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The Utilization of Video-Conference Shared Medical Appointments in Rural Diabetes Care

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THE UTILIZATION OF VIDEO-CONFERENCE SHARED MEDICAL APPOINTMENTS IN RURAL DIABETES CARE

Short title: Video-group appointments in diabetes

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ABSTRACT

Aim: To explore whether Video-Shared Medical Appointments (video-SMA), where group education and medication titration were provided remotely through video-conferencing technology would improve diabetes outcomes in remote rural settings.

Methods: We conducted a pilot where a team of a clinical pharmacist and a nurse practitioner from Honolulu VA hospital remotely delivered video-SMA in diabetes to Guam. Patients with diabetes and HbA1c $\geq 7\%$ were enrolled into the study during 2013-2014. Six groups of 4-6 subjects attended 4 weekly sessions, followed by 2 bi-monthly booster video-SMA sessions for 5 months. Patients with HbA1c $\geq 7\%$ that had primary care visits during the study period but not referred/recruited for video-SMA were selected as usual-care comparators. We compared changes from baseline in HbA1c, blood-pressure, and lipid levels using mixed-effect modeling between video-SMA and usual care groups. We also analyzed emergency department (ED) visits and hospitalizations. Focus groups were conducted to understand patient's perceptions.

Results: Thirty-one patients received video-SMA and charts of 69 subjects were abstracted as usual-care. After 5 months, there was a significant decline in HbA1c in video-SMA vs. usual-care (9.1 ± 1.9 to 8.3 ± 1.8 vs. 8.6 ± 1.4 to 8.7 ± 1.6 , $P=0.03$). No significant change in blood-pressure or lipid levels was found between the groups. Patients in the video-SMA group had significantly lower rates of ED visits (3.2% vs. 17.4%, $P=0.01$) than usual-care but similar hospitalization rates. Focus groups suggested patient satisfaction with video-SMA and increase in self-efficacy in diabetes self-care.

Conclusion: Video-SMA is feasible, well-perceived and has the potential to improve diabetes outcomes in a rural setting.

Keywords: video-Shared Medical Appointments; diabetes mellitus; group medical visits; rural medicine

Abbreviations:

ACE-inhibitor = Angiotensin converting enzyme - inhibitor

ARB = Angiotensin receptor blocker

CBOC = Community-based outpatient clinic

DM = Diabetes Mellitus

ED = Emergency Department

PACIC= Patient Assessment of Care in Chronic Conditions

VAMC = Veterans Affairs Medical Center

VHA = Veterans Health Administration

video-SMA = video-Shared Medical Appointments

1. INTRODUCTION

The burden of diabetes mellitus significantly impacts quality of life, as well as, economics for persons with diabetes and the healthcare system. Recent meta-analyses showed that multifactorial risk factor control reduces complications in diabetes without an increased risk of death, thus highlighting the importance of achieving guideline recommended goals for glycemic, as well as, hypertension, hyperlipidemia to reduce morbidity and mortality¹. Quality improvement strategies to reduce the burden of diabetes advocate for a concomitant multifactorial therapy². This must include vigorous behavioral and pharmacologic interventions which are labor intensive, costly², and difficult to accomplish in the traditional care settings³⁻⁵. Shared medical appointments (SMA's) are an innovative interdisciplinary model in improving care for chronic diseases including diabetes care⁶⁻¹¹. SMA's are defined as group visits in which several patients meet with one or more provider(s) at the same time⁸⁻¹⁵. In the group visit intervention, the SMA providers deliver interactive discussions to shape values that the person places on a given outcome in an environment of peer support. During the SMAs, the facilitator uses group dynamics to promote observational and experiential learning, provide reinforcement for healthy behavior, and foster diabetes self-management to promote self-efficacy^{10-12,16-19}. Thus, SMAs may well be an efficient method to achieve guideline recommendations in diabetes through efficient resource use, improvement of access to care, and promotion of behavioral change^{16-18,20,21} with peer support^{8-12,19,21}. It is also an ideal setting to activate patients and induce change in self-management behaviors^{8,9,12,13,22}.

Yet, the spread and access to these services are limited in rural areas due to lack of healthcare specialists and skill sets to conduct SMA's²³⁻²⁵. The challenges of health-care delivery in rural

areas are social and geographic isolation, limited access to multi-disciplinary expertise, lack of decision support and inter-professional exchange for the local providers^{11,23,24,26}. These socio-geographic barriers may be overcome by video-teleconferencing technology for real-time SMA (video-SMAs) between a distant provider and the local patients. Telemedicine is defined as the delivery of healthcare services using video-conference technology.²⁷ Given the recent advances in the delivery of health care through video-conference technology in the Veterans Health Administration (VHA)²⁸, this pilot study intends to explore the feasibility of innovative modes of care delivery, such as video-SMA, to improve DM care at remote clinical sites lacking local expertise.

