Acceptability and Feasibility of Web-based Diabetes Instruction for Latinos with Limited Education and Computer Experience

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Objective: To evaluate the feasibility and acceptability of delivering a web-based diabetes education program in a computer classroom for Spanish-speaking Latinos.

Methods: Spanish-speaking Latinos (n=26) attended two classroom sessions to learn computer skills while navigating a web-based diabetes education platform. Diabetes knowledge was assessed before and after the intervention; structured interviews were completed to assess program acceptability.

Results: Half of participants (50%) had not previously used a computer. Post-intervention, diabetes knowledge improved significantly (p=.001). The majority of participants (86%) indicated a preference for web-based instruction as a stand-alone program or as an adjunct to traditional classroom training, particularly citing the advantage of being able to engage the material at their own pace.

Conclusion: With limited support, Latinos with minimal computer experience can effectively engage in web-based diabetes education.

Keywords

Cover Page Footnote

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ABSTRACT
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Keywords: Education; Diabetes; Latino; Internet

INTRODUCTION

Diabetes disproportionately affects the 54 million Latinos living in the United States. It is estimated that 12.8% of Latinos are affected by diabetes, compared to 9.3% of the general population (US Census Bureau, 2014; Centers for Disease Control, 2014). Many Latinos face substantial barriers to acquiring the education and skills that needed to successfully manage their

diabetes. Latinos are more likely than non-Hispanic whites to be uninsured with less access to traditional diabetes education programs offered by health care providers. Moreover, language barriers and lower levels of education and health literacy place additional barriers to receiving diabetes education (Centers for Disease Control, 2014).

Patients are increasingly looking to the web for health information, (Free et al., 2013; Krishna & Boren, 2008; Krishna, et al., 2010; Lopez et al., 2013; Peña-Purcell, 2008). Web-based education has the potential to reach a large audience of patients with diabetes regardless of insurance status, and allows for self-paced, learner-centered instruction. These programs can be accessed when needed, not only by patients, but also by caregivers and other family members who can provide critical support for diabetes management. Unfortunately, there is a paucity of culturally and linguistically appropriate websites that offer comprehensive diabetes education for the growing community of Latinos with Type 2 diabetes (Ramadas, 2011). Even if such websites did exist, many Spanish-speaking adults in the United States have limited experience using computers (Lopez et al., 2013), so it is unknown if they would be interested in or able to use this platform for learning.

The *Juntos Controlamos la Diabetes* (Together We Control Diabetes) website was developed to provide culturally and linguistically appropriate diabetes education to patients with diabetes, as well as their caregivers and family members. The development and structure of this website has been described previously (Fitzgerald et al., 2013). The website was not designed to completely replace traditional face-to-face diabetes education, but rather to serve as a supplemental tool for provider-delivered educational program. Furthermore, it was envisioned to be used by *promotores de salud*, community health workers, working to improve health literacy and education among the Hispanic and Latino community (US Department of Health and Human Services, 2013).

The purpose of this study was to evaluate the feasibility and acceptability of delivering a Web-based diabetes education program in a computer classroom format for Spanish-speaking Latinos in need of information on diabetes management.

METHODS
Designing theWeb-based instructional platform.
The *Juntos Controlamos la Diabetes* Web site has been described elsewhere (Fitzgerald et al., 2013). In brief, it is a Spanish-language website that was designed by the study team to follow the American Association of Diabetes Educators framework for supporting diabetes self-care behaviors (American Association of Diabetes Educators, 2013).

