Self Management

Twelve-month outcomes of an Internet-based diabetes self-management support program

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ABSTRACT

Objective: Internet-based programs offer potential for practical, cost-effective chronic illness self-management programs.
Methods: We report 12-month results of an Internet-based diabetes self-management program, with and without additional support, compared to enhanced usual care in a 3-arm practical randomized trial. Patients ($n = 463$) were randomized: 77.3% completed 12-month follow-up. Primary outcomes were changes in health behaviors of healthy eating, physical activity, and medication taking. Secondary outcomes were hemoglobin A1c, body mass index, lipids, blood pressure, and psychosocial factors.
Results: Internet conditions improved health behaviors significantly vs. usual care over the 12-month period (d for effect size = .09–.16). All conditions improved moderately on biological and psychosocial outcomes. Latinos, lower literacy, and higher cardiovascular disease risk patients improved as much as other participants.
Conclusions: The Internet intervention meets the reach and feasibility criteria for a potentially broad public health impact. However, 12-month magnitude of effects was small, suggesting that different or more intensive approaches are necessary to support long-term outcomes. Research is needed to understand the linkages between intervention and maintenance processes and downstream outcomes.
Practice implications: Automated self-management interventions should be tailored and integrated into primary care; maintenance of patient self-management can be enhanced through links to community resources.

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1. Introduction

With the increased prevalence of diabetes [1], there is increasing need for diabetes self-management support that has the ability to reach large numbers of adults [2]. Traditional clinical approaches, such as physician counseling and group-based diabetes education programs [3], have inadequate reach, and have not been sufficient to support long-term behavior changes [4–6]. In addition, primary care offices generally do not have the resources or time to provide diabetes self-management education and follow-up support [7,8]. Widespread use of the Internet provides an opportunity to expand the reach of diabetes education programs, and to provide continuous support and tools for achieving necessary changes in multiple lifestyle behaviors, such as healthful eating, regular physical activity, and managing medications [9,10].

Despite reviews suggesting that computerized interactive behavioral health change interventions can be effective [4,11,12], questions remain about whether these programs will prove equitable in terms of access to services, or whether the "digital divide" may increase disparities and about their longer term effects and overall public health impact [13]. From an ecological perspective on health behavior change [14], it is also not known whether website use and outcomes are influenced by factors such as individual characteristics, especially factors such as

level of computer use and health literacy and numeracy; social network/social support; and community/environmental influences.

Evidence from our previous research indicates that effective diabetes self-management interventions (a) incorporate the patient as an active participant in setting goals, (b) are based on behavioral and social-ecological theory, (c) emphasize problem solving and use of supportive resources, and (d) provide proactive follow-up support [15–17]. Translating these important principles into interactive components in an electronic or virtual environment is complex. Furthermore, integrating such programming with primary care activities is important. With the growing emphasis on telemedicine and electronic health records, integrating Internet-based diabetes self-management activities with primary care is a logical step. Whether web-based approaches can eliminate or substantially reduce the need for personal and social support is unclear, and research is needed to understand the right formula of human and computerized support to produce sustained, long-term behavior change [18].

In this paper we follow up on our earlier publications [19,20] to report 12-month results of a three-arm pragmatic randomized trial to evaluate an Internet-based, computer-assisted diabetes self-management (CASM) intervention compared to a CASM plus human support (CASM+) condition. BOTH versions of the intervention were offered in English and Spanish, and compared to enhanced usual care (EUC). Initial results at a 4-month follow-up revealed relatively high levels of website use as well as dietary and exercise behavior improvements relative to the enhanced usual care comparison condition, but only modest and non-significant improvements in biological outcomes relative to the EUC condition [19,20].

Our primary purposes in this article are to expand upon our earlier immediate treatment results to: (a) report longer-term (12-month) results, including engagement, attrition, behavior change, biological impacts, and psychosocial outcomes; (b) using the RE-AIM model, investigate if the earlier, promising engagement and initial behavior change results were maintained and translated into broader public health outcomes at 12 months; and (c) investigate potential effects of moderator variables hypothesized to impact the outcomes of the intervention (e.g., health literacy or numeracy, age, racial or ethnic differences, and level of baseline computer use).

