# Augmenting Telemonitoring Interventions by Targeting Patient Needs in a Primarily Hispanic Underserved Population

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Underserved Hispanic patients are particularly vulnerable to problems associated with controlling diabetes. Hispanics not only are more susceptible to developing diabetes, but also have higher A1C values (1) and more severe diabetes-related complications. Hispanic Americans are 2.6 times more likely to start treatment for diabetes-related end-stage renal disease and have a 50% higher mortality rate than non-Hispanic whites (2). According to the Hispanic Community Health Study/Study of Latinos, the prevalence of diabetes in the United States is 10.2% in South Americans, 13.4% in Cubans, 17.7% in Central Americans, 18% in Puerto Ricans and Dominicans, and 18.3% in Mexicans (3). Total yearly costs in 2010 for Hispanics with diabetes totaled $49.8 billion and are estimated to reach $109.9 billion in 2025 because of an expected 111% increase in diabetes cases (4).

Many diabetes patients, including Hispanics, are overwhelmed by the high treatment burden of self-care demands (5). A retail pharmacy survey of individuals in five states found that many individuals with diabetes lack a focused management plan and may also be confused about specific health care issues (6).

One particular obstacle is nonadherence to diabetes treatments. Hispanic patients have exhibited nonadherence behaviors related to their diabetes treatment, including medication nonadherence (7,8). Nonadherence is very costly (9), and savings of $5 billion annually are possible with improved medication adherence on the part of non-Hispanic and Hispanic patients alike. This could result in 341,000 fewer hospitalizations and 700,000 fewer emergency room visits (10).

One tactic to mitigate nonadherence has been to involve pharmacists in diabetes management, particularly in primary care settings, where diabetes is a common diagnosis (11). Studies demonstrating the benefit of pharmacists in diabetes care and of their expertise in medication management highlight their importance as interdisciplinary team members (12–17). Including pharmacists in team-based health care delivery models and increasing their role in primary care service delivery have been strongly suggested (11).

Although pharmacists use various strategies to provide diabetes management, one unique tool is telemonitoring, a technology through which patients receive specific recommendations after transmitting health data electronically to providers in another location (18). Studies detailing pharmacists' roles in telemonitoring patients with diabetes and hypertension demonstrate favorable outcomes (12,19–23).

## Objectives

The aim of this study was to identify and describe, in a post-hoc manner, the strategies used to augment patient education during a 6-month tele-

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monitoring intervention. Although patients received daily education messages via telemonitoring, those messages were intentionally brief. The rationale for brevity was to prevent patients from feeling inconvenienced by lengthy messages and to ensure that patients would not stop participating in telemonitoring because of the time required to receive electronic education messages. However, the pharmacist occasionally also called patients to ask whether they had any questions or to address issues regarding out-of-range values or assess lapses in participation in telemonitoring sessions. This article provides a detailed description of the patient education that complemented the telemonitoring program.

## Methods

The methods of telemonitoring have been described elsewhere (12,23). The pharmacist recorded a tally of interventions provided in a post-hoc manner, tabulated the education and information provided to patients, and categorized interventions into discrete categories that represented a logical format. The rationale for the post-hoc evaluation was to highlight behind-the-scenes strategies used to augment and complement the telemonitoring program. During the 6-month program, the pharmacist recognized the phone calls made to patients as an opportunity to provide education and assistance.

### Inclusion/Exclusion Criteria

Specific details regarding study inclusion and exclusion criteria have been described elsewhere (12). Participants were primarily Spanish-speaking individuals with diabetes and/or hypertension and hyperlipidemia, who received medical care at three Community Health Centers (CHCs) in Utah. A bilingual pharmacist provided education in Spanish or English and had a collaborative practice agreement with CHC medical providers for medication management.