It uses the concept of a conversational road map, often used to facilitate in-person diabetes education. Conversation map tools have been shown to improve diabetes self-care practices and reduce negative attitudes toward diabetes (Merck & Co, Inc., 2011; Reaney & Eichorst, 2012). Content was developed using the National Standards for Diabetes Self-Care Management Education (DSME) (Funnell et al., 2012) and the American Association of Diabetes Educators 7 Self-Care Behaviors (AADE7) (American Association of Diabetes Educators, 2013). Local diabetes educators, physicians, and community health workers worked together to determine 9 important basic competencies, each placed into its own website section: (1) what is diabetes?; (2) healthy eating; (3) being active; (4) self-monitoring; (5) medications; (6) avoiding complications/reducing risk; (7) local clinics and services; (8) myths related to diabetes; and (9) self-management goals.

The majority of the content within each section was delivered through brief 3-5 minute Spanish-language videos designed for participants with limited literacy. Printable flyers and text information were also available. After viewing each video, participants had the option to use interactive self-assessment tools to assess their learning as they progressed through the Web site.

Setting, participants and procedures.

Participants were recruited from a list of patients with, or at high risk for diabetes identified at a local health fair for Spanish-speakers in the local metropolitan area. Twenty-six Spanish-speaking members of the Latino community with diabetes, at high risk for diabetes, or caregivers of those with diabetes were invited to attend two sessions to test the website. Sessions were held in a computer lab in the biomedical library at a university medical center. Spanish-speaking physicians and study staff obtained informed consent from each participant, and guided them to a computer already open to the Web site home page. Participants were encouraged to begin browsing the site at their own pace. Several participants who had not used a computer in the past received brief, individualized instruction on how to navigate the site. Physicians and staff were available to answer any questions participants had about content or site navigation.

Participants were given two hours to browse the Web site, although most finished between 30 to 90 minutes. The project was approved the University of Kansas Medical Center's institutional review board.

Measures

At baseline, participants provided basic demographic information. Participants were also asked diabetes knowledge questions and about their diabetes self-care activities in the past seven days (Toobert et al., 2000). To minimize bias related to repeated testing with the same instrument, we developed two distinct versions of a diabetes knowledge assessment instrument similar in content to the Diabetes Knowledge Test (Collins, et al., 2011; Fitzgerald et al., 1998) and SKILLD (Spoken Knowledge in Low Literacy in Diabetes) scale (Garcia, et al., 2014). Each version contained 11 knowledge questions. Participants were randomly assigned to complete one version at baseline and the second after completion of the program.

Upon completion of the program, participants were asked to rate all content they viewed (up to 32 items) on a 5-point Likert scale (*1, did not like at all* to *5, liked very much*). They also completed a structured interview inquiring about their preferred method of diabetes education (in person, website, or combination). They were also asked to provide reasons for their preference.

Data Analysis

Study data were managed using REDCap electronic data capture tools hosted at University of Kansas Medical Center (Harris et al., 2009). Data were analyzed using IBM Statistics for Windows, Version 21.0 (IBM Corp., Armonk, NY). Demographic characteristics were summarized using frequencies and descriptive statistics. Differences between computer users and computer novices were examined using independent sample t-tests and chi-square analyses where appropriate. Descriptive statistics were used to calculate means for satisfaction of website content. Differences between pre-assessment and post assessment self-care and knowledge scores were analyzed using paired sample t-tests. Knowledge was analyzed for all study participants, while self-care activities were limited to those with physician diagnosed type 2 diabetes. Binary logistic regression was completed to determine the likelihood of computer users preferring an online platform.

Content analysis methods were used to classify responses to open-ended questions. Responses to open-ended questions were sorted into mutually exclusive themes by two members

of the research team, who worked independently. They then met to check for agreement in coding. Frequencies were used to summarize the mutually exclusive response themes.

RESULTS

Of the 26 participants attending the first session, 13 (50%) were computer novices, although 16 (62%) reported having a computer and internet access at home. Participants were evenly divided by gender. The majority had less than a high school education (42%), did not have health insurance (85%), and did not have a primary health care provider (89%). Over half of the participants (54%) reported having physician diagnosed type 2 diabetes. Other participants were at high risk for developing diabetes or were caregivers of participants with diabetes. (Table 1) There were no statistically significant differences for baseline knowledge scores between computer uses and computer novices.

