

The Impact of a Diabetes Self-Management Education Program Provided Through a Telemedicine Link to Rural California Health Care Clinics

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Abstract:

Background: This project investigated the impact of a DM self-management education program provided through a telemedicine link at nine rural health clinics in Northern California.

Methods: Two hundred thirty nine patients were provided with a single 2-hour class on DM delivered through a live televideo connection. Patients provided pre-intervention information on: demographics and overall health, self-care behaviors, and knowledge about DM. All participants completed a post-education survey on knowledge and self-care behaviors.

Results: There was a significant decrease in the number of patients who felt overwhelmed with their DM; pre-intervention 18.8%; post-intervention 5.4% ($P < 0.0001$). Patients increased the number of days they exercised; pre-intervention 3.4 days; post-intervention 3.9 days ($P = 0.02$). Patients increased the number of days they checked their feet; pre-intervention 4.2 days; post-intervention 5.6 days ($P < 0.01$). Knowledge about DM improved over the study period ($P < 0.01$).

Conclusions: A single 2-hour class on DM administered through a telemedicine link to patients in rural health clinics resulted in feeling less overwhelmed, more knowledgeable about DM, and demonstrated an increase in self-care behavior; ie, exercise and foot care.

Keywords: diabetes, self-management, education, telemedicine, rural

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Introduction

Type 2 Diabetes Mellitus (DM) is a common metabolic disorder and a major health care problem. Rates of DM have been steadily increasing over the last few decades and by 2025 it is estimated that the worldwide epidemic will include 420 million people.¹ The impact of DM on the individual, their family, and the health care system is substantial. In 2007, the American Diabetes Association (ADA) determined that the economic costs in the United States exceeded \$174 billion.² DM also has a disproportionate impact on certain populations. There are well documented disparities in the prevalence of DM and its outcomes among African Americans, Pacific Islanders, Hispanics, Native Americans, and other groups.³ Patients from rural areas are also known to bear a disproportionate burden of DM and its associated complications.⁴ Intervention studies on patients with DM have demonstrated that patients with better self-management support have improved outcomes.^{5,6} Finding adequate resources for self-management support in rural health clinics is challenging. The purpose of this project was to examine the impact of a DM self-management education program provided through a telemedicine link at a number of rural health clinics in Northern California.

Methods

Geographic focus

For this project, we targeted rural clinics in a 33 county area in Northern California. This service area stretches from the Oregon border in the north down to the Central Valley through Merced County.

Site identification

We worked with the University of California Davis Health System (UCDHS) Center for Health and Technology to identify potential healthcare sites for this project. The Center has telemedicine partners based in 55 different clinics, practices, and hospitals serving rural and medically-underserved communities. All of these sites are located within the described 33 county area and have existing video conferencing capability. We solicited interest from these sites by direct phone contact through our project manager. Sites that expressed interest in the project then had a follow-up meeting with the project manager and the two health coaches via televideo conference.

These meetings allowed the research staff to inform the physicians and administrative staff of these clinics about the project and answer any questions. The materials provided included: background information on the project, human subjects and teleconferencing requirements. All participating sites were provided with a site binder containing all of the Institutional Review Board (IRB) approved documents, the diabetes class booklet, consent documents, surveys and recruitment materials. The administrative staff of each participating site was asked to identify a site champion who could play a role in the recruitment of patients. The site champion was a full-time administrative staff member of the clinic chosen due to their interest in promoting DM self-management education and to have the skills necessary to recruit patients, provide the necessary forms to these patients, and ensure that a space was reserved for the educational session, and televideo equipment was in working condition.

Patient recruitment

Flyers to be posted in the waiting room were provided to assist clinics in patient recruitment. The flyers indicated that these classes were eligible for all adult patients with DM and that they would be provided in English and in Spanish and that the project required completion of research form materials. There were no explicit exclusion criteria presented on the flyer and there were no other methods used for patient recruitment. The site champion took the responsibility to ensure that the classes had a sufficient number of participants; ideally 4–8 patients per class.

Curriculum

The curriculum was based on the American Diabetes Association (ADA) Diabetes Recognition Program.⁷ The ADA Program was developed by a Task Force in 2006 which was charged with reviewing the standards for DM self-management education “for their appropriateness, relevance, and scientific basis.” The standards include recommendations that specific content areas be provided.⁷ Due to the limitations of a single 2-hour class, we condensed the content under the following topics: basic understanding of diabetes, nutrition, exercise, foot care, and self-management. Based on this content, a booklet in English and Spanish was prepared to guide patients through the class presentations.