2. MATERIALS AND METHODS

2.1 Study Design

Setting: This study targets the socio-geographic barriers in rural diabetes care using the Honolulu VAMC video-conferencing technology to deliver video-SMA to the Guam Community-based outpatient clinic (CBOC). The western most U.S. territory of Guam is a 210-square-mile tropical island, 3,950 miles from Hawaii. Guam has a shortage of health care professionals and presently has only one public hospital and a Naval hospital for acute care.

This pilot consisted of a prospective non-randomized study where a target of 100 patients with chart documented diabetes and HbA1c $\geq 7\%$, and were seen by their primary care provider during the study period were recruited. Given the short time-frame of 5 months, only thirty-one patients were recruited to participate in the video-SMA program (**Figure 1**). Written informed consent was obtained from each video-SMA participant. The remaining 69 subjects with diabetes who attended Guam CBOC for primary care during the same period of time served as the usual care

comparator group. A waiver of informed consent was approved to review the time-matched usual care participants' data. The Institutional Review Board and Research and Development Committees at the Honolulu VAMC and Providence VAMC (coordinating site) approved the protocol. All study procedures were conducted in accordance with the ethical standards of the Helsinki Declaration of 1975. Enrollment for this study began in January, 2013 and ended in February, 2014.

2.2 Study Population

Patient enrollment in both groups is shown in **Figure 2**. Patients were eligible if they had documented diabetes and HbA1c $\geq 7\%$, or were referred by their primary care providers to assist in diabetes care. Patients were excluded from the study if they were unable or not willing to participate in the video-SMA. Patients for the usual care group were selected from the Guam Veteran population with the same criteria of a baseline HbA1c $\geq 7\%$. A total of 69 usual care patients were consecutively selected for a total of 100 patients in the study.

Time 0 for the intervention group occurred at the time of the first video-SMA, while for usual care, the first primary care visit within the study period. Study duration was 5 months for all patients.

2.3 Intervention

Participants received 4 weekly video-SMA group sessions (3-5 patients per group) followed by 2 bi-monthly booster video-SMA visits for a total duration of 5 months (a total of 6 sessions). Each session was 120 minutes. Additionally, family members, friends or social support were encouraged to participate in the sessions. A nurse practitioner and clinical pharmacist at the Honolulu VAMC facilitated these sessions through video-teleconferencing to participants at the

Guam CBOC. Both facilitators were diabetes core content experts and certified as diabetes educators. The sessions consisted of education with behavioral and pharmacological interventions for diabetes, hypertension, and hyperlipidemia. The education included interactive lectures and use of conversation maps that were based on the American Diabetes Association (ADA) standards of diabetes self-management. Each session focused on one or two of the core diabetes content areas such as healthy eating or physical activity. During the video-SMA, participants were given an individualized cardiovascular risk report card that contained their current vitals and laboratory values. These report cards were updated with lab results, such as HbA1c and lipid panel, at the 1 month, 3 month, and 5 month visits. Medications for diabetes, blood pressure, and lipids were initiated or titrated according to their report cards, based on the national VHA diabetes guidelines, and the VHA national formulary. Individualized plans regarding diet, exercise, medication, and self-monitoring of blood pressure or blood glucose levels were given to patients at each visit. Each participant provided input for their behavioral modification goal to ensure that these met the patient's needs and was appropriate for patient's self-care abilities. Telephone follow-up visits were provided on an "as needed basis" to participants in regards to self-monitoring, management skills, and/or laboratory values and occurred on an average of once-twice monthly. Each video-SMA participant completed a voluntary Patient Assessment of Care in Chronic Conditions (PACIC) survey after the initial weekly sessions and also attended a focus group which was centered on understanding the obstacles patients faced in caring for their diabetes, as well as, assessing the perceived efficacy of video-SMAs.

2.3.1. Usual Care

Given geographical isolation leading to limited access to subspecialist physicians and health professionals of other disciplines, usual care for individuals with diabetes in Guam CBOC consisted of regular individual visits with primary care physician every 4 to 6 months. There was no access to shared medical appointments, clinical pharmacists and/or nurse practitioners; and family members, friends or social support were not specifically invited to be involved in the physician office visits. Telephone follow-up did not routinely occur in usual care.

2.4 Measurements and Outcomes

Medical/social history and medications were collected through chart review.

Quantitative Outcomes

The primary outcome of this study was to assess changes from baseline in HbA1c measured at 5 months. The secondary outcomes included changes in blood pressure and fasting lipid values (LDL-c, triglycerides) in the same time frame. Blood pressure was measured using the standard methodology by clinical staff with the participant in the seated position using an automatic electronic cuff. HbA1c and lipid tests were performed in a Clinical Laboratory Improvement Amendments (CLIA)-accredited laboratory at the U.S. Naval Hospital Guam. Our third outcome of interest was ED visits and hospitalizations, which were recorded through chart review.