Table 1. Characteristics of participants testing the Juntos Controlamos la Diabetes Web site.

Characteristic	All participants (n=26)	Computer Novice (n=13)	Computer User (n=13)	p-value
Age in years, mean, (SD)	49.2 (9.8)	51.9 (9.3)	46.5 (9.9)	0.17
Male, n (%)	13 (50.0)	7 (53.8)	6 (46.2)	0.70
Health Insurance, n (%)	4 (15.4)	0 (0.0)	4 (30.8)	0.03*
Has a primary provider	3 (11.5)	1 (7.6)	2 (15.4)	0.47
Less than high school graduate, n (%)	11 (42.3)	8 (61.5)	3 (23.1)	0.15
Physician diagnosed type 2 diabetes, n (%)	14 (53.8)	7 (53.8)	7 (53.8)	1.00
Preassessment diabetes knowledge score, m (SD)	4.6 (2.2)	4.4 (1.9)	4.5 (2.3)	0.34

Twenty-two (85%) participants returned for a second session and follow-up assessment. The percentage of computer users vs computer novices remained even, at 50% in each group. After further navigation of the website during the second visit, these participants demonstrated significantly greater knowledge about diabetes and diabetes self-care, answering an average of 1.9 more out of 11 questions correctly on the post-assessment (p=.001). Participants also showed increased number of days completing diabetes self-care activities after viewing the Web site, although only days of foot examination increased to statistical significance (Table 2).

Table 2. Pre and post assessment scores for knowledge and self-care activities.

Instrument	Pre-test Mean (SD)	Post test Mean (SD)	p-value
Knowledge[1]*	4.6 (2.2)	6.5 (2.6)	0.001
Summary of Diabetes Self-care Activities[2]			
Days with 30 minutes of exercise	1.2 (1.3)	2.1 (2.2)	0.06
Days with physical activity	1.3 (1.4)	2.5 (2.5)	0.06
Days checked blood sugar	2.2 (3.2)	2.4 (3.0)	0.66
Days examined feet*	0.6 (2.0)	3.0 (2.8)	0.009
[1] n=24, all participants completing pre- and post assessment; Number correct out of 11 questions [2] n=12, participants with Type 2 DM completing pre- and post assessment; Number of days completing activity in the past 7 days *Statistically significant			

Participants indicated high levels of satisfaction with the program with mean scores on 32 segments of the program ranging from 4.40 (SD 0.681) to 4.96 (SD 0.204) on a 5-point Likert scale. Over 95% (n=21) stated that they would like to be able to access the site from home or another place, such as a local library or a friend or family member's house. No participants reported any website sections that they did not like or that they found irrelevant.

When asked to compare the relative merits of the website versus in-person educational sessions, the majority (n=14, 64%) stated they would prefer learning about diabetes via the website, and 23% suggested a combination of online information and in-person education. Those with prior computer experience were 7.5 times more likely to express a preference for the web-based platform (95% CI [1.31, 43.04]).

Participants preferring the website stated the following reasons for preferring the website: (1) information is easier to understand via website format; (2) it is easier to concentrate; (3) you can learn at your own pace/focus on specific information; and (4) it is always available. (Table 3.) Participants who preferred a combination of online and in-person education stated that they liked the idea of a website because it could reinforce the information they learned in-person. The main reason participants gave for preferring in-person classes was that they did not know how to use a computer. They also described the advantages of being able to ask questions of experts and clarify any doubts or confusion. Despite choosing only one preferred educational platform, many participants listed advantages for the other platforms.