### Description of the Telemonitoring Program

The telemonitoring program allowed patients to measure their blood glucose, blood pressure, and weight at home and also delivered brief educational messages. Part of the project plan was to assess two different telemonitoring systems to determine the viability of each. Thus, one of two telemonitoring delivery methods was used: *1*) Authentidate Electronic House Call (EHC) (Authentidate Holding Corp., Berkeley Heights, N.J.), a U.S. Food and Drug Administration–approved remote monitoring device, or *2*) an Interactive Voice Response (IVR) system (Authentidate Holding Corp.), which has been described previously (12,23). A total of 62 patients used the EHC device because it was available from the start in both English and Spanish. However, 13 patients used the IVR system when messages programmed in Spanish became available through that system in the last year of the project. There were no differences between patients using the EHC and those using the IVR system in age, sex, baseline A1C, or baseline blood pressure. As reported previously, decreases in A1C did not differ between the two groups; A1C decreased by 2.08 and 2.02% in the EHC and IVR groups, respectively ($P = 0.532$) (12).

Both telemonitoring systems allowed patients to perform monitoring sessions at home, with clinical data immediately forwarded to a secure website. The pharmacist then retrieved the data from the website.

The pharmacist called participants periodically throughout their tenure in the program. However, there was no set schedule for telephone follow-ups. The number of times patients were called depended in part on whether they were successfully completing sessions; calls were also made to check in with patients in case they had questions. Patients were called to answer questions about the telemonitoring process, medications, and their disease state (clinical aspects of diabetes or hypertension) and to provide further information. The pharmacist called patients in a nonsystematic manner to ask how things were going and then answered questions and provided patient-customized verbal education as needed.

The pharmacist reviewed telemonitoring session data several times daily. If out-of-range prespecified values were posted (low or high blood glucose or blood pressure levels), patients were called to verify the readings. Then patients were instructed to repeat the measurements and, if out-of-range values were verified, they were instructed about how to manage the one-time low or high blood glucose or blood pressure values. When missing entries were noted, the pharmacist directly contacted patients to determine whether they had a technical problem. Thus, there were several reasons patients were contacted during their involvement in the telemonitoring program. The pharmacist noted each time she provided an intervention and maintained a running list of these encounters, without linking them to individual calls or individual patients.

Medication management was also performed after doing reports every 2 weeks and evaluating trends in glucose or blood pressure values to help improve out-of-range blood glucose or blood pressure values that were transmitted during sessions (12).

## Results

The pharmacist tabulated clinical and medication management outcomes. At the end of the study, the pharmacist also performed a qualitative analysis of the interventions and found that interventions fit into three main themes: medication education, interpretation of clinical laboratory values, and disease state education and other problem-solving interventions (e.g., assistance in obtaining medications, supplies, and care when needed).

### *Clinical Outcomes*

A total of 75 patients were enrolled in the telemonitoring program. Patients

**TABLE 1. Baseline Demographics**

| Characteristic | Patients ($n$ = 75) (mean [SD]) |
|---|---|
| Age (years) | 48.28 (10.62) |
| Sex (%) | |
| Female | 49 (65.3) |
| Male | 26 (34.7) |
| Primary language (%) | |
| Spanish | 66 (88.0) |
| English | 9 (12.0) |
| Months evaluated | 7.28 (2.13) |

were middle-aged, mostly female, and primarily Spanish-speaking (Table 1). Clinical outcomes results have been reported previously (12) and are summarized in Table 2. Patients had a mean decrease in A1C of 2.07% ($P$ <0.001). Systolic and diastolic blood pressure decreased significantly by 8.02 ($P$ <0.001) and 2.77 ($P$ = 0.045) mmHg, respectively. Although baseline LDL cholesterol measurements decreased by 10 mg/dL, the change was not significant ($P$ = 0.051).

### *Medication Management Outcomes*

The pharmacist had a collaborative practice agreement to manage medications. A total of 163 changes were made to diabetes, hypertension, and hyperlipidemia medications (Figure 1). More specifically, if glucose values were consistently <70 or >300 mg/dL, the pharmacist worked with patients to adjust medications, particularly insulin. If blood pressure values were consistently higher or lower than 130 mmHg systolic or 80 mmHg diastolic, the pharmacist helped adjust antihypertensive medications. For interim LDL cholesterol values >100 mg/dL, the pharmacist also adjusted antihyperlipidemic agents (12).

