

Comparison of Diabetes Management by Certified Diabetes Educators via Telephone Versus Mixed Modalities of Care

Kayla Ward, Rhonda S. Eustice, Ann D. Nawarskas, and Nina D. Resch

■ **IN BRIEF** This pilot program evaluates the impact of telephone versus mixed modalities of care on A1C. A retrospective chart review was conducted to evaluate mean baseline and follow-up A1C values for all patients who received telephone care, video-conferencing, or in-person clinic appointments with certified diabetes educators at a single, rural U.S. Department of Veterans Affairs clinic. The results of this evaluation showed that glycemic control was improved both in patients who received diabetes management through telephone care alone and in those who received mixed modalities of care.

Diabetes is one of the most common chronic disease states affecting individuals worldwide and can result in significant adverse health outcomes if not managed appropriately. The prevalence of diabetes in the United States is approaching 10%, affecting ~29 million Americans (1). The prevalence within the state of New Mexico is similar (9.8%), and a large percentage of patients with diabetes (17.7%) are indigenous people (i.e., Native American/American Indian) (2). With the increasing prevalence of diabetes, the estimated health care cost (direct and indirect) in the United States is \$245 billion annually (1).

As a result of the increasing diabetes prevalence and challenges associated with diabetes self-management, the U.S. health care system has shifted its focus to multidisciplinary diabetes care teams. According to the American Diabetes Association (ADA) *Standards of Medical Care in Diabetes* (3), patients with diabetes should receive care from a health care team that may include physicians, physician's assistants, nurse practitioners, dietitians, pharmacists, and

mental health clinicians. In addition, patients must be actively involved in their own care. This can be accomplished by developing a collaborative approach between health care providers and patients and implementing diabetes self-management education (DSME), which is a key component of the ADA's Standards (4). It is sometimes difficult to provide DSME to patients who live in remote or rural areas. As a result, telemedicine is being implemented more often to help patients who live in remote locations receive appropriate medical care.

The World Health Organization (WHO) defines telemedicine as the "exchange of medical information and/or services between patient and clinician through electronic information communication technologies" (5). It includes different modalities such as telephone, video-conferencing, secure messaging systems to exchange medical information, websites, and other technologies (6). The benefits of telemedicine include increased access to care, expansion of care, reduced travel for both patients and providers,

New Mexico VA Health Care System and University of New Mexico College of Pharmacy, Albuquerque, NM

Corresponding author: Kayla Ward, kayla.ward2@va.gov

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reduced health care costs, and potentially increased convenience (7).

Previous research has not demonstrated any statistically significant differences between in-person visits and telemedicine modalities with respect to A1C outcomes (8–10). A majority of these studies primarily involved visits centered around diabetes education and rarely evaluated the use of telemedicine for medication management. Medication management encompasses the addition or removal of a medication or a dosage adjustment. Additionally, previous studies have not focused on glycemic control in patients who receive telephone care alone compared to telephone care plus face-to-face visits, which include in-person and video-conferencing modalities of care.

Telemedicine has been used to increase access to care within the Veterans Affairs (VA) Health Care System and is defined as “clinical treatment delivered using electronic communications and information technology when distance separates the provider and the patient” (11). At the New Mexico VA Health Care System (NMVAHCS), various specialty services conduct patient visits using telemedicine, primarily by video-conferencing or telephone, to increase access to specialty care delivered by a provider at the main VA medical center (VAMC) and patients at the outlying VA contract/community-based outpatient clinic (C/CBOC). Although video-conferencing offers a face-to-face interaction, its success relies on staffing, as well as technological resources. Support staff are necessary at both the C/CBOC and the main VAMC for scheduling, checking patients in and out, and setting up the video equipment and a private room in which to conduct each visit. Patient visits via video-conferencing cannot occur if patients are unable to drive to the C/CBOC because of transportation issues (e.g., lack of transportation or fiscal constraints) or if they live a significant distance from

the C/CBOC and thus perceive more hardship than benefit from traveling to the C/CBOC. Other challenges with video-conferencing may include numerous video appointments being scheduled concomitantly at the C/CBOC, thus increasing competition for private patient rooms and video equipment, as well as shortages of support staff. Conversely, telephone appointments may be limited only by access to reliable phone service.