Table 3. Advantages of a web-based diabetes educational platform

Advantages of Web site	Frequency
Information is easier to understand via Web site format *"Face-to-face classes give me written information, but I rarely read it, and it usually is not clear."* *"The page is more understandable."* *"The videos help people understand and learn about diabetes. You have to see it to believe it. "*	11
Easier to concentrate *"On the webpage, you can concentrate more on what you are watching and hearing."* *"It's hard to keep tracking during classes."*	5
Can learn at your own pace/focus on certain information *"I can go back and forth as many times as I want."* *"When I don't understand something easily the first time, I can go back and access the videos and/or content and review it."*	5
Always available (n=4) *"If I have doubts, I can always consult the page."* *"I can review the information anytime I want."*	4
Note: Many participants reported more than one advantage of the web-based platform.	

DISCUSSION

Spanish-speaking members of the Latino community indicated high levels of satisfaction with the *Juntos Controlamos la Diabetes* website and demonstrated significant improvements in diabetes knowledge after navigating the site. The majority of participants indicated a preference for web-based education over traditional classroom programs or at least indicated a desire to use web-based instruction as an adjunct to classroom education.

This web-based instruction was particularly popular among participants with prior computer experience. This finding is consistent with the growing popularity of the internet as a source of health information (Lopez et al., 2013; Reininger et al., 2013), but many Latinos are on the wrong side of the digital divide. While use of cell phones and text messaging are increasing rapidly among Latinos, use of the computers and the internet continues to lag behind, particularly among Spanish speakers and the middle-aged and older Latinos most likely to be afflicted by diabetes (Collins, et al., 2014). This Web site, as designed, can be used on a smart phone, but development of an application containing this information specific to smart phones seems warranted. Nevertheless, this study showed that with minimal support, participants can successfully access important information from the web, even if they have had minimal experience with using computers in the past.

Prior to the launch of this study, community members voiced concerns that many of our target audience would have limited experience in using computers. Consequently, we chose to conduct this study in a computer lab where we could provide basic technical assistance to participants who had never used a computer before. This setting could be ideal for use by *promotores* or community health workers engaged in educational program in the community (Cupertino et al., 2015). With the support of the core educational materials on the web, *promotores* could focus less on educational content and more on issues related to computer

literacy or navigation to resources in the community. An interesting side benefit of a program like this is the potential to help lower the digital divide – a divide that becomes increasingly important as more and more information is placed on the web (Lopez et al., 2013).

This study was limited by a small sample size that precluded us from looking more closely at differences between those with and without prior computer experience. Additional studies with larger sample sizes are warranted. We also limited this study to time spent on the website in the computer lab and cannot address how participants might engage with the website outside of a controlled setting. It is also important to note participants were not asked if they had received in-person education in the past, so it is unknown how many participants preferring Web site education had received in-person education.

Participants in this study showed improved knowledge and self-care activities after viewing the website, which demonstrates the potential for an online learning platform to improve diabetes outcomes.   Longitudinal studies with larger sample sizes are warranted to further investigate long term knowledge and outcome improvement. Additionally, it would have been beneficial to examine these outcomes between those with diabetes, caregivers, and those at risk for diabetes, as well as how outcomes might have differed by length of time spent browsing the Web site. However, due to small subsamples, this seems unjustified.

Of note, we did not limit this study solely to patients with diabetes. Indeed, we think one of the major advantages of a web-based training program is potential to expand diabetes to caregivers, family members and others in the community with a vested interest in diabetes management and control, as it has been shown that involving family members can help improve health behaviors and chronic health outcomes among this population (Shepherd-Banigan et al., 2014).

CONCLUSION

This study showed that use of a web-based, classroom-delivered diabetes education program is feasible and acceptable for Spanish-speaking Latinos and offers the potential to not only increase diabetes knowledge, but also to improve 'computer-literacy' and bridge the digital divide. This study lays a foundation for future work including efforts to see how this or other websites could be used by promotores or community health workers or used to supplement in-person education classes. Indeed, a website such as this might support 'flipped classrooms' (Young, et al., 2014) or other educational models that incorporate opportunities for more active learning.

ACKNOWLEDGEMENTS

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