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RESEARCH ARTICLE

Health Impact of a Mobile-Delivered Diabetes Intervention to Control Blood Pressure in Older Adults

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Introduction: Patient education is an effective modality to reinforce self-care practices for chronic disease management. The purpose of this study was twofold: (1) to assess the health impact of a phone-delivered diabetes intervention and (2) to identify predictors of telehealth message use among adults aged 18−65 years with diabetes in a primary care setting using the Technology Acceptance Model theoretical framework.

Methods: A pretest−posttest experimental study design was employed. Participants were randomized to receive 7 weeks of telehealth self-care messages or to the routine care group. Outcome measures included (1) telehealth use among patients who received weekly telehealth messages, (2) self-care behavior management derived from the Behavior Score Instrument, and (3) clinical outcomes measures.

Results: The study team enrolled 150 patients, and of these, 138 (aged 18−65 years) completed the study. Participants aged 53±9.6 (mean±SD) years were mainly females (n=93; 76%), and the majority received government-sponsored health insurance (n=75; 54%). Age was a strong predictor of telehealth use (p<0.001). Among patients who received telehealth messages, systolic and diastolic blood pressure measures (140/78 mmHg vs 134/74 mmHg) were statistically significant at follow-up (p=0.001 and p=0.007, respectively).

Conclusions: Digital support tools can play a valuable role in supporting lifestyle modification changes and reinforcing good diabetes self-care practices in older adults. Providing accessible tools and resources empowers adults to take an active role in their own health.

INTRODUCTION

Diabetes prevalence is increasing at an alarming rate in the U.S., with nearly 1.4 million newly diagnosed cases annually.[1] This disease, mainly affecting adults, stems from insulin resistance[2] and leads to elevated blood glucose (hyperglycemia). Approximately 3.6 million adults begin an insulin regimen within 12 months of a diagnosis.[1] Diabetes is among the top 10 leading causes of death and is most prevalent among American Indians/Alaskan

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Natives, those of Hispanic origin, Asian Americans, non-Hispanic Whites, and non-Hispanic Blacks.[1] Among Medicare beneficiaries aged ≥65 years, 61% of costs are diabetes related.[3] Global projections suggest that 693 million people will have diabetes by 2045.[4] To address this burden, the Centers for Disease Control and Prevention's National Diabetes Prevention Program creates partnerships with efforts geared at delaying its onset.[5]

Uncontrolled diabetes leads to long-term micro- and macrovascular complications, including cardiovascular and renal disease. Its etiology is multifaceted, including genetic and environmental factors.[5] Treatment includes pharmacologic and nonpharmacologic approaches, surveillance, and maintaining appropriate blood glucose levels.[2,6–9] Essential to diabetes care is managing hypertension. Diabetes and hypertension are prevalent comorbidities because 3 in 4 adults experience poorly controlled blood pressure.[10] Elevated blood pressure levels[11] increase the risks for premature disease-related complications.[12–20] For patients managing both hypertension and diabetes, self-care remains a vital component.[14–16]

Diabetes Self-Management Education and Support (DSMES) is a patient-centered framework, using evidence-based standards to improve disease management.[15,17] This approach remains underutilized among patients with government-sponsored insurance.[15,17,21] Digital health support tools are increasingly used to disseminate DSMES.[22] The digital infrastructure for diabetes management and support requires user-friendly, high-quality, yet cost-effective methodologies.[23] Digital technology platforms customizing self-care education using telehealth is one method to facilitate DSMES.[24]