The Veterans Health Administration (VHA) designates land areas as urban, rural, or highly rural using the census tract–based definition of the Rural Urban Commuting Area codes (12). As of May 2015, nearly 10,000 veterans at the NMVAHCS had a diagnosis of diabetes, and ~50% of them received their medical care through the 13 rural C/CBOCs located throughout New Mexico and southern Colorado. Currently, 2 of the C/CBOCs have <50% of patients living in rural areas, whereas the other 11 C/CBOCs have ~98% of patients living in rural and highly rural areas. Although telemedicine has been offered by specialty services at the NMVAHCS, a formal service specifically for diabetes management has not been established. Many C/CBOC patients with diabetes are managed by the local C/CBOC primary care provider (PCP), and some patients are managed by the local provider plus a certified diabetes educator (CDE) via informal verbal consultation.

Design and Methods

Pilot Program

A 1-year pilot program approved by the NMVAHCS institutional review board was implemented in January 2015. Telemedicine was used for diabetes management within one C/CBOC that was classified as predominantly rural and was located >100 miles from the main VAMC. Of the 2,400 veterans receiving care at this C/CBOC, nearly 2,250 (93%) lived in a rural community, and ~90 (4%) live in a highly rural

community. This clinic was selected for a formal diabetes telemedicine program because of the high percentage of patients with uncontrolled diabetes, as well as inconsistent PCP staffing and a lack of onsite CDEs at the C/CBOC.

CDEs at the main VAMC offered one-on-one telephone appointments, individual and group video-conference appointments, and in-person appointments (if transportation was available) to increase access to diabetes care. A variety of appointment options were provided to offset challenges expected with telephone and video-conferencing. Patients could select any one of these appointment options depending on their preferences and the availability of appointments (i.e., appointments were offered on a first come, first served basis).

CDEs provided medication management and DSME, including education on medication adherence, diet, exercise, hypoglycemia prevention and treatment, and self-monitoring of blood glucose (SMBG). DSME strategies included assisting patients with remembering to take their medications, helping them understand the timing of certain medications, identifying specific issues to focus on with regard to diet (e.g., carbohydrate counting or eating a high-protein diet), and making suggestions regarding physical activity. Additionally, patients were instructed about how often and when to perform SMBG. Medication management included the addition, removal, or dosage adjustment of diabetes medications, as needed.

Program Evaluation Project

It was uncertain from existing literature whether patients who select telephone appointments only would show benefit compared to those who were managed through a variety of modalities, including telemedicine and in-person appointments. This program evaluation aimed to assess the effectiveness of telephone appointments alone compared to mixed

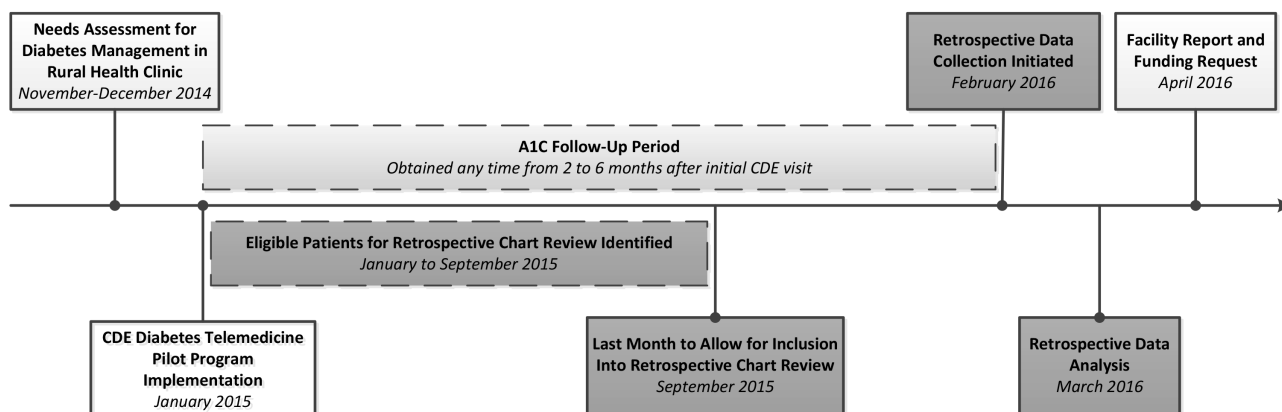


FIGURE 1. Timeline of rural health clinic diabetes management pilot program.

modalities (i.e., any combination of telephone, video-conferencing, and in-person appointments) within a rural health clinic. Based on the results of the pilot program, a second aim was to seek funding for additional staffing and technological resources to expand the most effective diabetes practice to the remaining C/CBOCs.