Telemedicine classes

Each class was a live 2-hour televideo presentation. The site champion at each clinic was asked to ensure that a teleconnection was established and that consent was obtained for each participant.

Data collection

Prior to the start of each class, patients were asked to complete the following forms: “About Me” (demographics, internet access, and medical insurance); “About My Diabetes and General Health” (type of duration of diabetes, medications, general health questions, and specific questions on the most recent A_{1c} , LDL-cholesterol, blood pressure values, and most recent eye examination); “My Diabetes Care” (questions regarding self-management support provided by their healthcare provider); “My Self-Care Behaviors and Confidence” (questions regarding importance and confidence in managing diabetes, prior education on diabetes and specific self-care behaviors); and a “Pre-Education Patient Survey” (self-reported estimates on the difficulty in performing self-management tasks and self-reported knowledge on nutrition, exercise, and self-care behaviors). Each class was taught jointly by the two project health coaches. After the class, all participants completed the “Post-Education Patient Survey” (containing the same information as the Pre-Education Patient Survey) and the “UCDHS Telemedicine Diabetes Education – Patient Satisfaction Survey” (questions regarding their experience with the televideo class). Two follow-up surveys, “My Self-Care Behaviors and Confidence” and the “Post-Education Patient Survey” were mailed to all participants 8 weeks after the class was conducted.

Chart review

The two health coaches visited the participating rural clinics sites once to conduct the chart audits. All data was extracted from the medical records exclusively by the health coaches. The data included: ethnicity, diabetes medications, other chronic conditions, diagnosis of depression, last recorded vital signs, last A_{1c} , and LDL-Cholesterol.

Data analysis

Descriptive tables with frequencies and means for the core items contained within each survey

were prepared. To assess change in self-care and knowledge, change scores were calculated and Chi-square and *t*-tests were calculated to assess whether changes observed over time were beyond the level expected by chance.

Results

Participating clinics

Nine clinics met the previously stated requirements and were willing to participate in the study. These are listed in Table 1. Population estimates are from the United States Census Bureau, 2011 report.⁸ All clinics met the California Department of Health Services definition of a rural area.⁹

Participant demographics

There were 239 patients who participated in one of the 43 2-hour televideo presentations and who had completed all of the forms described above. Aggregate data of all participants are presented in Table 2. There were more women than men participating in the study (women = 60.7%, men = 39.3%). The typical demographic profile of a participant in the study was as follows: Caucasian (77.4%), has had Type 2 DM for over 5 years (51.2%), is on Medicare (49.0%), has a high school diploma (32.0%), and has the following associated co-morbid conditions: hypertension (55.6%; range 37.0%–74.1%), hyperlipidemia (40.2%; range 24.0%–83.3%), arthritis (36.8%; range 25.0%–52.0%), and depression (29.3%; range 16.7–50.05). Most patients were on an oral agent (60.9%) and had the following reported biomedical outcomes:

Table 1. Participating clinics in the telemedicine study.

Clinic	City	Population*
Sierra family medical clinic	Nevada city	3,068
Western sierra medical clinic	Downieville	282
Eastern plumas healthcare	Portola	2,104
Lassen medical group	Redbluff	13,147
Tulelake health center	Tulelake	1,010
Miners family health center	Grass valley	10,922
John C. Fremont healthcare district	Mariposa	1,373
Southern trinity health service	Mad river	420
Jackson rancheria health center	Jackson	4,651

Note: *Data from United States Census Bureau, 2011 report.⁸



Table 2. Demographics of 239 Participants (Aggregate data from nine participating clinics).

Gender	
Female	60.7%
Male	39.3%
Average age	62.8 years
Race	
Caucasian	77.4%
Latino	9.2%
Native American	8.4%
Asian/Pacific Islander	2.1%
African American	0.8%
Other	5.0%
Patient education	
Grade school	3.9%
Some high school	10.8%
High school diploma	32.0%
Some college	29.0%
Associate's degree	9.1%
Bachelor's degree	9.5%
Other	5.6%
Insurance	
Medicare	49.0%
Medical	25.5%
None	6.7%
Not reported	18.8%
Duration of DM	
Less than 1 year	17.5%
Between 1 and 5 years	31.3%
Over 5 years	51.2%
Type of DM	
Type 2	84.7%
Type 1	6.5%
Don't know	8.8%
Medications for DM	
Oral agents	60.9%
Insulin and oral agents	10.7%
Insulin alone	8.9%
Most recent A _{1c}	7.5%; range 6.8–8.3
Most recent LDL-cholesterol	106.2 mg/dL; range 84.7–113.6
Most recent systolic blood pressure	130.5 mmHg; range 118.2–149.0
Most recent diastolic blood pressure	76.0 mmHg; range 70.2–79.5
Associated co-morbid conditions	
Arthritis	36.8%; range 25.0–52.0
Depression	29.3%; range 16.7–50.0
Hypertension	55.6%; range 37.0–74.1
High cholesterol	40.2%; range 24.0–83.3
Kidney problems	8.4%; range 0.0–14.8
Poor vision caused by DM	18.0%; range 0.0–51.9