Telehealth utilization was predicted to have a significant impact on diabetes management nearly 2 decades ago.[25,26] Today, it is intentionally integrated into routine care to optimize treatment goals[27] and is often used to provide care for marginalized areas.[22,23,28] During the coronavirus disease 2019 (COVID-19) pandemic, telehealth reduced barriers normally associated with access to care.[22,23] Telehealth can enhance the delivery of ongoing surveillance and self-care education to promote healthy lifestyle modifications and to supplement ongoing physician treatment regimens.[26] Digital health technology is important for managing diabetes, yet evidence is limited in demonstrating a documented rapid escalation of market value. The utilization increased because other options were limited for rural area patients prior to the pandemic, during the pandemic, and to date.[29] For patients, telehealth increased convenience, and access was made available to populations geographically dispersed from quality healthcare services.[17,30] Increased efficiency in health services delivery, reduced administrative burdens, and improved care coordination are among provider benefits. Documented barriers include reimbursement rates, multistate telehealth licensure, patient privacy/confidentiality, adequate digital literacy, medical liability,[31] limited reliable/high-quality internet bandwidth, and Health Insurance Portability and Accountability Act compliant platforms.[32–34] The shift to telehealth during the pandemic necessitated enhanced systems, processes, and efficiency that were lacking prior, causing its underutilization.[35] Although diabetes management during the COVID-19 peak had implications, the combined goal was preventing complications.

The American Diabetes Association suggests that technology combined with physician monitoring, education, and support improves overall quality of life.[11] However, early utilization of video telehealth was reported as a continued barrier for adults with diabetes who were older, had lower income, and spoke a foreign primary language.[36] Considering those barriers, this study used prerecorded audio messages that patients could listen to and not be required to interact in the way that some text messaging and applications on electronic devices required. This study explored patient use of a phone-delivered intervention to reinforce diabetes self-care practices. This study is based on principles of the Technology Acceptance Model (TAM), which explains the adoption and use of technology.[37] This study's purpose was twofold: (1) to assess the health impact of a phone-delivered diabetes intervention and (2) to identify predictors of telehealth message use among adults aged 18–65 years with diabetes in a primary care provider (PCP) setting using the TAM theoretical framework.

TAM posits that technology acceptance and use are influenced primarily by perceived usefulness and perceived ease of use.[37] TAM suggests that there are factors that explain intention to use, utilization, adoption, and acceptance of new technology. External variables, perceived usefulness, behavioral intention to use, and actual system use are the constructs that make up the TAM framework. The model further suggests that intent to use and acceptance of technology are mediated by perceived ease of use and perceived usefulness.[37] The TAM framework was modified for this study (Figure 1) to examine its effectiveness to identify predictors of system use of prerecorded audio telehealth messages among adults. The construct perceived ease of use was not measured in this study.

METHODS

Study Sample

The study team used a pretest–posttest experimental study design to examine the impact of a phone-delivered diabetes intervention on clinical outcome measures in adults with

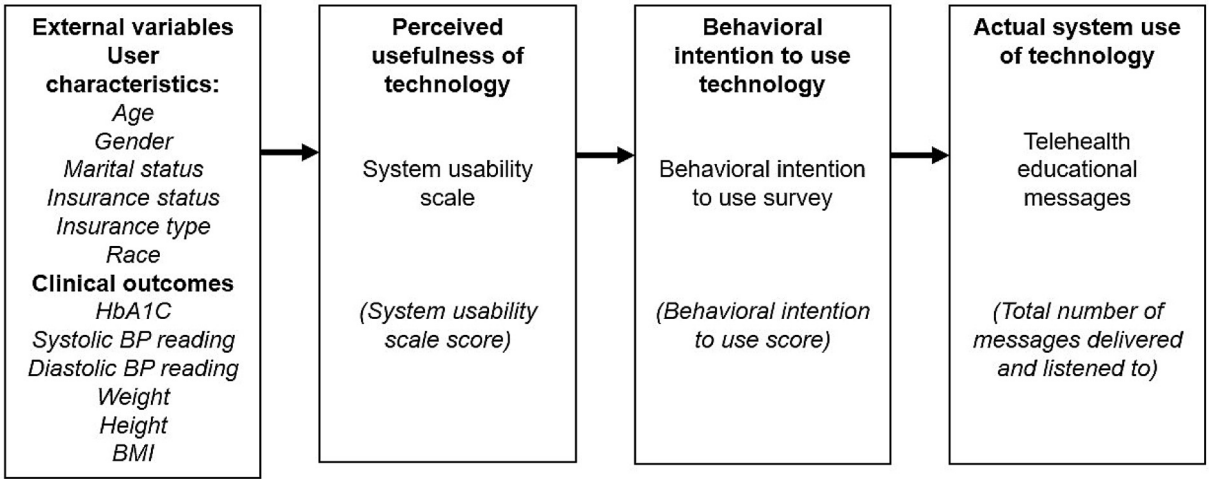

Figure 1. Modification of the TAM.