A retrospective chart review was conducted to determine the effectiveness of the pilot program for patients who received telephone care only compared to mixed modalities. Investigators used a predefined coding form to mitigate intra- and inter-reviewer variability. Baseline and follow-up A1C values were reviewed in the electronic medical record for all patients who had at least one CDE appointment between

1 January and 30 September 2015 within one rural C/CBOC. Patients were offered appointments through the pilot program when it began in January 2015, and only those who received care through September 2015 were included to allow for at least one follow-up A1C measurement by February 2016, the end of the 1-year pilot program (Figure 1).

Outcome Measures and Data Collection

During retrospective chart review, patients were sorted into groups based on the type of appointments they had (telephone only vs. mixed modalities). Entry criteria included age ≥ 18 years, diagnosis of diabetes, and a baseline A1C, defined as any A1C measurement between 90 and 30 days before the first CDE appointment. This time

period was chosen to identify the A1C value closest to the first CDE appointment that was unlikely to reflect any changes made during that appointment. A follow-up A1C could be any A1C measured from 2 to 6 months after the first CDE appointment, which would most likely reflect changes made as a result of that CDE interaction. If there was more than one A1C within the observation period, mean A1C was calculated and used as the follow-up value rather than the last recorded A1C. All A1C tests were processed at the main VAMC.

The chart review also included the number of pharmacological and nonpharmacological treatments documented per visit. Additional data collected included the total number of CDE interactions for each patient, average time spent per visit, and baseline hemoglobin/hematocrit laboratory values.

Statistical Analysis

Statistical analyses were completed with the use of SAS software version 9.4 (SAS Institute, Cary, N.C.). Descriptive statistics were used for baseline demographic information. Change in A1C was determined with a one-sided, two-sample *t* test with a 95% CI. Spearman rank coefficient and Pearson correlation coefficient analyses were employed to determine frequencies of pharmacological and nonpharmacological treatments within and between groups. All sec-

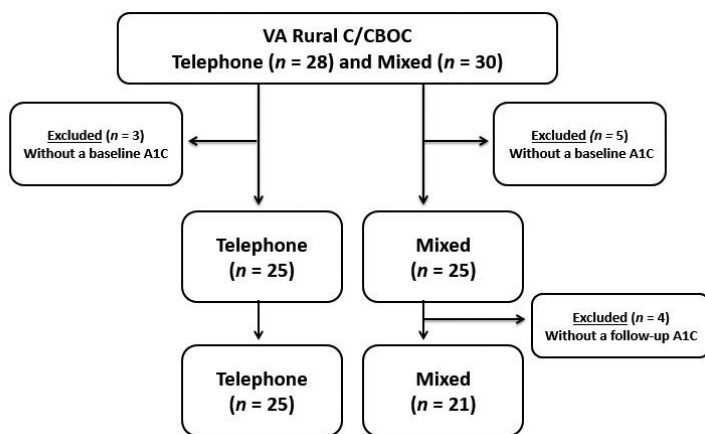


FIGURE 2. Schematic of patient selection throughout the pilot program evaluation.

ondary analyses were two-sided with an alpha level of 0.05.

Results

A total of 58 patient charts were reviewed, of which 12 patients did not meet entry criteria and were excluded. Of the 46 patients in the analysis, 25 were included in the telephone-only group and 21 were in the mixed-modalities group (Figure 2). Baseline demographics were similar between groups; 100% of the patients in each group were male, with an average age of 67 years in the telephone-only group and 66 years in the mixed-modality group. Native American/American Indian patients comprised 32 and 57% of the telephone-only and mixed-modality groups, respectively (Table 1).

Both groups had an overall reduction in A1C from baseline to follow-up (telephone-only group $-1.2 \pm 2.28\%$; mixed group $-0.9 \pm 1.26\%$) (Table 2). There were no abnormal hemoglobin/hematocrit values at baseline that could have confounded the reliability of the A1C values collected.

The frequency of medication management was 61% in the telephone-only group compared to 37% in the mixed-modality group. Regarding type of DSME provided, differences were noted for exercise (10% in telephone-only group vs. 42% in the mixed-modality group) and SMBG (75% in telephone-only group vs. 46% in the mixed-modality group). No other secondary outcomes were significant (Table 3).

