Impact of Instructor-Directed, Web-Based Education and Health Beliefs

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This study compared the effects of an instructor-directed, web-based education program with those of a conventional education program on the self-care behaviors of veterans with type 2 diabetes. It also looked for associations between veterans' health beliefs and their diabetes self-care behaviors.

Type 2 diabetes is a serious problem in the veteran patient population, with one in six veterans having been diagnosed with the disease.[1] Adhering to high standards of self-care can help these veterans to avoid diabetic complications. Keeping blood glucose levels as close to normal as possible, for example, slows the onset and progression of ocular, renal, and neurologic complications caused by prolonged hyperglycemia.[2] Poor self-care of diabetes, in contrast, can lead to the development of peripheral vascular disease, cardiovascular disease, and foot ulcers. These problems appear to be major determinants of disability in diabetic patients.[3]

To encourage high standards of self-care among its veteran population, the Philadelphia VA Medical Center (PVAMC) offers a diabetes self-management education (DSME) program. DSME has been shown to be cost-effective in the ultimate prevention of long-term complications of type 2 diabetes.[4] Through the PVAMC's program, an instructor teaches lessons that address such self-care topics as diet, exercise, blood glucose testing, foot care, and medication.

Like conventional diabetes education programs such as the PVAMC's, web-based education can help to enhance self-care behaviors. Studies show that web-based education has been applied as a patient education is an effective way of presenting patient information and improving clinical outcomes.[5–12] Results of randomized research, for example, have shown that computer based education improved patients' self-care in chronic illness.[8,9] In a systematic review, Lewis found that studies support computer-based education as an effective strategy for the transfer of knowledge and skill development for patients.[13] Furthermore, Gerber and colleagues found that a computer multimedia intervention was effective at influencing behavior change in patients with low health literacy. Patients who underwent the intervention had an increase in perceived susceptibility to disease compared with patients who received standard care.[7]

Not only can web-based education be effective, but it also may be preferred by patients. In a survey of 330 primary care patients, more than half used the internet for health care information. This survey also revealed that the majority of the patients who searched the internet for such information felt their health care provider should recommend specific web sites where they could learn more about their health care.[14]

The following study had the primary objective of comparing the effects of the PVAMC's conventional education program with those of an instructor-directed, web-based education program on diabetic self-care in a veteran population. Although the latter education program was based in a classroom setting and taught the same content as the conventional program, it also made use of the VA Diabetes Program web site (http://www1.va.gov/diabetes). This site offers access to evidenced-based information for health promotion, health maintenance, and prevention of diabetes complications. During the program, an instructor projected information from the web site onto a screen and encouraged participants to use the web site at home. The study's secondary objective was to determine whether participants' health beliefs predicted their diabetic self-care behavior following the programs. After providing a more detailed discussion

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of health beliefs and their influence on self-care, this article will describe the study and its results.

THE HEALTH BELIEF MODEL

In a review of studies on web-based education, the theoretical framework most commonly used to assess and promote knowledge and behavior change was the Health Belief Model (HBM). This model, which was proposed by Rosenstock[15] and later reformulated by Becker,[16] suggests that people's health beliefs have a strong influence on their health-related actions. The HBM emphasizes the importance of patients' beliefs in seven key areas: perceived susceptibility to a health problem, perceived seriousness or severity of the problem, perceived benefits of taking action, perceived barriers to taking action, cues (that is, motivating factors) to taking action, structural elements (that is, patients' cognitive and emotional understanding of a treatment regimen and the support they receive), and general health motivation (that is, patients' overall interest in health matters).[16,17]

The model suggests that, for behavioral change to be successful, patients must have an incentive to take action, feel threatened by their current behavior patterns, believe that a specific change will result in a valued outcome at an acceptable cost, and feel competent to implement the change.[18] With regard to the latter requirement, research has suggested that many veterans with type 2 diabetes are not confident in their ability to manage the disease.[19]

STUDY METHODS

The study had a two-group, pretest/posttest design. Participants' names were coded to protect their identities. The study was approved by the PVAMC Institutional Review Board.