Note: Operational definitions are denoted in italics. This figure was adapted from Davis et al.[37]
TAM indicates Technology Acceptance Model.

diabetes aged 18−65 years within a PCP setting. The study team further identified predictors of telehealth message utilization using the TAM theoretical framework. Patients diagnosed with Type 2 diabetes were recruited from a PCP clinic in Hampton Roads, VA. Targeted participants were adults prescribed a medication regimen to manage a physician diagnosis of diabetes and those with weekly access to an operable landline phone or a cell phone. Adults aged ≥65 years, patients with gestational diabetes at the time of the study, Spanish-only speaking patients, those on current enrollment in another intervention, and patients not having an office visit within the past year were excluded. Patients provided written consent to participate in this research study. Permission to conduct this study was granted by Old Dominion University's Human Subjects IRB (Study Number 12-179).

Clinical outcome measures and demographic characteristics were extracted and recorded from the PCP's electronic medical record system at baseline and follow-up. Demographic characteristics included the patient's age, sex, marital status, race, and insurance status and type. In this study, age was a discrete variable, in which a review of the patient's electronic medical record was completed to extract and record age in years. To establish baseline clinical outcome measures, the patient's BMI, weight, HbA1C, systolic blood pressure, and diastolic blood pressure readings were extracted and recorded. Postclinical outcome measures were recorded 3−4 months later during a diabetes-related visit from the electronic medical record to examine differences within and between the telehealth group and routine care group. Clinical outcome measures with significantly high or alarmingly low data points extracted from the electronic medical record were identified as outliers and were reassessed for accuracy.

Using a systematic sampling approach, half of the patients (n=75) were randomly assigned to the telehealth group, whereas the remaining (n=75) were assigned to the routine care group. The random starting point for group assignment was the routine care group and alternating with the next patient assigned to the telehealth group. Both groups received usual care, which included a PCP visit, laboratory specimen collection, review of past clinical values, medication management, and education. Patient education was made available using 2 options: an individual session with the onsite health educator or a group shared medical appointment, which involved not more than 10 patients who consented to participate in this peer setting. Clinical outcome measures were collected and recorded in the electronic medical record by the certified clinical medical assistant assigned to the clinic during the patient's diabetes-related visit at baseline and follow-up. Patients completed the Behavior Score Instrument (BSI) as an initial assessment at baseline and were randomized to either the telehealth group or routine care group. Telehealth group participants experienced 7 weeks of audio messages focused on the 7 self-care behaviors, whereas the routine care group received printed educational handouts on optimal diabetes management at enrollment.

Measures

Telehealth for this study is operationalized as an automated voice message communication system, providing

weekly educational messages on the 7 self-care behaviors defined by the Association of Diabetes Care and Education Specialists (ADCES) (formerly the American Association of Diabetes Educators).[38] Telehealth use is defined as listening to the prerecorded audio messages on self-care behaviors in its entirety, as assessed by the automated system.

Self-care behavior management is operationalized as efforts, activities, or practices that reduce the risk for diabetes-related complications. Self-care behavior management was measured by the BSI, a 21-item assessment developed by the ADCES that is used to address patient-reported self-care behaviors related to healthy eating, physical activity, medication instruction, blood glucose monitoring, problem solving, reducing complications, and healthy coping.[39] The BSI is a valid and reliable tool used to measure behavior change in diabetes self-management that captures behaviors over the past 7 days.[39] For this study, the BSI was administered at 3 intervals: the initial visit, immediately after the intervention, and at the 3−4-month follow-up diabetes-related visit.

The System Usability Scale (SUS) measured perceived usefulness of the system and its ability to deliver diabetes education.[40−42] The SUS is a 10-item questionnaire measuring system usability using a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Higher SUS scores indicate better usability.