Qualitative Outcomes

Patients: The PACIC survey²⁹ was administered for each video-SMA group at either week 3 or 4 of the video-SMA sessions. The PACIC is a well validated 20-item questionnaire, scored 1-5 for each question (1 for “none of the time”, 2 for “a little of the time”, 3 for “some of the time”, 4 for “most of the time” and 5 for “always”) and is a measure for concordance of care with the tenets of the chronic care model and has 5 subscales: Patient Activation, Delivery System

Design/Decision Support, Goal Setting, Problem-solving/Contextual Counseling, Follow-up/Coordination. The overall scale and the various subscales were internally consistent and moderately stable during test-retest.²⁹ Given abnormal distribution, PACIC scores are presented as the median and [interquartile range].

Focus groups were conducted by a clinical pharmacist (TT) and a nurse (LM) from Providence VA with expertise in the conduction of SMAs, one week after the PACIC survey administration. Focus groups were conducted only with those participants who were willing to stay after their video-SMA intervention. The focus groups were informed by the patients' responses to the PACIC surveys and input was elicited from the participants about the facilitators, barriers to diabetes self-management and perceived reasons for non-adherence to healthy behaviors. The level of satisfaction with the program and overall diabetes care at the VA were solicited from the participants to determine in what ways, the video-SMA helped or did not help them in their diabetes.

Provider: The video-SMA providers (clinical pharmacist and nurse practitioner) from Honolulu VAMC were interviewed after the intervention to elicit input about health system barriers to diabetes care, and how video-SMA may or may not have overcome those barriers. The interviews also focused on provider's attitudes and satisfaction about the video-SMA's as a mode of care delivery and whether they believe the video-SMA's helped provide better diabetes care.

2.5 Statistical Analyses

Continuous data were presented as mean and standard error of the mean (SE), whereas categorical variables presented as percentages. Baseline characteristics were compared using two-sample T-test with unequal variance for continuous variables and Pearson chi square test for categorical variables. Comparison of the change from baseline in HbA1c, lipids, and blood pressure values between the video-SMA and usual care groups were analyzed by linear mixed effects modeling which accounts for differences in baseline values, where the fixed effects are the study time period (baseline or 5 months), video-SMA intervention (or usual care) and time-period*video-SMA interaction, with the study subject being the random effect variable to account for multiple correlated measures within the same subject. Adjustments for baseline characteristics were made when significant imbalances existed in baseline characteristics between study groups were found. No significant differences between the intervention and control arm were found in baseline characteristics except for diastolic blood pressure which was accounted for in the linear mixed model. Comparisons between number of hospital admissions and non-hospitalization ED visits were also made using chi-square tests. Analyses were performed using the Stata SE version 11.0 (Stata Corp, College Station, TX). All *P* values were two-sided and a $P \leq 0.05$ was considered significant.

3. RESULTS

3.1 Baseline Characteristics

Thirty-one patients (divided into 6 cohorts) received video-SMA intervention and charts of 69 patients in usual care were abstracted for a total of 100 patients in the study. Amongst the video-SMA participants, 87% of them attended at least 5 of the 6 sessions of video-SMA visits. As shown in **Table 1**, overall mean age in both groups was 61 years, 95% were males, and 63% were Asian/Pacific Islander. At the time of study enrollment, most patients had diabetes duration

<10 years. Aside from a 5 mmHg difference in diastolic blood pressure, other variables were similar between the two groups.

3.2 Video-SMA and HbA1c Levels

The change from baseline value in HbA1c for patients in the video-SMA group was significantly greater than the usual care group (9.1 ± 0.3 to 8.3 ± 0.3 vs. 8.6 ± 0.2 to 8.7 ± 0.2 , respectively, $P = 0.03$, **Table 2**). As described in **Figure 3**, the greatest decline in HbA1c values in the video-SMA group was observed after 1 to 3 months.

3.3 Video-SMA and Blood Pressure and Lipid Levels

In regards to blood pressure, patients in the video-SMA group had significant decreases in both systolic ($P=0.01$) and diastolic blood pressures ($P=0.04$) from baseline, but not the usual care group (**Table 2**). However, the differences in the change from baseline in blood pressure were not significantly different between the video-SMA intervention and usual care groups ($P = 0.15$ for systolic and $P = 0.12$ for diastolic blood pressures).

Similar to blood pressure, differences in the change from baseline in LDL cholesterol or triglyceride levels were not significantly different between the video-SMA intervention and usual care groups (*LDL*: $P = 0.55$; *Triglyceride*: $P = 0.75$; **Table 2**).

3.4 Video-SMA and Healthcare Utilization

Patients in the video-SMA-intervention group showed a lower rate of ED visits relative to the usual care group (3.2% vs. 17.4%, $P=0.01$), but the hospitalization rates were similar between the two groups (3.2% vs. 2.9%, $P=0.64$).

Patients in the video-SMA-intervention group had a trend towards higher prescription rates of metformin (80.6% in video-SMA vs. 60.8% in control, $p=0.052$) and ACE Inhibitors/ARB (93.5% in video-SMA vs. 79.7% in control, $p=0.08$), while the prescription of statins, sulphonylurea and insulin were similar between the study arms (Table 5).