A_{1c} (7.5%; range 6.8%–8.3%), LDL-cholesterol (106.2 mg/dL; range 84.7–113.6 mg/dL), systolic blood pressure (130.5 mmHg; range 118.2–149.0 mmHg), and diastolic blood pressure (76.0 mmHg; range 70.2–79.5 mmHg).

Perceived self-management support

There were 19 different questions pertaining to a patient's perception of self-management support at the clinic where they receive medical care for their DM. (Appendix D). The questions were scored on a 5-point Likert scale; eg, 1 = "none of the time," 2 = "a little of the time," 3 = "some of the time," 4 = "most of the time," and 5 = "always." Patients were advised that their answers were confidential and would not be shared with their provider. Overall, there was no substantial difference in response between any of the 19 questions within a specific clinic and between the nine participating clinics. The mean overall score was 2.8; range 2.4–3.3.

Patient reported self-care and confidence

Participants in this study came in with fairly high scores of confidence and importance that trended upwards, but did not reach the level of statistical significance; mean pre-intervention confidence 3.7; mean post-intervention confidence 3.8 ($P = 0.30$); mean pre-intervention importance 4.4; mean post-intervention importance 4.7 ($P = 0.06$). However, there was a significant decrease in the number of patients who felt overwhelmed with their DM; pre-intervention 18.8%; post-intervention 5.4% ($P < 0.0001$).

Self-care behavior

There were significant changes in reported self-care behavior that persisted over the 8-week follow-up period. Patients reported an increase in the number of days that they exercised at least 30 minutes; pre-intervention 3.4 days; post-intervention 3.9 days ($P = 0.02$). They also reported an increase in the number of days they checked their feet; pre-intervention 4.2 days; post-intervention 5.6 days ($P < 0.01$). While each of the other behaviors trended upwards; there was no significant change in following a healthy eating plan, testing of blood glucose, or in mood.



Knowledge about DM

There were significant changes in self-reported knowledge about DM that persisted over the 8-week follow-up period. The Pre-Education Patient Survey (Appendix F) included seven questions that focused on patient's knowledge about DM. Patients reported an increase in how much they felt they know about these areas in aggregate ($P < 0.01$).

Discussion

Overall findings

A 2-hour diabetes education and self-management class, administered through a telemedicine link to patients in rural health clinics in California, demonstrated significant improvements in participant's self-confidence, knowledge, and self-care behavior. Specifically, patients felt more knowledgeable about their DM, felt less overwhelmed by their disease and reported exercising and checking their feet more frequently. These effects persisted over the 8-week follow-up period. The other notable findings of this project were as follows: (1) The recruitment of clinics was challenging. Of fifty-five identified clinics with a telemedicine infrastructure, only 9 were able to join this project. The most commonly stated barrier to participation in the project were competing priorities and lack of available personnel to help with patient recruitment. (2) Patients perception of the support they receive from their clinic in helping them manage their diabetes was concerning. All clinics received weak scores across all domains assessed.

Study limitations

Many of the demographic features of this study population were consistent with patients typically seen in a primary care setting. Most had DM for over 5 years, were on an oral agent and had comorbid conditions such as hypertension, hyperlipidemia, osteoarthritis, and depression. We were unable to determine whether this patient profile is reflective of the population of patients from each practice site. However, we are concerned with the demographics of the study population and how that might impact the ability to generalize our results. As described, the participants in this study were not as ethnically diverse as we had expected. We were also surprised by the lack of participation of patients who spoke Spanish; as we had specifically

developed classes in Spanish for this group. It is possible that the recruitment methodology influenced the demographic profile of the participants. Specifically, if we had access to a larger share of the aforementioned fifty-five clinics, a number of these clinics had a substantially more diverse patient population from which we could have recruited participants.