Intention to use in this study was measured as the participant's likelihood to utilize resources provided to enhance self-care diabetes management.

The primary outcome variable in this study, actual system use, was measured using data recorded from the automated voice message communication system. Actual system use was calculated using the total number of messages successfully delivered and listened to in its entirety over the 7-week period. Each participant had the potential to receive and listen to 7 complete calls.

The telehealth method used as the intervention in this study refers to telephone-based, prerecorded audio messages developed and provided by the ADCES. Good diabetes self-care practices are operationalized in this study as the ADCES's 7 self-care behaviors (i.e., ADCES7), a comprehensive framework for the self-management of diabetes and other related conditions, such as prediabetes and cardiometabolic diseases.[38,43,44] A structured set of strategies are provided to improve self-care behaviors.[38,43,44] The 7 constructs for good diabetes self-care include (1) healthy eating, (2) being physically active, (3) medication adherence, (4) blood glucose monitoring, (5) informed decision making, (6) reducing risks, and (7) healthy coping.[38,44] For each of the constructs, definitions, behaviors, activities, tasks, and implementation into daily living were provided. Audio messages focused on diabetes self-care management and were delivered to participants over a 7-week period. Permission to use the prerecorded messages for the telehealth group was obtained from the ADCES. On average, messages were 5 minutes, with 1 audio message delivered each week. Total message time was 34 minutes during the 7-week intervention. Three attempts were made to reach the participant in the event of a hang-up, busy line, or voicemail. The intervention required participants to answer and listen to the self-care message. Active listening was operationalized as a successful call, which required the participant to answer and listen to the message in its entirety. Data recorded from the messaging system included the total number of messages delivered, messages listened to in their entirety, and failed messages.

Statistical Analysis

Quantitative analyses were conducted using the SPSS, Version 28.0.[45] Outcome measures included (1) telehealth utilization among patients who received weekly prerecorded audio telehealth messages, (2) self-care behavior management derived from BSI scores, and (3) clinical outcome measures. Telehealth utilization was derived from the total number of messages successfully delivered and messages listened to in their entirety. Descriptive analyses of demographic and clinical outcome measures for both the telehealth group and the routine care group are presented by count and proportion. Clinical outcome measures were reported using mean and SD. The study team examined statistically significant differences between the telehealth group participants and those in the routine care group. Multiple linear regression analyses were conducted to determine whether user characteristics, telehealth system use, and BSI scores effectively predicted changes in the clinical outcome measures from baseline to follow-up. Statistical significance was accepted at $p<0.05$.

RESULTS

The study team enrolled 150 patients in the study. The final analyses included 138 participants (telehealth group, n=67; routine care group, n=71) (Table 1). Participants had a mean age of 53 years (SD=9.59). The ages for all participants ranged from 21 years to 65 years. The majority were non-Hispanic Black individuals, were married, and had government-sponsored insurance. In both groups, participants were mainly females (telehealth group: n=49, 73%; routine care group: n=44, 62%). Table 1 details the demographic characteristics of both groups.

Table 1. Demographic Characteristics of Study Participants

Demographic characteristics	Telehealth group (*n*=67)	Routine care group (*n*=71)
Race/ethnicity		
Non-Hispanic Black	63 (94%)	69 (97.2%)
Other	4 (6%)	2 (2.8%)
Sex		
Male	18 (26.9%)	27 (38%)
Female	49 (73.1%)	44 (62%)
Marital status		
Never married/single	33 (49.3%)	35 (49.3%)
Married	22 (32.8%)	25 (35.2)
Widowed/divorced/separated	12 (18%)	10 (12.6%)
Insurance type		
Private	32 (47.8%)	25 (35.2%)
Government sponsored	33 (49.3%)	42 (59.2%)

Mean blood pressure readings decreased for telehealth and routine care groups from baseline to follow-up (141/78 vs 136/76) after study participation. Among telehealth group participants specifically, ANOVA results revealed that systolic scores and diastolic scores were statistically significantly higher at baseline (140/78) than at follow-up (134/74) after the intervention (p=0.001 and p=0.007, respectively) (Table 2).

