer diabetes self-management knowledge to DEP enrollees while monitoring blood glucose level, blood pressure, BMI, and self-management behavior adherence.

Continuing education is important in sustaining and enhancing CHW knowledge and performance. Patients who enrolled in the DEP at a later date experienced a greater reduction in HbA_{1c} on average than patients who enrolled at earlier dates. We believe that this observation is due to the steep learning curve the CHWs experienced in translating knowledge gained from formal training to the delivery of patient care. We provided CHWs with on-the-job training through continuous monitoring and feedback as well as structured education. During biweekly CHW-management team meetings, CHWs exchanged information about patient and program challenges, received feedback from DEP management, and developed solutions. The DEP management team continuously monitored the CHWs' performance through patient satisfaction surveys providing feedback to the CHWs' about good performance or areas for improvement. Although the state of Texas requires CHWs to complete 20 hours of continuing education every 2 years to maintain certification, we provided the CHWs with 35 hours of continuing education in the first year. Community health workers who are hired in the future will be required to shadow experienced CHWs as part of their initial

training because we have found that there is no substitute for real-world experience.

Building on existing community infrastructure

By embedding the DEP program within community charity clinics, the BHCS used the existing community-based health care infrastructure to remove barriers to care for underserved patients while enhancing the effectiveness of the DEP. Utilizing this community “hub” strategy, the DEP was able to build on existing programs that reduced financial barriers to care related to co-pays, transportation, and access to low-cost prescriptions. BHCS could also leverage the trust that the charity clinics and clinicians had previously established with the targeted minority communities. Patient trust in the CHWs was demonstrated by the willingness of patients to discuss health and other personal concerns with CHWs such as self-management adherence, health care costs, disease control, food security, depression, and anxiety. This open communication allowed the CHW to work with the patient and family to identify and overcome barriers to achieving diabetes control and enhanced the effectiveness of the DEP intervention.

Integrating the CHW’s role within a health care system’s care coordination strategy

Implementation of the DEP involved a system-level transformation and demonstrated how the role of CHWs can be effectively integrated within the ambulatory care component of a health care system. By enhancing the role of CHWs to include the delivery of diabetes education and chronic disease management, in addition to the traditional role of CHWs of providing culturally sensitive health information and social support, the DEP empowered CHWs with the ability to provide diabetic patients with timely, efficient, and coordinated care. Expanding the role of CHWs required a structured system of management and support. While the CHWs were embedded within the

administrative and clinical leadership infrastructure of 5 local charity clinics, BHCS also provided centralized management for the DEP with a supervising nurse manager for daily oversight. The CHWs were encouraged to take ownership of the project and their patients; however, the DEP program management team and clinic providers provided support for social and clinical situations that were beyond the CHWs’ capabilities and training.

True integration of CHWs into a health care delivery system required changing the organizational culture to recognize and integrate CHWs as members of the primary health care team. In an assessment of CHWs working to provide chronic disease care management, Keller et al¹⁹ found that CHWs were often invisible to clinical providers, as most providers did not recognize the CHWs’ ability to provide diabetes self-management support. In addition, in their study, all communications from the CHWs had to be filtered through a diabetes educator, creating large gaps between the work of the clinicians and the CHWs. Recognizing the importance of effective integration of the CHWs into the delivery of diabetes care, we took proactive measures to build relationships between the CHWs and clinic staff, establishing the CHW as a member of each clinic’s primary care team. To accomplish this, we scheduled monthly meetings between the clinic leadership, DEP manager, and CHWs for the first 12 months after program launch to discuss DEP processes and preliminary outcomes. We also facilitated communication between CHWs and clinicians by providing CHWs with a predefined process and go-to person for clinical questions. In addition, the CHWs provided standardized written, visit summaries to the primary care provider within 24 hours of a patient’s visit. These reports facilitated coordination of patient care by providing the primary care physician with additional information about the patient’s condition and alerts about health issues that needed to be addressed during the next office visit.

Providers initially utilized CHWs because there was a lack of available diabetes

education services for their patients. However, over time, they grew to embrace the unique value of a CHW. This learning curve likely could have been shortened by engaging the clinicians in the monthly clinic-DEP meetings and using different communication strategies to familiarize them with the role of CHWs during project implementation. The CHWs noted that their perceived value was enhanced when they had direct interaction with providers and could work directly with clinicians to address patient situations that required physician expertise. Communicating guidelines concerning scope of practice, the evidence base for the program, and support systems for the CHWs created a level of comfort with clinicians and clinic administrators. Ultimately, patient feedback and documented improvements in patient outcomes have led clinicians and administrators to realize the unique value of CHWs.