3.5 Qualitative Results:

Patient Assessment of Care in Chronic Conditions (PACIC) Survey:

Of the 31 patients in the video-SMA intervention, 19 participants agreed and completed the PACIC survey. Data was complete for 89% (17/19) of the surveys (Table 4). The median [interquartile range] of the PACIC summary score was 4.5 [4.1 to 4.6] indicating a perceived concordance with the tenets of the chronic care model in the “most of the time” to “always” range. There were slight differences between the different PACIC subscale scores. The subscale score for “follow-up/care coordination” resulted the lowest with a median score of 4.0 [3.3 to 4.5], corresponding to a rating of “a little of the time” to “most of the time” range. The highest subscale score was “problem-solving/contextual counseling” with a median subscale score of 4.8 [4.0 to 5.0], corresponding with a rating of slightly lower than “always” (Table 4).

Focus Groups:

Patients: Of the 31 patients in the video-SMA group, 15 patients and 2 members of social support participated in 4 focus groups. Six themes emerged: 1) overall satisfaction with the video-SMA experience, 2) patients feeling that the information provided was informative and personally beneficial, 3) improved awareness of the importance of social support in diabetes, 4) improvement in self-efficacy to perform self-care behaviors, and 5) an increased concern over

health and life expectancy, 6) satisfaction with the cultural competency of the video-SMA providers and the use of culturally appropriate educational materials.

The first theme of satisfaction with the group was present in all 4 of the focus groups. Overall, patients expressed enjoyment of the video-SMA visit and reported that it helped them manage their condition. Examples of quotes are: *“I found it informational...I learned a lot about my diabetes and what I need to do to prevent complications”*, *“the providers answer all my questions and explain to me what is happening and why”*, and *“I think there is a great need for something like this for everyone”*.

Patients also acknowledged that they were satisfied with their clinical care and management. Examples include: *“Everyone seems like they really care about us and are concerned and, want us to take care of ourselves....,”* and *“...she [the video-SMA provider] is very good., and she is a smart lady and knows about all the foods we eat and how it is over here” ...”*

Two participants however, provided recommendations for program improvement. The first participant expressed that he would prefer to have more *“individual time”* with the video-SMA providers to discuss his personal diabetes concerns such as *“mental health issues that affect the way I take care of my diabetes”* and another participant expressed frustration with members of the group who were allowed to *“get off track too much”*.

The second theme was patients feeling that the information provided was informative and personally beneficial. Patients acknowledged an increase in knowledge stating: *“I learned about*

what my goals are, how often I should be checking my sugars and what can happen if I don't take care of it [diabetes]”, and “...they talked about diet, you know, carbohydrates, exercise, all the other things you're supposed to do if you have diabetes”.

The third theme was improved awareness of the importance of social support in diabetes. When they were asked the question about whether or not other members of the group helped them take care of their diabetes, patients' responses indicated they learned a lot from others in the group and that peer interaction and support was beneficial: *“I learned a lot about what other people are doing for their diabetes”, and “This guy told me about what was going to happen to me if I don't do what I am supposed to do”.* Several participants also shared that it was comforting to know that *“they weren't alone”, or “other people have the same problems as me”.*

The fourth theme was improvement in self-efficacy to perform self-care behaviors. This is especially important since the participants also expressed lack of self-control over dietary habits and lack of confidence to manage their own diabetes. Patients in the video-SMA group expressed increased motivation for self-care behavior change or improvement in self-care skills: *“The sessions are making me more responsible. I know that someone is going to be checking me and all the other guys will have their stuff done so I have to get it done too”, “Now, I know how many times I should be checking [blood glucose] and what to do about it...” and “...Now I know how important it is to take all my medications”.*

The fifth theme was an increased concern over health and life expectancy. Patient expressed that *“now that I know what can happen if I don't eat right and take my medications” and “now that I*

know all the problems that I can have with my feet, eyes and heart I am going to be more careful”.

The final theme was satisfaction with the cultural competency of the video-SMA providers and the use of culturally appropriate educational materials. Patients made statements such as “*She [the video-SMA provider] knows it is different over here. We have our [customary] barbecues and everyone tells you to eat, eat! It is hard to say no...*” and “*...the food we have is different, we have our poi poi and we make our food different; she knows that*”

Providers: The video-SMA providers were interviewed after the video-SMA intervention. Four themes emerged from the semi-structured interviews: 1) Overall satisfaction with the video-SMA experience, 2) Perceived benefits for their patients 3) Health system barriers to diabetes care and potential resolutions for these barriers and 4) Effective video-SMA facilitation strategies and key elements.

The first theme of overall satisfaction with the video-SMA experience was endorsed by both providers. Both providers expressed that “*it was very rewarding to see challenging, high-risk patients become better self-managers, teachers and motivators for other patients, as well as have improved clinical outcome measures after participation in video-SMA*”.

The second theme was the perceived benefit of peer support for their patients. The video-SMA providers acknowledged that peer support contributed to the improvements in patient outcomes

and stated *“with team guidance, patients learn from each other about solutions to tackle the day-to-day challenges in a way that is impossible to achieve in traditional individual clinic visits”*.