The BSI was administered and examined at 3 intervals. The interaction between time and group on BSI scores was assessed to determine whether differences were as a result of time. Because the interaction term was found to be statistically significant, posthoc analyses determined that for the telehealth group participants, statistically significant differences were found in BSI scores. Results showed that at baseline, scores were lower than scores immediately after the intervention and at follow-up.

Results from the SUS assessment revealed that telehealth group participants had a mean score of 94.3 (SD=2.95). Higher SUS scores indicated better usability. Among telehealth group participants, 82% (n=55) listened to 7 messages. Of the 651 messages delivered, 73% (n=475) were listened to in their entirety. Multiple linear regressions were conducted to identify the predictors of system use of telehealth messages on the basis of the TAM framework. Results revealed that age was

Table 2. Comparison of the Telehealth Group With the Routine Care Group on Pre- and Postclinical Outcome Measures

Clinical outcomes	Telehealth group (*n*=67)	Routine care group (*n*=71)
Systolic BP (mmHg)		
Pretreatment systolic	140 (20.13)	143.45 (22.01)
Posttreatment systolic	134.53 (16.21)	139.24 (16.64)
Diastolic BP (mmHg)		
Pretreatment diastolic	78.07 (13.88)	78.31 (12.14)
Posttreatment diastolic	74.77 (11.11)	77.46 (11.55)
HbA1C		
Pretreatment HbA1C	8.38 (2.35)	8.18 (2.52)
Posttreatment HbA1C	8.41 (2.26)	8.06 (2.46)
Weight (lbs)		
Pretreatment weight, lbs	216.5 (49.85)	221.8 (49.71)
Posttreatment weight, lbs	217.31 (46.8)	219.90 (50.92)
BMI		
Pretreatment BMI	35.36 (7.94)	35.3 (7.27)
Posttreatment BMI	35.55 (7.57)	35.4 (7.40)

Note: Clinical outcome measures data are presented as mean ± SD.
BP, blood pressure.

Table 3. Multiple Linear Regressions on System Usability in the Telehealth Group

Variables	B	SE	B	*t*	*p*-value	95% CI
Age	0.06	0.02	0.48	3.90	0.000	0.03, 0.09
Sex	0.11	0.34	0.04	0.33	0.743	−0.58, 0.80
Marital status	0.52	0.29	0.21	1.81	0.076	−0.06, 1.10
Insurance type	0.18	0.29	0.07	0.63	0.531	−0.40, 0.76
Perceived usefulness	0.03	0.05	0.07	0.60	0.548	−0.06, 0.12
Intention to use post	0.50	0.52	0.12	0.96	0.343	−0.55, 1.55

Note: F(6, 58)=4.52, p=0.001, and R^2=0.32.

statistically significantly related to the number of messages listened to (p<0.001) (Table 3). Age, sex, marital status, insurance type, perceived usefulness, and intention to listen to the telehealth messages predicted utilization (R^2=0.32, F[6, 58]=4.52, p=0.001). Age is a strong predictor of telehealth message utilization (B=0.06, p<0.001) because older adults were more likely to listen to messages in their entirety. Among patients in the telehealth group, those who were never married also saw a decrease in their systolic blood pressure reading (F[1, 60]=5.87, p=0.018, R^2=0.09, B= −10.11). In addition, being divorced was a significant predictor of change in systolic blood pressure (p=0.005). Individual t-tests indicated that being divorced was a statistically significant predictor of systolic pressure change in the telehealth group after the intervention (t=2.89, p=0.005). Findings suggest that divorcees had an increase in systolic pressure (13.88 mmHg).

DISCUSSION

Results from this study demonstrate that a phone-delivered intervention was an effective modality to reinforce good diabetes self-care practices. In this study, participants actively listened to 1 telehealth message per week. Additional configurations were not required for application or use because patients in the study were not required to have a special phone system nor any additional devices to connect to their phone lines in order to participate. Telehealth messages provide a cost-effective and an immediate intervention to engage patients on healthier lifestyle modifications to manage diabetes and reduce associated complications. Although there were no observed decreases in HbA1C among participants, there existed a significant decrease in blood pressure after the intervention. These findings show interventions integrating technology and behavioral change as an effective approach to managing chronic conditions such as diabetes and hypertension.

