A Patient-Centric, Provider-Assisted Diabetes Telehealth Self-management Intervention for Urban Minorities

by Ernest L. Carter, MD, PhD; Gail Nunlee-Bland, MD, FACE, FAAP; and Clive Callender, MD, FACS

Abstract

This article describes the design and implementation of an online diabetes self-management intervention for a sample of inner-city African Americans with diabetes. Study participants were randomly assigned to the treatment (26) and control (21) conditions. The results indicate that treatment group participants were more likely to achieve positive outcomes in terms of lowered hemoglobin A1c and body mass index measurements than were control group members. These findings support the development of telehealth interventions to promote effective chronic disease management in medically underserved communities.

Keywords: diabetes, self-management, telehealth

Introduction

Minority Americans, particularly African Americans, are at increased risk for contracting type 2 diabetes, which if not managed correctly can lead to organ failure and the need for transplantation. However, African Americans, particularly inner-city residents, are likely to be medically underserved and hence without access to constant provider monitoring. Currently, most diabetic patients are treated in a healthcare provider's office with little or no self-management education or provider interaction between visits. It can be costly and time consuming for healthcare practitioners to provide the necessary education and intervisit availability. A provider-assisted, patient self-management telehealth intervention could create access to quality monitoring for the medically underserved and lead to improved patient outcomes including an overall reduction in organ transplants. This article describes the design, implementation, and outcomes of a pilot self-management intervention targeting urban African Americans with type 2 diabetes.

Background

According to Centers for Disease Control estimates for 2007, the latest data available, 7.8 percent of the US population, or 23.6 million persons, had diabetes, with the vast majority of them having type 2 diabetes.[1] African Americans are particularly at risk for developing type 2 diabetes, with 11.8 percent of

African Americans having the disease in 2007 as compared to the overall national rate of 7.7 percent.[2] The rate of diabetes in Washington, DC, is 14.1 percent.[3]

Diabetes self-management has long been recognized as the cornerstone of care for individuals with diabetes.[4] A study of the long-term effects of self-management education for patients with type 2 diabetes found that self-management was effective in improving glycemic control and in delaying the need for insulin therapy. The study also found that regular reinforcement improved the effectiveness of self-management education.[5]

Effective chronic disease management seeks not only to reduce costs but also to maintain quality care. The American Diabetes Association estimated the annual economic cost of treating diabetes to be $174 billion in 2007.[6] This cost arises partly due to the lack of coordinated care among the various providers involved in treating persons with diabetes. Providers' inability to manage and/or share vital information has hampered the effective management of the disease and often results in minimal involvement of patients in the decision making surrounding their condition. Studies have found that the use of community-based telehealth kiosks and clinician-supported patient self-management reduces overall care costs by improving care coordination and reducing service delivery time.[7, 8] Giving providers ready access to up-to-date patient information facilitates risk management, timely referrals, and coordinated care—practices that also reduce costs.[9]

The present study tested a coordinated service delivery model that integrates seamless provider-patient communication with patient self-management and health education in a format that can be easily monitored. The main research question was whether a sample of low-income, urban African Americans with diabetes who had access to an online diabetes self-management intervention would achieve better patient outcomes in terms of hemoglobin A1c, blood pressure, and body mass index (BMI) measures than a sample of African Americans with diabetes who did not have such access.

Methods

Selection of Sites and Subjects

We selected Washington, DC, as the target community because the team members are headquartered there and have linkages to the medical community that facilitated community buy-in for the project as well as participant recruitment.

To be eligible for participation, patients had to have been diagnosed with type 2 diabetes at least two years prior to the start of the study based upon a positive reading on any of the following three tests, followed by a second positive test on a different day:
- Fasting plasma glucose equal to or greater than 126 mg/dl with symptoms of diabetes;
- Casual plasma glucose (taken at any time of the day) equal to or greater than 200 mg/dl with symptoms of diabetes; or
- Oral glucose tolerance test (OGTT) value equal to or greater than 200 mg/dl, measured at a two-hour interval. The OGTT is given over a three-hour time span.

Inclusion criteria for patient participants were as follows:
- Having a diagnosis of type 2 diabetes,
- Being age 18 years or older,
- Residing in the target area,
- Having a primary care physician willing to participate in the project or being willing to be assigned to a participating primary care physician in their community,
- Being African American, and
- Having the ability to read at an eighth grade level or higher.

