Original research

Improvements in illness self-management and psychological distress associated with telemonitoring support for adults with diabetes

James E. Aikens [a,], Ann-Marie Rosland [b,c], John D. Piette [c,d]*

[a] *Department of Family Medicine, University of Michigan, Ann Arbor, MI, USA*
[b] *Division of General Internal Medicine, University of Michigan, Ann Arbor, MI, USA*
[c] *VA Ann Arbor Center for Clinical Management Research, Ann Arbor, MI, USA*
[d] *Department of Health Behavior and Health Education, School of Public Health, University of Michigan, Ann Arbor, MI, USA*

ABSTRACT

Objective: The objective of this observational open label trial was to characterize changes in diabetes self-management and psychological distress associated with a mobile health (mHealth) interactive voice response (IVR) self-management support program.

Methods: For 3–6 months, 301 patients with diabetes received weekly IVR calls assessing health status and self-care and providing tailored pre-recorded self-management support messages. Patients could participate together with an informal caregiver who received suggestions on self-management support, and patients' clinicians were notified automatically when patients reported significant problems.

Results: Patients completed 84% of weekly calls, providing 5682 patient-weeks of data. Thirty-nine percent participated with an informal caregiver. Outcome analyses adjusted for study design factors and sociodemographics indicated significant pre–post improvement in medication adherence, physical functioning, depressive symptoms, and diabetes-related distress (all p values <0.001). Analyses of self-management problems indicated that as the intervention proceeded, there were significant improvements in patients' IVR-reported frequency of weekly medication adherence, SMBG performance, checking feet, and frequency of abnormal self-monitored blood glucose readings (all p values <0.001).

Conclusions: We conclude that the combined program of automated telemonitoring, clinician notification, and informal caregiver involvement was associated with consistent improvements in medication adherence, diabetes self-management behaviors, physical functioning, and psychological distress. A randomized controlled trial is needed to verify these encouraging findings.

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* *Corresponding author at*: Department of Family Medicine, University of Michigan, 1018 Fuller Street, Ann Arbor, MI 48104-1213, USA. Tel.: +1 011 734 998 7120x327; fax: +1 011 734 998 7335.
E-mail address: aikensj@umich.edu (J.E. Aikens).

1. Introduction

Inadequate self-management of blood glucose and blood pressure among patients with type 2 diabetes are associated with subsequent chronic hyperglycemia, microvascular complications, and heart disease [1]. Although care management improves outcomes [2], such services depend upon scarce personnel to provide between-visit monitoring and patient education [3]. Mobile health (mHealth) services, including interactive voice response (IVR) calls in which patients respond to automated prompts, may help address these barriers to effective care management [4,5].

Support from informal caregivers also is likely to improve diabetes outcomes. However, in-home caregivers often lack the tools they need to systematically monitor changes in patients' health status and support self-care [6]; and caregivers are at risk for burnout in part due to the high demands and insufficient clinical support for their role [6,7]. Many patients live alone, with up to 7 million Americans receiving "long-distance" caregiving [8]; and caregivers at a distance may receive insufficient information about the patient's day-to-day self-management [9]. mHealth monitoring and feedback to caregivers may enable these geographically distant supportive individuals to be more involved and effective.

To address the gaps in informational support for people with diabetes and their social networks, we developed an mHealth service that makes weekly automated IVR calls to patients in order to closely monitor their self-management and provide immediate problem-tailored support. The service notifies health care teams when patients experience significant difficulties and provides caregivers from outside the patients' home with automatic, structured updates about the patient's status along with guidance on self-management support. In a prior report describing our implementation of this intervention [10], we demonstrated that the system detects abnormal glycemia and blood pressure levels that might otherwise go unreported; provides clinical information that is reliable, valid, and actionable; and increases patients' access to between-visit monitoring and diabetes self-management support. In this present report, we test the hypothesis that the intervention yields long-term improvements in functional status, depressive symptoms, and diabetes-related distress increases, and that it improves three self-management behaviors (medication adherence, self-monitoring of blood glucose (SMBG), and checking one's feet for tissue damage) as well as the frequency of high and low blood glucose values as indicated by SMBG.

2. Methods

2.1. Patient eligibility and recruitment

Patient participants were recruited from 16 Department of Veterans Affairs (VA) outpatient clinics in Michigan, Illinois, Indiana, and Ohio between March 2010 and December 2012. Eligibility criteria were: an ICD-9 diagnosis of type 2 diabetes; one or more outpatient VA primary care visits in the prior 12 months; and one or more current VA prescriptions for an antihyperglycemic medication. We excluded patients with diagnoses indicating cognitive impairment or severe mental illness or who were living in a supervised residential facility. Potential participants were mailed an introductory letter and then further screened for eligibility by telephone. After providing written informed consent, patients received information about using the IVR system and communicating effectively with informal caregivers and clinicians. Participants were paid $20 for each of two 45-min interviews, which occurred at baseline and at study completion. The study was approved by human subjects committees at the Ann Arbor VA Healthcare System and University of Michigan.

2.2. Baseline assessment

We assessed patients' characteristics at baseline by telephone. For the current analyses, we created dichotomous indicators for minority race/ethnicity, being married, and having more than a high school education. Self-reported annual household income was collapsed into approximate quartile brackets of <$15,000, $15,000–29,999, $30,000–54,999, and $55,000+. We computed a summed index of physician-diagnosed medical comorbidities based on a self-report checklist of common chronic conditions, and collapsed this into brackets for 0–3, 4–6, and 7+ comorbid conditions. The Morisky Medication Adherence Scale (MMAS) was used to measure long term medication nonadherence, and for descriptive purposes we applied the standard cut-off of 2 to indicate nonadherence [11,12]. From the Medical Outcome Study 12-Item Short Form (SF-12) [13], we calculated the Physical Composite Score (PCS) and Mental Composite Score (MCS). For both the PCS and the MCS, higher scores reflect better functioning in the respective domain, the potential range spans 0–100, and the population mean is 50.0 (SD = ±10.0). We administered the 10-item version of the Center for Epidemiological Studies Depression Scale (CES-D) [14], and for descriptive purposes we also created a binary indicator for clinically significant depressive symptoms using Irwin et al.'s [15] cutoff for older adults. We applied the established cutoff of 40 to define diabetes distress using the Problem Areas in Diabetes (PAID) [16], which measures diabetes-specific psychological distress.

2.3. Intervention

The focus of the mHealth service was based on the assumption that patients, informal caregivers, and healthcare teams would use frequent updates about the patient's health and self-care along with automated tailored advice to address emerging problems and improve illness self-management [17]. The overall goals of the intervention were to: (a) monitor patients' symptoms and self-management problems, (b) provide patients with tailored messages about diabetes self-management and medical help-seeking, (c) generate guidance on self-management support for patients' informal caregivers via structured emails, and (d) provide patients' clinicians with actionable feedback via faxed updates about selected patient-reported health and self-care problems.

During each week that an IVR call was scheduled, the system made up to three attempts to contact each patient on