Cost-effective telehealth modalities are increasingly used for chronic disease surveillance, management, and patient education. The global pandemic forced the adoption, implementation, and acceptance of strategies to maintain continuity of care using telehealth.[27,31] As such, providers utilized a plethora of health information technologies to deliver self-care behavior messages and to monitor clinical outcome measures in real time.

Self-care management of a disease is multifaceted owing to the premise that patients assume a proactive role. Patient-centered services for hypertension and diabetes management enhance self-care practices. Although active listening does not necessarily equate to behavior change, findings from this study supports the use of telehealth messages as an effective intervention to reinforce self-care management and to maintain blood pressure. Moreover, modifying language used in the treatment and care of diabetes may also impact overall health outcomes.[46] Sustained behavioral change presents unique challenges for patients managing diabetes. However, the adoption and maintenance of active self-care management improves overall quality of life and delays the onset of diabetes-related comorbidities such as blood pressure as found in this study.

Of importance to note is the relationship between marital status and blood pressure. In this study, marriage status impacted change in blood pressure values because divorced patients saw an increase. A study evaluating the relationship between marital status and risk of death from diabetes found that minority and non-Hispanic White, divorced/separated men are at an increased risk of diabetes mortality, where minority is operationalized as all races and ethnicities that are not identified as non-Hispanic White.[47] Findings also showed that widowed minority and non-Hispanic White women were also at an increased risk of death as a result of diabetes compared with their counterparts.[47] The present study's findings suggest that interventions should include the appropriate social support systems for patients because this may be a factor that enables patients to both make and sustain lifestyle changes in diabetes management.

This study assessed the health impact of a phone-delivered diabetes intervention and identified predictors

of telehealth message use among adults aged 18−65 years with diabetes in a PCP setting. Overall, participants intended to utilize the resources provided to further optimize their respective glucose targets, lower blood pressure, increase physical activity, and better understand the impact of appropriate carbohydrate intake related to healthy eating.[48,49] These findings echo similar results that phone-delivered interventions are an effective strategy to engage older adults.[22,50,51]

Limitations

These findings, although promising, had some limitations. First, BSI responses were self-reported data, which introduced measurement bias. Second, responses were collected at 3 intervals, which may have sensitized participants to the nature of the research when discussing self-care management. A third potential limitation in this study includes the process for the collection of pre- and postclinical outcome measures because there were more than 1 certified clinical medical assistant assigned to the clinical providers. Vitals were collected and recorded in the electronic medical record system by the certified clinical medical assistant assigned to the clinic during the patient's visit. In addition, clinicians recognize the various physiologic and pathologic processes affecting vital signs and measurements, and their proper interpretation may very well fluctuate.[52] Furthermore, the early detection of clinical issues can be a result of vital signs and measurements that could otherwise go unnoticed. These assessments used electronic equipment, but there are limitations such as subjectivity, unreliable results, and other challenges such as rater reliability, which may impact the usefulness and accuracy of vital measurements. However, vital signs are a method to determine diagnosis, disease progression, and the identification of the next steps required to connect the patient to the correct level of required care.[52]

Providing comprehensive patient education in a group setting is the principle on which a shared medical appointment is built.[19,53−55] Patients in this study may have participated in a group medical visit, which uses the ADCES7's framework to address self-care management of diabetes, which may increase the likelihood of multiple study interference. Although playing a prerecorded message may be considered a study limitation, the content of the audio messages provided is considered a supported evidence-based intervention by the ADCES for self-care management.[43,44,56,57] This framework is a collaboration of healthcare professionals to develop a person-centered model to improve both behavioral and clinical outcomes with a goal of a better quality of life among those diagnosed with diabetes or prediabetes.[43,44,56,57] Continued research is necessary to broaden this framework to incorporate any new discoveries that improve self-care management.[43,44,56,57] The ADCES continuously evaluates the framework to support these advances among the changing landscape of chronic condition management, which includes the innovation of telehealth.[43,44,56,57] Results of this study demonstrated a significant change in postclinical blood pressure values; future studies assessing the patient's understanding of the 7 self-care behaviors may provide further insight. Finally, this study employed sampling from 1 PCP practice in an urban area. Outside of this study's sample, generalizations should be made with caution. Findings may be strengthened using longitudinal studies inclusive of a larger sample size.