Developing an electronic diabetes registry

Supporting technology in the form of the DiaWEB chronic disease management software was key to the successful integration of the DEP into clinic operations because it provided a means to collect and monitor patient clinical indicators, guide the CHW through the patient visit, and evaluate the effectiveness of the DEP. The software enabled the CHWs to view trends in clinical indicators such as HbA_{1c} and blood pressure and to monitor the patient's receipt of preventive services. DiaWEB was structured to guide the CHW's visit-specific patient interaction, with key decision points clearly identified for when the CHW would seek assistance from her nurse manager or the patient's primary care physician. This feature gave the CHWs the confidence to work independently when appropriate and the necessary decision support to know when to engage other members of the care team. Through DiaWEB-enabled data collection, the management team had the ability to evaluate the overall effectiveness of the DEP and individual CHWs in improving

diabetes clinical indicators and outcomes for all participants and to identify areas for opportunities for improvement. We believe that the use of DiaWEB fostered clinic and physician acceptance and utilization of the DEP as it generated additional data that was helpful in treating patients, provided reassurance that the CHWs would seek clinician input for the management of patients when appropriate, and allowed them to observe improvements in patient outcomes through summary reports.

CONCLUSION

The DEP is a low-cost, high-quality model for the delivery of patient care to underserved populations that blends care coordination services and disease-specific patient education for patients. The model was constructed by applying lessons learned from previous studies on the effectiveness of CHW-led diabetes education programs for low-income, chronically ill patients.^{22,23} We have refined the DEP on an ongoing basis on the basis of feedback from CHWs and program staff and analyses of participant outcomes. The implementation of the DEP was successful because it featured an evidence-based, team-oriented, patient-centered approach to care. The CHWs were integrated into the health care team and empowered through ongoing training and support. Systems such as a diabetes registry, patient satisfaction surveys, and dashboards were used for tracking and reporting of outcomes and to ensure accountability. The program was mission rather than task oriented and allowed for the tailoring of treatment protocols to meet individual patient needs.

Outcome data from the first 18 months of the DEP indicate that a CHW-led diabetes management program for uninsured Hispanic patients with uncontrolled diabetes can help patients achieve improvements in glycemic control (HbA_{1c}) while achieving superior patient satisfaction. BHCS's successful adaptation of the CoDE™ pilot program has

provided an affordable strategy for expanding chronic disease self-management education and care coordination principles to underserved communities and substantively increased its capacity to reduce diabetes health disparities. This research has important policy implications for the design of programs to improve diabetes management in underserved populations. The DEP's program performance over the first 18 months suggests that its long-term value proposition resides in the fact that CHWs can help patients who have been unable to manage their diabetes with usual care achieve sustainable diabetes control. The initial success of the DEP and of similar projects that have utilized a CHW to coordinate care and provide chronic disease management in underserved populations provides a strong case for the use of this model as a means to augment the traditional treatment of chronic disease. The results of this study were consistent across 5 collaborating charity clinic sites throughout Dallas with similar demographics, indicating that these results may be generalizable to similar populations in other cities. The need for new care models has been recognized by health care providers and policy makers alike because current health care delivery models cannot combat the rising prevalence of chronic diseases such as di-

abetes or the disparities in health care access and outcomes faced by some populations.

This study does have several limitations. It is an observational study and there is no control group. The statistical analysis was conducted using a limited data set of outcome variables gathered during the first 18 months of a 5-year project for the purpose of a program evaluation. All patients with 2 or more visits with the CHW were included in the analysis even if they had less than a year's worth of follow-up data. The true impact of the DEP program on improving patient care and health outcomes will not be evident until we collect data from additional program participants over time and analyze additional process and outcome measures. However, we believe that the lessons we have learned to date from the program implementation are important and should inform the development of new CHW-led interventions. BHCS's successful implementation of the DEP in Dallas communities provides a viable roadmap for reducing health disparities and achieving a high-performing health care delivery system. New delivery-of-care models such as the DEP that use CHWs to provide care coordination have the ability to transform health care and improve outcomes for patients with chronic conditions other than diabetes.

REFERENCES

- Centers for Disease Control and Prevention. *National Diabetes Fact Sheet, 2011*. Atlanta, GA: US Department of Health & Human Services, Centers for Disease Control and Prevention; 2011.
- Texas Diabetes Council, Texas Department of State Health Services. *Diabetes: A Comprehensive Approach*. Austin, TX: Texas Diabetes Council, Texas Department of State Health Services; 2010-2011. Publication E45-10524.
- Spencer MS, Kieffer EC, Sinco BR, et al. Diabetes-specific emotional distress among African Americans and Hispanics with type 2 diabetes. *J Health Care Poor Underserved*. 2006;17(2)(suppl):88-105.
- 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.
- Sequist TD, Fitzmaurice GM, Marshall R, Shaykevich S, Safran DG, Ayanian JZ. Physician performance and racial disparities in diabetes mellitus care. *Arch Intern Med*. 2008;168(11):1145-1151.
- Coberley CR, Puckrein GA, Dobbs AC, McGinnis MA, Coberley SS, Shurney DW. Effectiveness of disease management programs on improving diabetes care for individuals in health-disparate areas. *Dis Manag*. 2007;10(3):147-155.
- Davis KL, O'Toole ML, Brownson CA, Llanos P, Fisher EB. Teaching how, not what: the contributions of community health workers to diabetes self-management. *Diabetes Educ*. 2007;33(suppl 6):208S-215S.
- Heisler M, Spencer M, Forman J, et al. Participants' assessments of the effects of a community health worker intervention on their diabetes