Medication management strategies were documented in the eClinicalWorks electronic medical record of the Community Health Centers (eClinicalWorks, LLC, Westborough, Mass.). Overall, 84% ($n$ = 63) of patients had diabetes medication changes, with most modifications to intensify insulin doses. Changes were made to antihypertensive agents in 29.3% of patients, and 16% had changes in antihyperlipidemic agents. These results have been previously reported (12).

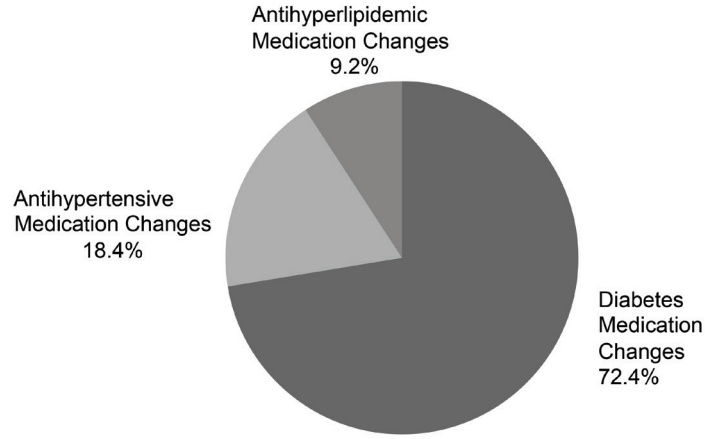


**FIGURE 1**. Medication changes.

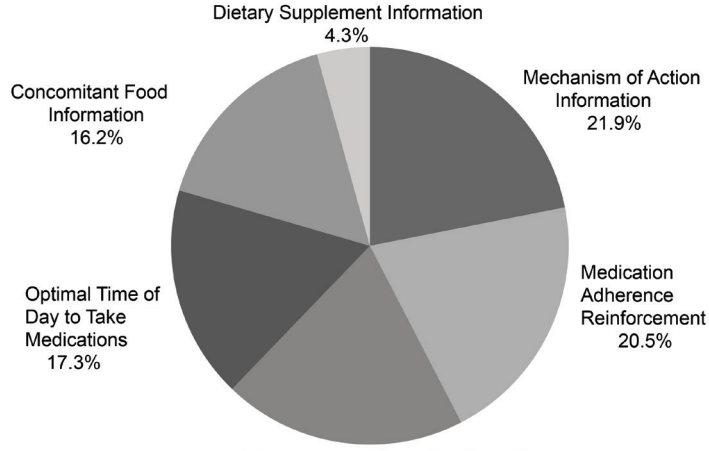


**FIGURE 2**. Medication education.

### *Medication Education Strategies*

One main medication education strategy identified was to enhance patient understanding of the importance of optimal glucose control. Communication was key in establishing rapport with patients to assess their beliefs and attitudes regarding diabetes, diabetes self-management strategies, and medication-taking. It was important to provide medication information and also to rectify erroneous health care beliefs regarding diabetes. A total of 278 medication education interventions were provided to patients (Figure 2).

Education to explain the mechanism of action of the individual medications and the specific role they played was a major part of helping patients understand why they were taking different medications and of explaining that different medications work on different aspects of their disease state. Another important aspect of education was to reinforce medication adherence. For example, several patients stated that they had difficulty with adherence because they felt they were taking too many

medications and were fearful that harm might ensue. Explaining that sometimes several medications are required to manage diabetes helped increase adherence. As previously reported, diabetes and antihypertensive medication adherence improved in the study, as assessed by validated medication adherence scales (12,23). Education about possible side effects and their management was another modality to help patients manage their diseases (e.g., providing information about how to treat hypoglycemia and prevent over-correction). Education was also provided regarding the timing of food with medications. For example, patients were educated about the appropriate timing of prandial insulin with regard to meals and how to adjust prandial doses for extra carbohydrate eaten at meals and were cautioned to avoid skipping or delaying meals if they were taking a sulfonylurea. Education was also provided to optimize the time of day to take diabetes medications and antihypertensive agents. Specific examples included emphasizing not injecting prandial insulin too late at night, making sure diuretic agents were taken during the day and not at night, and emphasizing that other medications (such as certain statins) should be taken in the evening.