Discussion

Incorporating telemedicine modalities into current health care practice is an important strategy to increase access to care for patients located in remote areas. As this program evaluation demonstrated, patients in both the telephone-only and the mixed-modality groups had clinically significant reductions in A1C values. Although the number of patients was small, the outcomes from this pilot program provide additional insight

TABLE 1. Baseline Characteristics

	Telephone-Only Group (n = 25)	Mixed-Modality Group (n = 21)
Male (n [%])	25 (100)	21 (100)
Age (years; mean [SD])	67 (7)	66 (9)
Race/ethnicity (n [%])		
Native American/American Indian	8 (32)	12 (57)
White/Caucasian	8 (32)	5 (24)
Hispanic/Latino	3 (2)	3 (14)
Asian/Pacific Islander	1 (0.004)	0 (0)
Not listed	5 (20)	1 (0.05)
Microvascular complications (n [%])	16 (64)	12 (57)
Macrovascular complications (n [%])	4 (16)	7 (33)
Chronic kidney disease, stage ≥ 3 (n [%])	4 (16)	6 (29)

TABLE 2. Change in A1C From Baseline to Follow-Up

	Telephone-Only Group (n = 25)	Mixed-Modality Group (n = 21)
Baseline A1C (%; mean \pm SD)	9.5 \pm 1.90	10.2 \pm 2.11
Follow-up A1C (%; mean \pm SD)	8.3 \pm 0.92	9.3 \pm 1.98
Change in A1C (%; mean \pm SD)	-1.2 ± 2.28	-0.9 ± 1.26

TABLE 3. Visit Characteristics

	Telephone-Only Group (n = 25)	Mixed-Modality Group (n = 21)
Medication management (n [%])	66 (61)	26 (37)
DSME documentation (n [%])		
Medication adherence	14 (13)	13 (18)
Diet	39 (36)	45 (63)
Exercise	11 (10)	30 (42)
Hypoglycemia education	26 (24)	21 (30)
SMBG education	81 (75)	33 (46)
Total visits during observation period (n)	108	71
Average visits per patient (n)	6	5
Average time per visit (min)	22	28
Average number of A1C values (n)	3	3
Total telephone visits per group (n [%])	108 (100)	25 (35)
Total video-conference visits per group (n [%])	0 (0)	20 (28)
Total in-person visits per group (n [%])	0 (0)	26 (37)

into the efficacy of telephone visits with CDEs compared to telemedicine plus in-office visits with CDEs.

The A1C reductions found in this evaluation were similar to what have been reported previously in the literature (Table 4). A randomized, parallel, control-group study conducted by McFarland et al. (8) compared

two groups of patients who received medication management through either home telemonitoring (HT) with the use of information retrieval software (i.e., messaging devices or video conferencing) or telephone follow-ups between their face-to-face visits. There was no statistically significant between-group difference

TABLE 4. Summary of Telemedicine Literature

	Groups	A1C Outcomes (%)	Statistical Findings
McFarland et al. (8) Primary outcome: A1C change from baseline to 6 months	Care coordination: HT versus usual care (in-person + telephone)	-1.6 (HT) versus -2.1 (non-HT)	No significant difference
Izquierdo et al. (9) Primary outcome: A1C change from baseline to 3 months	Telemedicine (CVT) versus in-person	-1 (in-person) versus -0.9 (CVT)	No significant difference
Greenwood et al. (10) Primary outcome: A1C change from baseline to 9 months plus behavioral outcomes	In-person, telephone, or secure messaging	Total mean A1C change: -0.88	No significant difference

in A1C change from baseline to 6 months. In an article by Izquierdo et al. (9), DSME was delivered via video-conferencing or at an in-person appointment. There was no statistically significant between-group difference in A1C change from baseline to 3 months after the third educational visit. Similar results were reported in a study by Greenwood et al. (10), in which patients who received telephone follow-up and secure messaging had a change in A1C from baseline to 9 months that was similar to that of patients who only had in-person follow-up. CDEs provided services in only two of these three studies (9,10), which may be important to consider when comparing results. Sample sizes were relatively small in all three studies. In contrast to these previous studies, the current program evaluation included both DSME (nonpharmacological treatments) and medication management (pharmacological treatments).