The third theme was perceived health system barriers and potential resolution for these barriers. Both providers acknowledge that the physical distance (Honolulu to Guam) and lack of personnel dedicated to video-SMA activities along with an overburdened support staff initially posed challenges to care delivery at the intervention site. The physical distance and mail delivery from a VHA central filling pharmacy often created a lag time for medication delivery, making it difficult to initiate new medication therapies. Therefore, the video-SMA providers worked with the intervention site to increase their cache supply of medications relevant to diabetes care. Since the tele-communication system on the island of Guam is inconsistent it was often difficult for Honolulu providers to call patients to obtain blood glucose values. The video-SMA providers partnered with the intervention site provider to obtain blood glucose readings during interim care visits in order to titrate medications accordingly. Finally, the lack of support staff dedicated to video-SMA activities created delays in obtaining vital signs prior to the video-SMA appointment. Negotiation and partnership with local providers at the intervention site increased dedicated time of local personnel to video-SMA related activities and re-prioritization of workload, resulting in decreased delays during sessions.

The final theme discussed was the effective video-SMA facilitation strategies and key components to maximize patient interaction in the group setting while participating in video-SMA communication. The providers identified that the use of interactive games and patient education tools such as diabetes report cards and standardized self-monitoring forms were

essential to promote interactive discussions among participants. Also, the video-SMA providers underscored the importance of cultural competency stating that it was “*critical that we [the video-SMA providers] were sensitive and expressed a value for diversity; that we were conscious of the dynamics inherent to the participant’s cultures especially in the group interaction and demonstrated that we [the video-SMA providers] had knowledge regarding these differences and were willing to adapt our service delivery to reflect an understanding of cultural diversity*”.

3.6. Working collaboration between the clinical pharmacist and the nurse practitioner

The pharmacist and the nurse practitioner were in the same room during the SMAs where they complement their different expertise to manage diabetes and counsel the patients on a variety of topics in diabetes self-care. The pharmacist’s emphasis was in medication management, adherence and side effects; while the nurse practitioner’s emphasis was on clinical signs and symptoms of comorbid conditions or complications of diabetes, interpretation of test results and the need for referral to other clinical specialists. In addition, both providers were able to initiate or adjust medications for diabetes, hypertension and lipids.

4. DISCUSSION

In a prospective, non-randomized study with concomitant historical controls, we showed that video-SMA in diabetes, delivered remotely through video conferencing technology, was feasible, well perceived by the patients and providers, and associated with a significant decline in HbA1c compared to the usual-care comparator. Additionally, patients in the video-SMA group had

significantly lower rates of ED visits (3.2% vs. 17.4%, $P=0.01$) compared to the usual-care, but with similar hospitalization rates.

Although previous studies have shown the efficacy of SMAs in improving glycemic and blood pressure control,^{16-18,20,21} these SMAs have been conducted in the concomitant physical presence of both the providers and the patients. Thus, the feasibility and efficacy of SMAs in diabetes delivered through video-conferencing technology is unknown. This study represents the first steps to show that this novel mode of care delivery is feasible and possibly efficacious. In addition to the overall satisfaction with the video-SMA experience, our patient focus groups suggested that the overarching goals of education, medication titration and peer support were achieved and there appeared to be improvement in the self-efficacy to perform self-care for these patients with diabetes. There were also trends toward higher prescription of guideline recommended therapy for diabetes such as metformin and ACE inhibitors/ARB. These are likely contributory factors through which the improvement in HbA1c and reductions in ED visits were observed. On the other hand, the highest impact of video-SMA's on HbA1c was seen after the four weekly sessions up to month 3, after which the patients get a bi-monthly booster session, where we found HbA1c values had started to rise again. This finding would suggest that it takes frequent video-SMA support to inculcate diabetes self-management and to maintain glycemic control on the long term. Potential implications of the above would favor the use of non-physician providers as suggested by this study for sustainability of the program and control of cost.

Aside from usual barriers to diabetes self-management such as lack of self-control over dietary habits and lack of personal control over how to manage their diabetes,³⁰ there are also unique barriers to diabetes self-management in diabetic patients in Guam. There is generally a low physical activity level and a lack of fruits and vegetables in their diet in the lifestyle habits of people in Guam.^{31,32} In addition, geographic isolation may also result in limited access to qualified personnel to provide diabetes self-management education as well as medication and testing supplies in a consistent fashion (focus groups). Thus, the potential impact of implementation of the video-SMA initiative in rural areas, such as Guam, could facilitate diabetes care and self-management by: 1) improving access to providers experienced in diabetes management for monitoring and reinforcement of diabetes self-care behaviors; 2) providing multi-disciplinary diabetes care to educate about multiple aspects of diabetes self-management; 3) training local health care personnel and help rural sites meet quality standards for diabetes care and 4) providing peer support for diabetes self-management. Video-SMA's may enable patients residing in rural areas to receive a similar level of care for their diabetes from remote providers of distant clinic or hospital facilities without the inconvenience and expenses of traveling to those distant sites. These results also shed light on the program capacity for planning of future large scale implementation trials. In this case, a team of a clinical pharmacist and a nurse practitioner were able to complete 6 video-SMA groups of 31 participants in a short duration of 5 months with good results.