CONCLUSIONS

These findings suggest that phone-delivered diabetes education improves and reinforces self-care behaviors aimed at achieving better clinical outcomes within the PCP setting. Physicians in primary care are often the first point of contact for patients managing diabetes. Chronic disease management in this setting includes diagnosis and treatment, surveillance, and referrals to specialists to ensure that patients receive comprehensive care. This study demonstrates that PCP settings are instrumental in utilizing proactive strategies to help patients cope with the emotional burden associated with diabetes and creating personalized self-care plans using digital platforms. Results in this study are consistent with research[22,46,58] showing the effectiveness of telehealth messages in providing diabetes education, medication management and adherence, and remote monitoring of blood glucose levels and blood pressure. Providers in this study recognized that older adults are not forthcoming with discussing needs or questions related to self-care. Teo and colleagues found that minority ethnic older adults, races and ethnicities inclusive of Black, people of color, and racially minoritized populations, are hesitant to converse about health status or diagnoses because of language barriers; condition unfamiliarity; or differing health beliefs rooted in upbringing, ethnicity, religion, or spirituality.[58] The literature further suggests that stigma and negative experiences surrounding a diabetes diagnosis may cause some patients to experience guilt and embarrassment.[46] To encourage communication between patient and providers, studies have suggested different terminology to give the patient a better experience and perhaps not feel blamed for their diagnosis.[46]

The majority of patients in this study were non-Hispanic Black and female. Non-Hispanic Black individuals are twice as likely to die from diabetes as their

counterparts. Moreover, the trend of racial and ethnic disparities continues with non-Hispanic Black women for gestational diabetes, progression from gestational diabetes to Type 2 diabetes, genetic predisposition to diabetes,[59] and proteomic predictors of incident diabetes.[60] Important to diabetes self-care management are culture and ethnicity as well as help-seeking behaviors, healthy literacy, and the environment, particularly for older adults.[58] As such, interventions and medication regimens should incorporate customized care plans.

DSMES underpins self-care management of the chronic condition diabetes and associated complications.[20] Although these services and supplies are covered for most insurers, health policy mandates for DSMES ensure that providers have tools to reinforce diabetes self-care practices to improve clinical outcomes. Improperly managed diabetes may cause avoidable, long-term complications, including cardiovascular and renal disease.[6–8,61] Foregoing American Diabetes Association–recommended annual screenings may result in adverse clinical outcomes. A comprehensive care coordination plan for diabetes management must include annual screenings to increase timely interventions and proactive care to minimize complications and associated comorbidities. Further policy recommendations should include increased prediabetes awareness and marketing efforts to wider audiences and support of innovative technologies to sustain long-term behavior change. Because diabetes and hypertension are chronic conditions that often coexist, the use of telehealth could be vital for enhancing patient self-care. Digital support tools, whether used for surveillance and monitoring or educating patients, remain essential to diabetes care and treatment. Convenient and accessible tools and resources empowers patients diagnosed with chronic diseases to take an active role in their health.

As diabetes prevalence rapidly increases across the globe, collaboration between communities, physician scientists, and healthcare professionals is essential to advance research on prevention, diagnosis, and treatment. Future research leveraging artificial intelligence and geographic information systems may guide the development of appropriate community-level interventions to improve patient-level clinical outcome measures and overall public health. Early identification of communities at an increased risk for developing diabetes on the basis of environmental factors may garner health policy support to invest in community-based interventions that advance health equity. This study supports multidisciplinary integration of ongoing yet consistent telehealth messaging to facilitate care continuity for patients and support self-care management of chronic diseases.

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CREDIT AUTHOR STATEMENT

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