Hispanic patients commonly use various supplements along with traditional medications (24). Thus, it was no surprise that many patients had questions about dietary supplements for diabetes. Patients had questions and received education about products such as sábila (aloe vera), canela (cinnamon), linasa (flaxseed), nopal (prickly pear cactus), and chia.

### *Interpretation of Clinical Values and Disease State Education*

The pharmacist also provided education to enhance patients' understanding of disease states (i.e., diabetes, hypertension, and hyperlipidemia). A total of 171 such interventions were provided. These included interpretation of blood glucose values, other laboratory values (e.g., lipid values, complete metabolic profile results, or albumin/creatinine ratio), blood pressure, and heart rate. Reinforcement of blood pressure monitoring technique was also provided. Figure 3 provides a breakdown of clinical education provided.

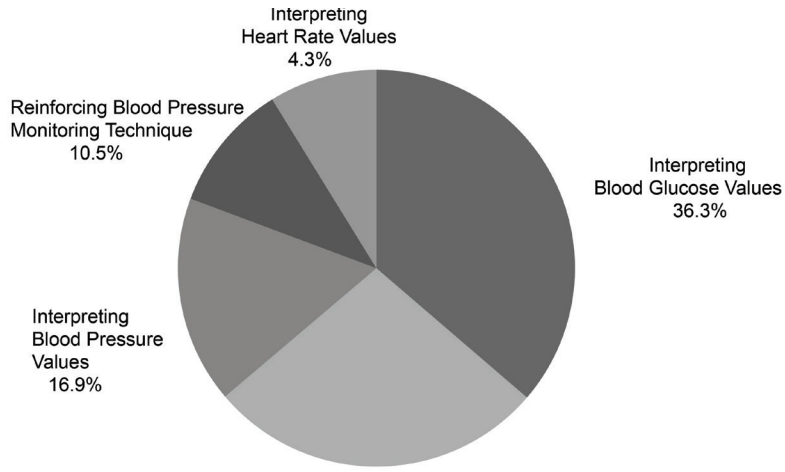


**FIGURE 3**. Clinical education.

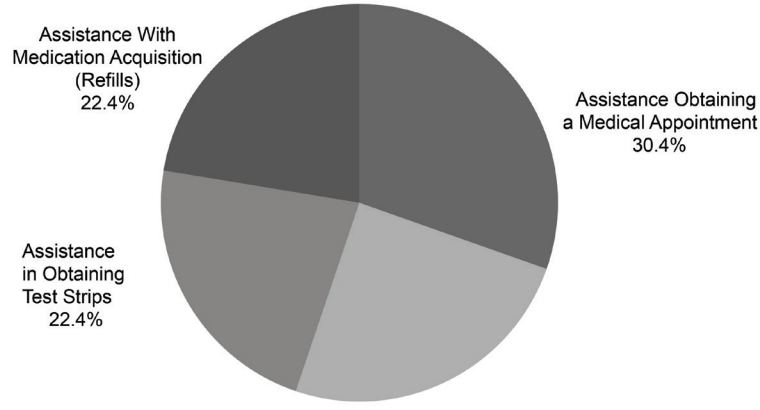


**FIGURE 4**. Problem-solving.

Patients were eager to learn whether their glucose, blood pressure, and heart rate values were too high or low, and this helped them understand the impact of taking medications. They also were receptive to learning whether their lipid levels were appropriate and wanted to better comprehend the lipid panel components. Many also wanted to learn more about other clinical laboratory values. Many said that, often, they had been told, "You are doing fine" or "Your labs are abnormal" but did not understand what this meant and welcomed more detailed explanations.