However, we also noted that video-SMA did not completely fulfill the health care needs of the patients with diabetes (theme from focus groups), and there was the need for individual time with

the video-SMA provider and possibly frequent visits, which may be an important facet to incorporate in the future design. Another aspect of the theme from the focus groups was the importance the patients placed on the cultural competency of their health care providers. In this case, the video-SMA providers from Honolulu were well-versed with the idiosyncrasies of the local culture, especially food, as well as the use of culturally appropriate educational materials, which may explain in part their success with achieving good diabetes outcomes.

From the provider perspective, although there were system barriers such as lack of dedicated support for the video-SMA patients and communication challenges with patients (lack of a consistent telecommunication system), many of these barriers were overcome and there was overall satisfaction and perceived benefit of this video-SMA intervention. In contrast, we did not see significant differences in blood pressure between the two groups despite significant reductions in blood pressure in the video-SMA patients. The likely reason for this discrepancy is the small sample size of this pilot which limited statistical power. Similarly, significant differences in reduction of lipid parameters were not detected. In addition to sample size, other possible reasons for similar lipid outcomes between video-SMA and usual care could include relatively low LDL levels at baseline which limits room for improvement, and the improvement in lipid values in both arms.

On the other hand, the results of this trial should also be considered preliminary as potential limitations are: 1) its small sample size and the enrollment of mostly men (reflective of the gender composition of U.S. military veterans), which may limit generalizability; 2) the quasi-experimental design which may be prone to selection bias, despite that baseline characteristics

appeared to be balanced between the treated and usual-care groups; and 3) the unique setting in Guam and Honolulu sites with electronic medical records and video-conferencing capacity which may limit expansion to programs without a similar set up. Given the pilot nature of the study without an attention control arm, it is also possible that our findings can be explained by paying more attention to patients included in the video-SMA group than to patients in the usual-care group. Nonetheless, we showed that the program is feasible, associated with a significant decline in HbA1c and with high patient and provider satisfaction; therefore, justifies a larger, multi-site randomized-control trial to further confirm these preliminary findings.

AUTHORS' CONTRIBUTIONS

All of the listed authors have made substantial contributions to the intellectual content of this manuscript. LT, LL, AT, TT, LM and WW conceived and designed the research, acquired the data, analyzed and interpreted the data. AT, TT and WW performed the statistical analyses. LT, LL, AT, HH, DE, SK, TT and WW drafted the manuscript and made critical revision of the manuscript for important intellectual content.

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STATEMENT ON CONFLICTS OF INTEREST

None

SUMMARY POINTS

- Multifactorial behavioral and pharmacological interventions for cardiovascular risk reduction are necessary to reduce complications, but are difficult to accomplish in traditional care settings.
- Shared medical appointments (SMA's), defined as group visits in which several patients meet with one or more providers at the same time, are an innovative interdisciplinary model to target multiple risk factors in the same setting for chronic diseases including diabetes but may be difficult to deliver in rural setting given limited resources and availability health care providers.
- This prospective, non-randomized study with concomitant historical controls, showed that video-SMA in diabetes, delivered remotely through video conferencing technology, was feasible, well perceived by the patients and providers, and associated with a significant decline in HbA1c compared to the usual-care comparator.
- Video-SMA to improve DM care may also lower rates of emergency department visits, but does not impact rates of hospitalization.

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TABLE 1 Baseline Characteristics

	Usual Care	Video-SMA Intervention	P value
N	69	31	-
Age (mean ± SE, years)	61.6±1.1	60.4±1.4	0.48
Asian/Pacific Islander (%)	71	55	0.17
Male (%)	89.9	100	0.07
Weight (mean ± SE, kg)	93.5±2.1	95.9±4.2	0.61
Duration of diabetes (%)			
≤5 years.....	30.4	16.1	0.32
6-10 years.....	30.4	34.4	
>10 years.....	39.1	48.4	
Smoker, current (%)	34.8	32.3	0.80
Coronary Artery Disease (%)	43.5	38.7	0.66
Stroke (%)	10.1	6.5	0.55
Hypertension (%)	95.7	96.8	0.92
Systolic Blood Pressure (mean ± SE, mmHg)	135.1±1.9	141.8±3.0	0.07
Diastolic Blood Pressure (mean ± SE, mmHg)	75.0±1.4	80.8±2.2	0.03
HbA1c (mean ± SE, %)	8.6±0.2	9.1±0.3	0.21
Total cholesterol (mean ± SE, mmol/L)	4.4±0.1	4.5±0.2	0.68
Triglycerides (mean ± SE, mmol/L)	2.2±0.2	2.6±0.7	0.57
LDL-cholesterol (mean ± SE, mmol/L)	2.4±0.1	2.4±0.2	0.95
Insulin, all forms (%)	52.1	51.6	0.96
Metformin (%)	66.6	74.2	0.44
Sulphonylurea (%)	37.6	48.3	0.32

Statin (%)	79.7	77.4	0.80
ACE Inhibitors/ARB (%)	88.4	87.0	0.86
<p>ACE= angiotensin-converting enzyme; SE = Standard error of the mean; ARB = Angiotensin receptor blocker Bold = Significantly different between video-SMA and usual care groups.</p>			

TABLE 2 Effect of Video-SMA on HbA1c, Blood Pressure, and Lipid Levels.