Only persons with type 2 diabetes were eligible for participation because of the importance of diet and exercise when taking type 2 diabetes oral medications. Women with gestational diabetes (as

diagnosed by a 50 gram glucose screening test or other) were not be eligible to participate because the condition may not be chronic. We required an eighth grade literacy level because the intervention was delivered online and required users to have basic reading skills in order to use it effectively. We focused exclusively on African Americans because they have the highest rate of diabetes among any racial/ethnic group in the country. We reasoned that it would be best to focus on this group first and see if the proposed intervention is effective for them before branching out to other groups.

Persons who met any of the following criteria were excluded from the study:
- Non–African American;
- No diagnosis of type 2 diabetes;
- Illiteracy or inability to read at an eighth grade reading level;
- Visually or hearing impaired;
- Non-English-speaking;
- Dialysis requiring (excluded because their disease is too far advanced for them to benefit from the proposed diabetes self-management program); and
- Reliance on psychotropic medication (excluded because their mental illness could lead to behavioral issues relative to treatment adherence that are beyond the scope of the proposed diabetes self-management program).

Procedures

We recruited diabetic patients from one primary care practice in Washington, DC. After briefing interested persons on the study, assessing their literacy level with a brief test, and obtaining signed informed consent, we randomly assigned the patients to the treatment or the control group, using a random-numbers table. We then collected baseline biometric data (height, weight, blood pressure, and hemoglobin A1c) and obtained responses to a brief participant survey of health knowledge, attitudes, behaviors, and practices relative to diabetes as well as demographic information and self-perceived physical and mental health status. We readministered the survey at the conclusion of the nine-month enrollment period just before the patient exited the project.

We then made an appointment for a home visit with each participant in the treatment group. During the visit, the project staff provided each participant with a laptop equipped with peripherals (a wireless scale, a blood pressure cuff, and a glucometer) to measure weight, blood pressure, and glucose, respectively. We instructed the participant on how to use these devices, which automatically transmitted patient data to the patient's health record. Participants were required to use the peripherals to weigh themselves and check their blood pressure weekly and to monitor their blood glucose three times per day. We also provided participants with instructions on how to go online to access the portal and how to use the camera attached to the laptop for video conferencing with the project's telehealth nurse. Upon accessing the portal, patients encountered the following modules:

- A **self-management module** that housed the patient's health record and included the patient's culturally competent action plan based on the treatment plan provided by the patient's healthcare provider, the evidence-based literature, and the patient's individual needs and preferences. The project's telehealth nurse worked with the patient to develop the action plan during the biweekly 30-minute video conferences. The nurse structured the content of the interaction based on the project's curriculum. The interaction began with the nurse reviewing the patient's most recently uploaded biometric data while the patient viewed a 10-minute self-management video or read health education material housed on the portal. Then the nurse and the patient discussed the data and behavior-change strategies needed to maintain or change patient outcomes and support progress toward patient goals. During this portion of the video conference, patients typically raised questions or mentioned problems or challenges in managing their disease (e.g., medication side effects), and the nurse provided guidance based on the patient's data and verbal feedback. The nurse then updated and transmitted a summary of the patient's health record data to the electronic health record (EHR) that was accessible to the patient's provider. In turn, the provider was able to transmit updated treatment plans, laboratory results, and other directives via the portal

to the nurse and to the patient, both of whom could access this information via the portal. In the interval between video conferences, patients had the option to review their data (e.g., daily glucose measurements) and use the data to guide their behavior.

- A **health education module** provided the participant with culturally and age-appropriate health education videos, links to health education Web sites, and materials on nutrition, physical activity, stress management, weight loss, and health and wellness in general. Throughout the project, the research team regularly updated this module using lessons learned and culturally competent best practices in diabetes treatment.
- A **social networking module** linked all intervention participants so that they were able to exchange coping strategies, pose questions, and share preferred educational resources or any other information relative to losing weight and adopting a healthy lifestyle.

Members of the control group did not have any access to the online portal or any interaction with the telehealth nurse. Throughout the course of the study they received the standard of care from their providers.