### *Problem-Solving Strategies*

The pharmacist called patients who were not consistently completing telemonitoring sessions to determine the reason. A total of 41 patients required technical assistance with the EHC or IVR system. However, other issues that required problem-solving strategies also were identified. There were 125 such strategies, including solving medication acquisition issues (i.e., patients had run out of medications and refills were needed), assisting to mitigate medication costs (e.g., by enrolling patients in phar-

**TABLE 2. Comparison of A1C, Blood Pressure, and LDL Cholesterol Values From Baseline to End of Study (12)**

| Parameter | Baseline (mean [SD]) | Study End (mean [SD]) | Change (mean [SD]) | *P* (from baseline) |
|---|---|---|---|---|
| A1C (%) (*n* = 75) | 9.87 (20.6) | 7.80 (1.64) | –2.07 (2.36) | <0.001 |
| Systolic blood pressure (mmHg) (*n* = 72) | 126.20 (17.25) | 118.18 (18.32) | –8.02 (19.74) | <0.001 |
| Diastolic blood pressure mmHg (*n* = 72) | 77.48 (9.44) | 74.70 (10.65) | –2.77 (11.576) | 0.045 |
| LDL cholesterol (mg/dL) (*n* = 47) | 103.63 (38.39) | 93.27 (31.38) | –10.36 (35.20) | 0.051 |

**TABLE 3. Lessons Learned From Patient Comments (of total *n* = 75)**

| Comments | Patients Reporting (*n* [%]) |
|---|---|
| Increased awareness of the importance of medications | 28 (37.3) |
| Learned more about diabetes | 42 (56) |
| Increased awareness of day-to-day blood glucose values | 54 (72) |
| Increased awareness of the impact of illness on blood glucose values | 11 (14.6) |
| Increased awareness of the impact of food on blood glucose values | 45 (60) |
| Increased awareness of day-to-day blood pressure values | 27 (36) |
| Increased awareness of the impact of illness on blood pressure values | 5 (14.6) |

maceutical company assistance programs or finding lower-cost alternatives), helping a patient obtain more affordable test strips (which impeded the patient's ability to check and enter blood glucose values into the telemonitoring system), and assisting in arranging a medical appointment for an illness-related issue (during which the patient did not feel well enough to do the telemonitoring session). These problem-solving strategies are summarized in Figure 4.

### *Additional Lessons Learned From Patients*

As a result of the education strategies employed, other outcomes were noted. These are summarized in Table 3. This information came from exit interviews at discharge from the telemonitoring program; however, responses were not statistically analyzed. Patients were interviewed by the pharmacist and were not asked specific questions; they were simply asked what they learned, and the pharmacist collected and tallied the responses and grouped them into categories.

Patients indicated that they had learned more about diabetes, increased their awareness of day-to-day blood glucose values and blood pressure fluctuations, increased their awareness of the role and importance of medications, as well as of the impact of food, stress, and illness on blood glucose and blood pressure levels. As previously reported, scores measuring diabetes and hypertension knowledge improved (12). Patient activation scores (a measure of patients' confidence to manage their disease state) also improved (12).

At the end of the program, patients were also informally asked questions to evaluate their experiences. Patients were asked if they would recommend telemonitoring to other patients and whether the process was easy to learn. A total of 70 people (93.4%) said they would recommend telemonitoring to others, four were neutral (5.3%), and one (1.3%) said he or she would not recommend it to others. Regarding the ease of learning the technology, 57 (76%) stated that it was easy to learn, and 18 (24%) stated it was not easy to learn.

A total of 97.3% agreed or strongly agreed that telemonitoring was useful to managing their diabetes. Also, 89.4% agreed or strongly agreed that telemonitoring helped them remember to take medications on time, and 97.3% agreed or strongly agreed that they were satisfied with the process (12).