Outcomes (mean ± SE)	Usual Care			Video-SMA intervention			P Value for comparison between video-SMA and Usual care
	N	Baseline	5 month	N	Baseline	5 month	
HbA1c (%)	69	8.6±0.2	8.7±0.2	31	9.1±0.3	8.3±0.3	0.03
Systolic Blood Pressure (mmHg)	67	135.1±1.9	131.5±1.5	31	141.8±3.0	132.6±3.2*	0.15
Diastolic Blood Pressure (mmHg)	67	75.0±1.4	74.3±1.3	31	80.8±2.2	75.8±1.8*	0.12
LDL-cholesterol (mmol/L)	69	2.4±0.1	2.3±0.1	31	2.4±0.2	2.2±0.2	0.55
Triglycerides (mmol/L)	69	2.2±0.2	2.4±0.3	31	2.6±0.7	2.1±2.3	0.75

*P<0.05 compared to baseline
SE = Standard error of the mean
Bold = Significantly different between video-SMA and usual care groups.

TABLE3 Effect of video-SMA on Emergency Department and Hospital Visits

	USUAL CARE (N = 69)	Video-SMA INTERVENTION (N = 31)	P Value
	Number of Events (%)	Number of Events (%)	
Emergency Department Visits*	16 (17.4)	1 (3.2)	0.01
Hospitalizations	4 (2.9)	1 (3.2)	0.64

Bold = Significantly different between video-SMA and usual care groups.
 *Did not result in hospitalization.

TABLE 4. Patient Assessment of Care in Chronic Conditions (PACIC) Score from Participants in the Focus Groups

PACIC Domains	N	Median	Interquartile Range
Patient Activation	19	4.3	3.7 to 5.0
Delivery System/Decision Support	19	4.7	4.0 to 5.0
Goal Setting/Tailoring	19	4.4	4.0 to 4.8
Problem Solving/Contextual Counseling	18	4.8	4.0 to 5.0
Follow-up/Coordination	17	4.0	3.3 to 4.5
PACIC SUMMARY SCORE	17	4.5	4.1 to 4.6
PACIC = Patient Assessment of Care in Chronic Conditions			

TABLE 5. Diabetes and Lipid-Related-Medications at 5 Months from Baseline

	Usual Care	Video-SMA Intervention	P value
N	69	31	-
Insulin, all forms (%)	56.5	61.3	0.65
Metformin (%)	60.8	80.6	0.052
Sulphonylurea (%)	37.7	51.6	0.19
Statin (%)	79.7	83.8	0.62
ACE Inhibitors/ARB (%)	79.7	93.5	0.08
ACE= angiotensin-converting enzyme; ARB = Angiotensin receptor blocker Bold = Significantly different between video-SMA and usual care groups.			