Another concern from the demographic profile of this population, is that those who did participate were likely in a higher stage of readiness to engage in the education program and the behavioral changes necessary to obtain better control of their DM. This is reflected in higher or increased scores in importance and confidence. Further, this group had fairly good control of their DM, blood pressure, and lipids at the onset of the study. Typically, those in the action stage of change represent approximately 20% of those with DM.¹⁰ We are unable to determine if patients who are more contemplative about starting a behavioral change are also helped by this type of educational intervention.

In general, the survey results suggest that patients found the technology to be user friendly and were accepting of this intervention. However, we did not compare other approaches that could deliver the same content. For example, an online webinar could have delivered the same content and we could have administered the telehealth classes at community centers, at patient homes and other locations with access to the internet and thereby circumvented the competing priorities of clinical sites.

Comparison to other studies

Our results support the findings of other studies which have shown that self-management training improves attitudes about DM and outcomes. For example, Norris and associates performed a systematic review of 72 randomized controlled trials. They concluded that the evidence supports the effectiveness of self-management training, particularly in the short-term. However, they were not able to demonstrate consistent improvement in long-term outcomes.¹¹

Our outcomes were similar to those involving an educational intervention. The diabetes education and self management programme (DESMOND) involved a three year follow-up of a multicentered randomized controlled trial in primary care clinics in



the United Kingdom.¹² Their intervention was more extensive than ours and involved face to face educational discussions; however, the basic theme was the same. They did a structured group education program for six hours delivered in the community by two trained healthcare professional educators and compared the outcomes to usual care. They found that the intervention did not result in statistically significant changes in biologic outcome measures such as glycated hemoglobin, blood pressure, weight, blood lipid levels or smoking status. However, there were some sustained improvements in some illness beliefs. These illness beliefs included: a greater understanding of their illness and its seriousness and a better perception of the duration of their diabetes and of their ability to affect the course of their disease. They did not assess specific activities such as regular foot examinations as we had done.

Siriwardena and associates published a review of telemedicine interventions in diabetes care.¹³ They assessed different types of telemedicine interventions including video conferencing, mobile phones, and telephone calls. The 8 studies using videoconferencing were similar to ours in the nature of the intervention; an emphasis on diabetes education materials and self-management training. They were able to show similar improvement in self-confidence and in attainment of behavioral goals consistent with our findings.

One challenge in assessing the impact of DM self-management education programs, has been to assess the comparative effectiveness of face-to-face training versus telemedicine training. A study by Kearns and associated specifically assessed this question.¹⁴ Their intervention was very similar to ours; two 3-hour sessions on DM education offered by a diabetes nurse educator, dietitian, and exercise physiologist. These were delivered either face-to-face (N = 39) or through real-time teleconferencing (N = 27). Monitored outcomes included assessments of glycated hemoglobin, a questionnaires on “emotional functioning in diabetes,” and “diabetes treatment satisfaction.” There were no substantive differences in outcomes between the face-to-face group versus the telemedicine group.

The long-term clinical impact of self-management education is unknown, particularly how it affects the associated complications and costs associated with DM. Given the epidemic of DM and its impact on

healthcare costs, it is important that future studies on this subject be conducted to assess these outcomes. We need to know whether the up front costs of these educational interventions have a meaningful return on investment. We need to know how this type of intervention affects utilization of health care services. Given the challenge clinics face with competing priorities, we need to know if other forums are equally capable of delivering this information and providing similar results on outcomes.

The results of this study have implications for those stakeholders in controlling costs and outcomes associated with chronic conditions such as DM. Education programs on chronic conditions may be considered within the course and scope of a public health intervention perhaps similar to the model used to help patients stop smoking. Patients in a stage of readiness to change could access this information, it would be credible and standardized and adjustable to language and provided outside the confines of the clinical setting.

Conclusion

In conclusion, patients with DM who participated in this self-management education program demonstrated improvement in self-confidence, knowledge, and made changes in their behavior that could have an impact on their disease outcome. Educational interventions similar to this may be an effective adjunct in dealing with the burden from chronic diseases such as DM.

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Competing Interests

Author(s) disclose no potential conflicts of interest.

Disclosures and Ethics

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also confirmed that this article is unique and not under consideration or published in any other publication, and that they have permission from rights holders to reproduce any copyrighted material. Any disclosures are made in this section. The external blind peer reviewers report no conflicts of interest. Provenance: the authors were invited to submit this paper.

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