## Discussion

Given the increasing incidence of diabetes, it is important for health care providers to investigate new ways to deal with this burgeoning epidemic. Telemonitoring has been one strategy to improve diabetes outcomes. It is also important to recognize strategies that may augment telemonitoring.

Underserved Hispanic patients have reported poor adherence with taking diabetes medications. In one study, 60% of Hispanic patients were nonadherent primarily because they forgot to take their medications

(8). In a cross-sectional study of predominantly Hispanics, patients cited medication beliefs as a reason for nonadherence (25). These included not understanding the necessity of taking medications if glucose is normal, concerns about side effects or the possibility of "becoming addicted" to medications, regimen complexity, and lack of confidence in controlling diabetes. Other studies have cited additional factors that affect adherence, including access (using medications from Mexico or complementary and alternative medicine use), cost, language difficulties, and transportation issues (7).

Medication management and educational strategies to help improve diabetes and hypertension care have been successfully implemented by pharmacists (26). Pharmacists have unique skills and training to improve patient care. Health care teams have included pharmacists as integral members to manage diabetes (17).

In our study, certain interventions augmented telemonitoring and were associated with improvements in diabetes control in underserved patients in a CHC setting. We believe the medication changes, medication education, clinical education, and problem-solving strategies provided in the telemonitoring program may have helped improve clinical outcomes. However, the post-hoc nature of this report may only determine associations between the strategies used and clinical outcomes. Nevertheless, learning to use information to improve outcomes is a key aspect of diabetes management (27).

The pharmacist involved with the telemonitoring program was assigned to spend 40% of her workweek on telemonitoring. Telephone calls to several patients were made in the evenings or on weekends because these often were the only times patients said they were available or that the pharmacist was able to successfully reach them. It sometimes took several tries to successfully reach patients. The pharmacist spent ~15 hours per week on telephone calls with patients. However, this potentially saved these underserved patients time and money by obviating the need to pay for or lose wages to attend a face-to-face clinic visit.

Increased access to diabetes education has helped improve outcomes; an understanding of specific individualized strategies may help patients better manage diabetes and hypertension. Some specific areas in which education seemed to be especially helpful to patients included taking and optimizing the use of various medications and better understanding the clinical aspects of their diseases to improve self-care management. Factors affecting disease control include the external influences of medication costs, difficulties acquiring medications and monitoring supplies, and difficulties making necessary medical appointments.

Several additional lessons were learned from patient exit interviews. First, patients felt they had an improved comprehension of their disease state and that they better understood their blood glucose, blood pressure, and clinical laboratory values. This was corroborated by an improvement in diabetes and hypertension knowledge scores (12). In addition, patients' comments helped to verify that telemonitoring technologies may be used successfully with underserved patients in real-world settings. Most patients felt that the technology was easy to learn and said they would recommend it to others. Thus, telemonitoring may be one way to help mitigate health disparities.

### *Limitations*

Because this project involved primarily Hispanic patients, results are not generalizable to other populations. We did not analyze or evaluate the impact of specific education types or problem-solving strategies. The fact that the pharmacist who delivered the intervention also tabulated the education provided in a qualitative manner is another limitation and could potentially have resulted in bias. Bias also may have been introduced by having the same pharmacist who did the telemonitoring also ask the exit-interview questions. Despite these limitations, we identified several clinical, medication management, and education/assistance modalities that may have augmented telemonitoring. As diabetes care clinicians, it is important to be cognizant of the importance of the support and education services we provide.

## Conclusion

Telemonitoring projects improve clinical outcomes in patients with diabetes (12,23), and a variety of individualized strategies may be used to augment the technology and its effectiveness. Specific augmentation strategies include providing targeted medication education, education regarding clinical parameters, and problem-solving strategies. Similar programs are evolving, and it is important to identify and provide useful individualized, behind-the-scenes patient care strategies to enhance their success.

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## Duality of Interest

No potential conflicts of interest relevant to this article were reported.

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