- self-management and interactions with healthcare providers. *Am J Prev Med.* 2009;37(6)(suppl 1):S270-S279.
9. Collins KS. *Diverse Communities, Common Concerns: Assessing Health Care Quality for Minority Americans* New York, NY: *Findings from the Commonwealth Fund 2001 Health Care Quality Survey.* the Commonwealth Fund; 2002.
 10. Cooper-Patrick L, Gallo JJ, Gonzales JJ, et al. Race, gender, and partnership in the patient-physician relationship. *JAMA.* 1999;282(6):583-589.
 11. Thompson JR, Horton C, Flores C. Advancing diabetes self-management in the Mexican American population: a community health worker model in a primary care setting. *Diabetes Educ.* 2007;33(suppl 6):159S-165S.
 12. Reinschmidt KM, Hunter JB, Fernandez ML, Lacy-Martinez CR, Guernsey de Zapien J, Meister J. Understanding the success of *promotoras* in increasing chronic diseases screening. *J Health Care Poor Underserved.* 2006;17(2):256-264.
 13. Gavin JR III, Wright EE Jr. Building cultural competency for improved diabetes care: African Americans and diabetes. *J Fam Pract.* 2007;56(9)(suppl):S22-S28.
 14. Brown SA, Blozis SA, Kouzekanani K, Garcia AA, Winchell M, Hanis CL. Health beliefs of Mexican Americans with type 2 diabetes: the Starr County border health initiative. *Diabetes Educ.* 2007;33(2):300-308.
 15. Glazier RH, Bajcar J, Kennie NR, Willson K. A systematic review of interventions to improve diabetes care in socially disadvantaged populations. *Diabetes Care.* 2006;29(7):1675-1688.
 16. McElmurry BJ, McCreary LL, Park CG, et al. Implementation, outcomes, and lessons learned from a collaborative primary health care program to improve diabetes care among urban Latino populations. *Health Promot Pract.* 2009;10(2):293-302.
 17. Volkman K, Castanares T. Clinical community health workers: linchpin of the medical home. *J Ambul Care Manage.* 2011;34(3):221-233.
 18. Brownstein JN, Hirsch GR, Rosenthal EL, Rush CH. Community health workers "101" for primary care providers and other stakeholders in health care systems. *J Ambul Care Manage.* 2011;34(3):210-220.
 19. Keller T, Borges WJ, Hoke MM, Radasa T. *Promotores* and the chronic care model: an organizational assessment. *J Community Health Nurs.* 2011;28(2):70-80.
 20. Swider SM, Martin M, Lynas C, Rothschild S. Project MATCH: training for a *promotora* intervention. *Diabetes Educ.* 2010;36(1):98-108.
 21. Rosenthal EL, Wiggins N, Ingram M, Mayfield-Johnson S, De Zapien JG. Community health workers then and now: an overview of national studies aimed at defining the field. *J Ambul Care Manage.* 2011;34(3):247-259.
 22. Culica D, Walton JW, Prezio EA. CoDE: community diabetes education for uninsured Mexican Americans. *Proc (Bayl Univ Med Cent).* 2007;20(2):111-117.
 23. Culica D, Walton JW, Harker K, Prezio EA. Effectiveness of a community health worker as sole diabetes educator: comparison of CoDE with similar culturally appropriate interventions. *J Health Care Poor Underserved.* 2008;19(4):1076-1095.
 24. Knowles M. *The Adult Learner: A Neglected Species.* 3rd ed. Houston, TX: Gulf Publishing; 1984.
 25. The Diabetes Control and Complications Trial Research Group. The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. *N Engl J Med.* 1993;329(14):977-986.
 26. Gimpel N, Marcee A, Kennedy K, Walton J, Lee S, DeHaven MJ. Patient perceptions of a community-based care coordination system. *Health Promot Pract.* 2010;11(2):173-181.
 27. Love MB, Legion V, Shim JK, Tsai C, Quijano V, Davis C. CHWs get credit: a 10-year history of the first college-credit certificate for community health workers in the United States. *Health Promot Pract.* 2004;5(4):418-428.
 28. Jackson EJ, Parks CP. Recruitment and training issues from selected lay health advisor programs among African Americans: a 20-year perspective. *Health Educ Behav.* 1997;24(4):418-431.