FIGURE 1

Flowchart of Study Inclusion Exclusion Criteria

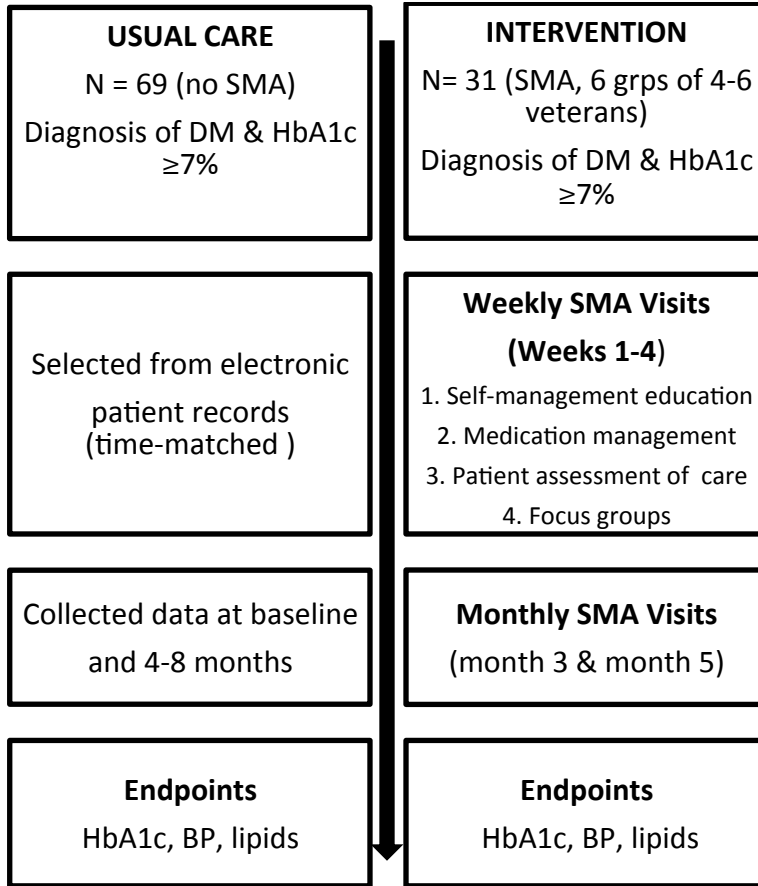


FIGURE 2

Consort Diagram of Participants

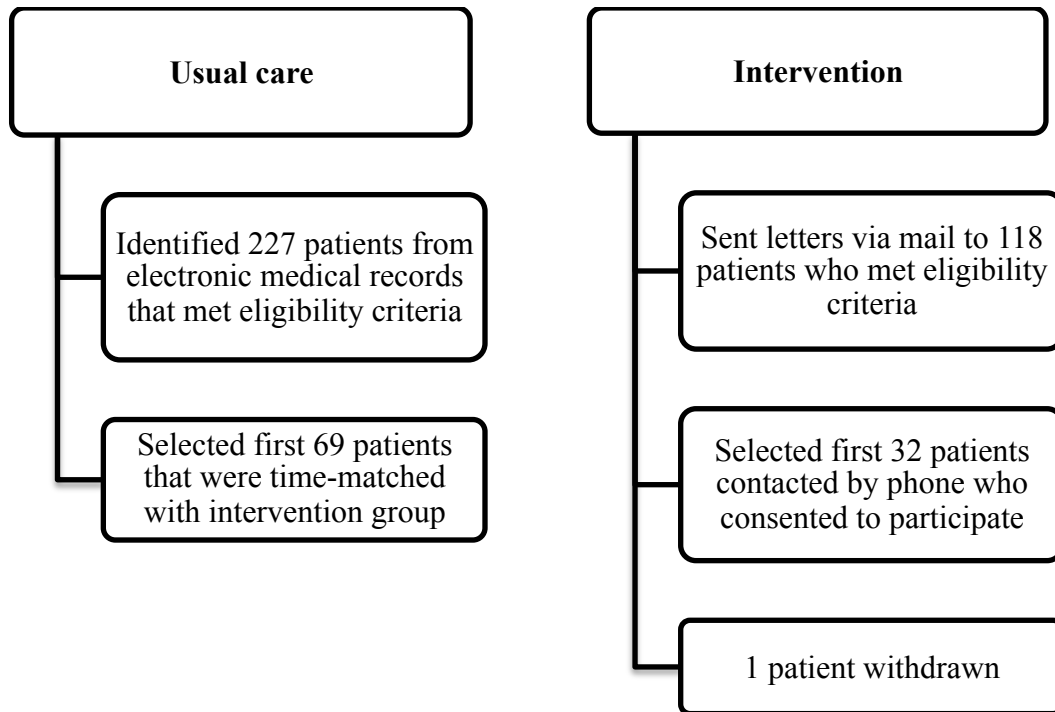


FIGURE 3

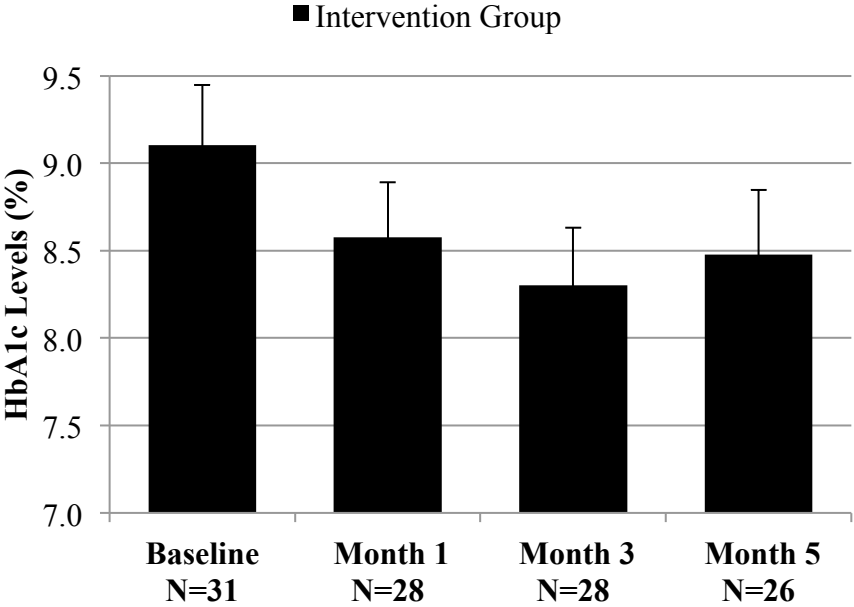


Figure 3. Effect of video-SMA on HbA1c Levels over Duration of Study. HbA1c levels were measured in the video-SMA group at baseline, 1 month, 3 months, and 5 months. Values represent the mean \pm SE.