A large number of patients included in this program evaluation identified as Native American/American Indian. Of these patients, more had mixed-modality appointments than telephone-only appointments (57 vs. 32%, respectively), which could be a potential source of bias due to self-selection. One possible reason for this may be a lack of adequate telephone service in rural areas. Thus, it is important to consider the specific community being served when deciding to implement telemedicine strategies, to ensure that the needs of that community will be met by the modalities provided (13).

However, the difference observed in this program evaluation is more likely the result of chance due to the small number of patients reviewed.

There are several limitations to this pilot program evaluation. First, it was a retrospective and nonrandomized evaluation. This may have added a degree of selection bias because patients chose the type of appointment they preferred, which could have been based on their transportation or financial constraints or on CDE availability. A prospective study with only one CDE providing different modalities of care may result in different outcomes.

Second, there was inconsistent documentation within the patient charts and differences in the way information was documented based on individual CDE styles and preferences. Regarding baseline characteristics, patient problem lists were not always updated with the most current information.

Other limitations included differences in the degree of medication management and variability in the time between CDE visits per patient, the duration of follow-up by the CDE, and the total number of CDE visits. The mixed-modality group also included some group education sessions in which individual medication management did not occur. PCPs may have co-managed patients, although it is unlikely because these patients were referred to CDEs for medication management, and the CDEs were the primary prescribers of diabetes medications. Moreover, the pilot program was implemented

in this rural clinic because of inconsistent PCP staffing.

Finally, costs of the pilot program (e.g., for equipment, staff, and transportation) were not evaluated.

The key takeaway points from the pilot program are that the benefits and barriers, as well as patient preferences and the organization's available resources, must be considered when determining modalities of care. However, if telephone care alone is a useful option, it may be worth implementing to provide more timely and convenient diabetes management and follow-up to patients located in rural areas.

Some general advantages of telephone care alone include fewer required resources, greater opportunity for communication, and improved continuity of care. By having their glucose meter and medications readily available, patients may be better equipped to answer questions about their glucose readings and about how they are taking their medications. Some potential barriers to telephone care include auditory limitations, having potentially less personal interactions, and dealing with environmental distractions.

Potential benefits to video-conference appointments include maintaining a face-to-face appointment, greater convenience, and increased appointment availability for patients unable to travel long distances for an in-person appointment. Within the VA Health Care System, video-conferencing is also referred to as clinical video telehealth (CVT) and encompasses multiple types of

appointments that can be offered via video-conference to veterans in rural locations. Some potential barriers of video-conferencing involve hearing difficulties; technical difficulties with the video system; lack of communication between hospitals and clinics attempting to connect, resulting in delayed appointments; and costs associated with obtaining and maintaining the necessary equipment.

Health care systems may consider offering in-person appointments for face-to-face and nonverbal communication that may not be easily conveyed through other modalities of care. However, for some patients, transportation and costs associated with traveling long distances for an in-person visit may prevent them from keeping medical appointments. Having the option of telemedicine for diabetes management can enable patients to become more active in their own health care. The ability for patients to reach their providers via telephone or video-conference more often than they could in person may enable closer follow-up and more timely medication adjustments for patients in rural locations. Future studies may include a patient satisfaction survey to further assess the benefits and barriers of telemedicine modalities.

Conclusion

Telephone care alone and mixed modalities of care are both effective for managing diabetes with respect to A1C reduction. Although there were no statistically significant differences between groups, both groups did have a reduction in A1C from baseline to follow-up, which may be clinically significant. Although telephone care is not a novel concept, it remains a useful option among more modern telemedicine modalities.

The VHA is a closed health care system for which CDE telephone and telemedicine services are not billable and reimbursement is not a limitation; other health care systems may face additional limitations with this model. Within the NMVAHCS,

findings from this program evaluation were used to help obtain funding for three full-time employee equivalent specialists to provide remote access to diabetes care via telephone and video-conference appointments for patients in rural locations. Providers interested in telemedicine should consider the benefits and barriers of each modality of care, the specific needs of their community, and the resources available within their health care system.

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Duality of Interest

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

Author Contributions

K.W. was involved in data collection and interpretation and writing the manuscript. R.S.E. contributed to the discussion and interpretation of the data and assessment of the pilot program. A.D.N. contributed to the discussion, writing, and editing of the manuscript. N.D.R. edited the final manuscript. K.W. is the guarantor of this work and, as such, had full access to the data in the study and takes responsibility for the integrity of the data and the accuracy of the analysis.

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Disclaimer

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