2. Methods

A patient-randomized practical effectiveness trial [21] evaluated two Internet-based diabetes self-management programs relative to EUC. The interventions were (a) self-administered, computer-assisted self-management (CASM), based on social-ecological theory [22] and the "5 As" self-management model [23] and (b) the CASM program with the addition of enhanced social support (CASM+). EUC provided computer-based health risk appraisal feedback and recommended preventive care behaviors using the same contact schedule as the CASM conditions, but did not include the key intervention procedures.

The study was conducted in five primary care clinics within Kaiser Permanente Colorado (KPCO). Clinics were selected based on variability in size, location and socioeconomic status of neighborhood, and to maximize percentage of Latino patients. Recruitment issues are described in detail in Glasgow et al. [19] and summarized in Fig. 1. Eligibility criteria included: 25–75 years of age, diagnosis of type 2 diabetes, body mass index (BMI) of 25 kg/m^2 or greater, and at least one other risk factor for heart disease (e.g., hypertension, smoking, hyperlipidemia). Additional inclusion criteria were access to a telephone and at least biweekly access to the Internet, ability to read and write in English or Spanish, and ability to perform mild to moderate exercise. Participants were individually randomized via a computer program developed by our computer programmer and statistician. Data were collected from April 2008 to August 2010 and analyzed from September 2010–January 2011. All procedures were approved by the KPCO institutional review board.

2.1. Interventions

Both interventions included a set of behavior change techniques which we have listed using the classification system developed by Michie and colleagues [24]. These techniques are listed in Table 1 by intervention and intervention phase. Social cognitive theory [25] and a social-ecological model [26] were the primary intervention frameworks used. The RE-AIM framework was used for planning and evaluation. Interventions were available in English and Spanish, and based on refinements of interactive self-management programs found effective in our prior research [27].

2.1.1. CASM

CASM participants were given access to the "*My Path to Healthy Life*"/"*Mi Camino A La Vida Sana*" website and instructed in log-in, navigation, and usage procedures by a research staff member. Participants were asked to select initial, easily achievable goals in each of three areas: medication adherence, physical activity, and food choices. They recorded their progress on these three daily goals using the tracking section of the website and received immediate feedback on success in meeting their goals over the past 7 days. The website, described in detail elsewhere [28], included a graphic display of the patient's hemoglobin A1c, blood pressure, and cholesterol results; a moderated forum; and community resources (e.g., healthful recipes, printable handouts) for diabetes self-management and healthful lifestyles, as well as features to enhance user engagement, such as rotating quiz questions and motivational tips.

After 6 weeks, participants created personalized "action plans" for medication taking, healthy eating, and physical activity. For each of the three areas, users identified barriers to achieving the goal(s) they had selected, and then chose from a list of problem-solving strategies to overcome those barriers [29]. Each user's action plan summary was available for easy reference and revision. In addition to the website, CASM participants received periodic motivational calls and prompting using a computer-based telephone system that initiated outbound calls, received inbound calls, and collected data.

2.1.2. CASM+

CASM+ participants received all aspects of the CASM intervention with the addition of two follow-up calls from an interventionist, and an invitation to attend three group visits with other participants in the same study condition. The two extra follow-up calls occurred 2 and 8 weeks after the initial visit to answer any intervention-related questions and troubleshoot problems with the website or self-management goals, and to discuss the participant's action plans, respectively. The first call was from a research project staff member and the second call to coordinate with the patients more general diabetes management goals was from a KPCO diabetes care coordinator.

The 120-min group sessions focused on (1) healthy eating, interacting with one's physician and using community resources and (2) maintenance enhancement through the use of analyzing personal behavior chains related to relapse [30]. The first group session for CASM+ participants, scheduled after their action plans were created, focused on healthful eating, and was led by a nutritionist. The meeting included information on healthful restaurant eating behaviors and grocery shopping tips. The second