Analytical Techniques

Study data came from four sources—responses to the baseline and endpoint patient surveys; treatment group biometric data that were uploaded via the portal on a daily basis; control group biometric data collected from providers; and qualitative in-depth interviews conducted with a random sample of half (13) of the treatment group participants. Quantitative data were entered and analyzed using SPSS. We used Atlas.ti to analyze the qualitative data. Data from the two sites were merged using the SPSS version 17.0 databases. SPSS was then used to construct the variables and perform the univariate and correlational analyses outlined below.

Results

We recruited 74 patients but lost roughly a third to attrition, leaving a sample of 47, with 26 in the treatment group and 21 in the control group. As shown in Table 1, the majority of the participants were female.

All participants were African American, and the median age of the sample was 56, with the oldest participant being 74 and the youngest being 36. The majority of the sample (66 percent) earned between $25,000 and $50,000 annually. A similar proportion (60 percent) had graduated from high school; 25 percent had attended some high school; and 15 percent had attended some college. As shown in Table 1 and Table 2, the analysis did not identify any significant differences ($p > .05$) between the treatment and control groups relative to age, socioeconomic status, or educational attainment. Also, no significant differences were observed in baseline disease status, as measured by hemoglobin A1c measures, BMI, and blood pressure reading; diabetes knowledge; or self-reported self-management behavior and practices, such as healthy eating and engaging in physical activity ($p < .001$). The average hemoglobin A1c reading for the sample at baseline was 8.9, the average blood pressure was 147/88, and the average BMI was 35.8.

Table 2 presents the health outcomes achieved by the study participants. The primary dependent variable in our study was having hemoglobin A1c measure of 7 percent or below during the last month or longer of enrollment. The secondary dependent variables were having blood pressure less than 130/80 during the last month or longer of enrollment and achieving a BMI of between 18.5 and 24.9 during the last month or longer of enrollment. We conducted Pearson chi-square tests to assess the effect of the intervention on each of these variables. As Table 2 indicates, participation in the intervention had a positive effect on hemoglobin A1c measures and BMI outcomes.

The analysis showed a significant association between participation in the intervention and achieving a hemoglobin A1c measure of 7 percent or below, $\chi^2(1) = 5.983$, $p < .05$. Based on the odds ratio, patients were 4.58 times more likely to reach the desired hemoglobin A1c target if they were enrolled in the

intervention. As shown in Table 2, we also found a significant positive relationship between participation in the intervention and achieving a healthy BMI, $\chi^2(1) = 4.058$, $p < .05$. However, no such association was found between being in the treatment group and maintaining blood pressure at 130/80 ($p > .05$).

Patients in the treatment group reported other benefits to participation beyond improved health outcomes. Although we did not measure it quantitatively, these patients often voiced how the intervention allowed them to develop a close relationship with the telehealth nurse, which then facilitated their relationship with their primary care provider. One patient observed, "Nurse is like my friend. I look forward to talking with her and I don't want to miss [that]." Another stated that the intervention had changed her view of healthcare and physician visits. "I used to hate it. I mean hate it because it was always about what I couldn't do but now we [the nurse and the participant] talk about what I can do within the circumstances I have." Many praised the convenience of "healthcare at home." One participant stated: "My vision is bad and then it was a bad winter but having the nurse through the computer well I didn't have to go nowhere to get the care and advice I need." Others appreciated being able to spend half an hour twice a month with a skilled provider discussing their health. "I would never have all that time with my doctor. Never. Ten minutes and I'm out."

Although some reported that they were initially apprehensive about the using the Internet, thanks to the home visit tutorial conducted by the project staff and to the social networking module that allowed participants to connect with each other, the majority of the participants interviewed reported no major difficulties in using the intervention. From an implementation standpoint, the greatest challenge the project team had was establishing broadband connections for some of the participants. In some neighborhoods in the target cities, we discovered dead zones where broadband access is limited or impossible. We were able to work around this problem by equipping the laptops with wireless broadband cards.

As noted in Table 2, at the conclusion of the study, treatment group participants reported increased knowledge of diabetes and improved adherence to sound diabetes management practices such as regular feet checks ($p < .05$). The quantitative analytical findings may be understood in light of how treatment group members said their behavior has changed as a result of their participation. Several who were interviewed noted that they were more regular in keeping doctor's appointments as they now understood the importance of physicals and checkups. The comments of one participant illustrate this point: "I'm 200 percent better. Before [participating], I only went [to the doctor] if I ran out of drugs and the doctor stopped my refills then I would go in to see him." Other patients reported becoming very disciplined about checking their blood glucose levels. One female participant admitted that prior to participation she never checked her blood glucose levels, but now she does so at least twice daily. Overall, as shown in Table 2, patients in the treatment group reported feeling better mentally and physically, $\chi^2(1) = 6.1823$, $p < .05$, than those in the control group. They also stated that their ability to take charge of their health had been enhanced by their participation, $\chi^2(1) = 5.362$, $p < .05$.

Discussion

Implications

The project demonstrated that it is possible to design and deliver an effective telehealth intervention for African Americans with diabetes who live in the inner city. This population is often underserved and for a variety of reasons escapes regular monitoring of chronic conditions. The online intervention increased the accessibility of services and created a patient-provider partnership that endured for nine months, left patients feeling empowered to take charge of their health, and led to improved patient outcomes. Some challenges were encountered in connecting patients to the Internet, and there were costs in providing each patient with a laptop and Internet access.

Limitations

The sample is relatively small and is skewed toward an older, predominantly female population. Data were insufficient to explore whether those who dropped out of the study differed greatly from those who remained. Furthermore, the study was restricted to participants with an eighth grade or higher reading

level. However, this level of educational attainment may not be present in some of the lowest socioeconomic strata and among the oldest African Americans, whose opportunities to attend school may have been limited. Future studies need to explore the acceptability and the effectiveness of this intervention for younger and male patients.

Future Research

Future research should explore the effect of this intervention on care coordination by collecting data from patients' primary care providers on their use of the portal, the type of information they exchange, and the size of the provider network in which patient information is exchanged. Also, a cost-benefit analysis of the intervention would illustrate its potential viability as a complement to the existing health system that would be attractive to third-party payers.

Conclusion

The study found that the online diabetes self-management portal complemented by biweekly virtual visits with a nurse enabled 26 African Americans with diabetes to improve their health outcomes and assume more responsibility for their health. Future research should address the impact of this intervention on providers and on treatment costs. Additional study on the nature and extent of patient data exchange via the online portal is also warranted.

Ernest L. Carter, MD, PhD, is an adjunct professor at Howard University Hospital in Washington, DC.

Gail Nunlee-Bland, MD, FACE, FAAP, is an associate professor of pediatrics and medicine at Howard University Hospital in Washington, DC.

Clive Callender, MD, FACS, is a professor of surgery at Howard University Hospital in Washington, DC.

Notes

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Table 1

Characteristics of the Sample

	Treatment (N = 26)	Control (N = 21)
Gender		
Female	18	12
Male	8	9
Mean age	52	49
Education[a]		
Less than high school	23%	29%
High school graduate	62%	57%
Some college	15%	14%
Annual income		
Less than $25,000	12%	14%
$25,000–50,000	65%	67%
Greater than $50,000	23%	19%
Marital status		
Married/in a partnership	67%	72%
Single/not in a partnership	33%	28%
Mean height (inches)	66.5	65.2

[a]Participants were required to have an eighth grade reading level or above.

Table 2

Health Outcomes for the Treatment and Control Groups

	Treatment		Control	
	Baseline	**Endpoint**	**Baseline**	**Endpoint**
Mean weight (pounds)*	222.7	149.7	218.3	160.2
Mean BMI*	35.4	23.8	36.1	26.5
Mean blood pressure	146/90	139/75	148/86	140/72
Mean hemoglobin A1c*	9.0	6.82	8.8	7.9
Score of 80 percent or higher on diabetes knowledge scale*	50%	92%	57%	76%
Score of 80 percent or higher on diabetes management practices scale*	46%	92%	38%	81%
Score of 80 percent or higher on healthy eating scale	81%	100%	76%	95%
Score of 80 percent or higher on physical activity scale	45%	69%	48%	66%
Positive self-perceived physical health status*	62%	89%	66%	79%
Positive self-perceived mental health status*	75%	89%	81%	76%

*$p < .05$