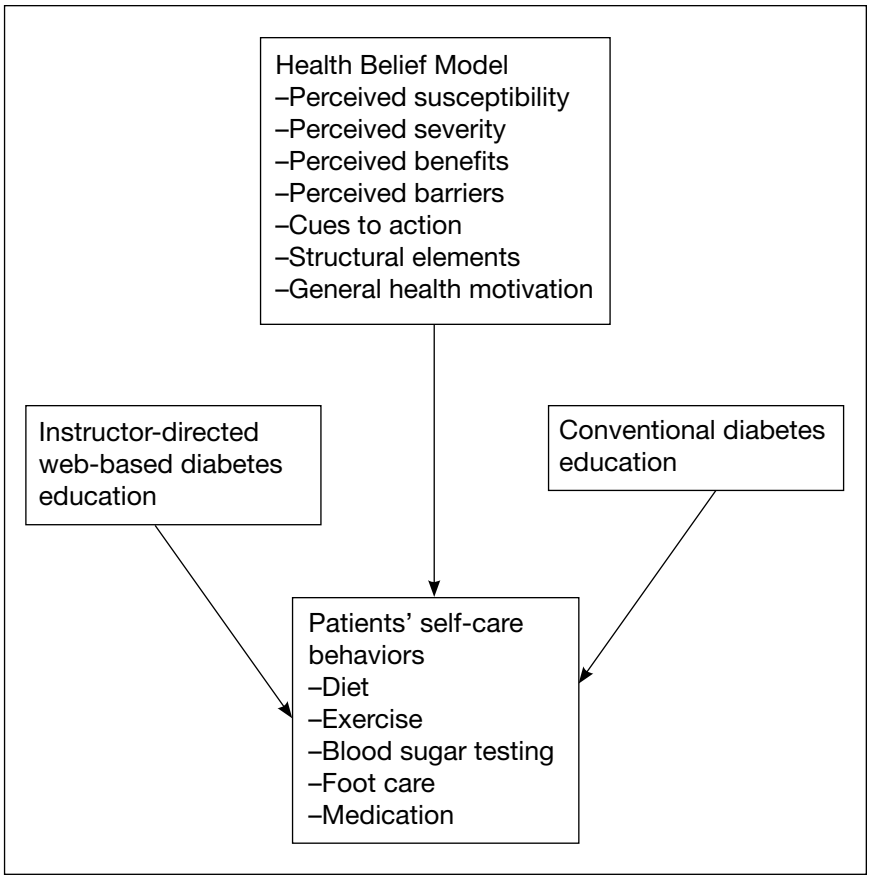

Figure. Theoretical framework of the study, suggesting that instructor-directed, web-based diabetes education; conventional diabetes education; and participants' health beliefs may have an impact on participants' self-care behaviors.

Participants

All patients aged 40 years or older who were receiving primary care at the PVAMC's Fort Dix Outpatient Clinic, Fort Dix, NJ or its Horsham (Willow Grove) VA Outpatient Clinic, Horsham, PA; who were prescribed one or more oral hypoglycemic agents; and who had not attended a diabetes education class since January 2007 were identified for possible inclusion in the study. Excluded patients included those who were not veterans; did not speak English; were pregnant, wheelchair bound, or incapable of giving informed consent; or required maximum assistance with activities of daily living.

Intervention and data collection

Program participants were assigned randomly to a conventional education group or to an instructor-directed, web-based education group. For both groups, diabetes education consisted of two 45-minute lessons taught by two registered nurses in an alternating fashion over a two-week period. The instructors for both groups used identical lesson plans, which were reviewed by the principal investigator, to teach about diabetes and self-care behavior. The chief difference between the groups was that, for the instructor-directed, web-based group, the instructor used a computer and a liquid crystal dis-

Table 1. Characteristics of the conventional education group

Characteristic[a]	Mean	Minimum	Maximum	SD
Age in years (n = 43)	70.65	45.00	83.00	8.48
Weight in lb (n = 42)	218.45	147.00	334.00	45.09
Body mass index kg/m^2 (n = 42)	32.58	22.70	49.30	6.32
Education[a] (n = 43)	4.67	2.00	6.00	1.15
No. of years with diabetes (n = 43)	10.99	0.20	31.00	9.26

[a]N = 42. [b]2 = 8th grade education or less, 6 = college graduate.

Table 2. Characterstics of the instructor-directed, web-based education group

Characteristic[a]	Mean	Minimum	Maximum	SD
Age in years (n = 41)	66.88	49.00	79.00	9.33
Weight in lb (n = 40)	223.32	145.00	360.00	41.72
Body mass index in kg/m^2 (n = 40)	33.44	23.90	53.20	7.09
Education[a] (n = 41)	4.56	2.00	6.00	1.02
No. of years with diabetes (n = 39)	9.96	0.60	28.00	6.78

[a]N = 38. [b]2 = 8th grade education or less, 6 = college graduate.

play projector to project information from the VA Diabetes Program web site onto a screen. The conventional group instructor conveyed the same information but did not use computers or projectors.

All participants in both groups were asked to fill out three surveys before their first class began. The first survey, which took about five minutes to complete, asked questions about demographic and other information, including questions about the participants' access to and use of the internet. The second survey, which took about 20 minutes to complete, was the Diabetes Health Belief Scale (DHBS). It measured participants' beliefs about diabetes with regard to the seven HBM concepts mentioned above.[20]

The third survey, which took about 15 minutes to complete, was the validated Summary of Diabetes Self-Care Activities (SDSCA). The SDSCA asks participants about their self-care behaviors, including general and specific diet, exercise habits within the past seven days, blood glucose testing (the number of times testing was carried out in the past seven days and how often it was carried out according to the health care providers suggestions), foot care (the number of times in the past seven days feet were self-checked and inside of shoes self-inspected), and medication (the number of times in the past seven days the recommended diabetes medications or injections were taken).[21] The average between-item correlation within scales from seven studies using the SDSCA was 0.47, except for specific diet; test-retest correlations had a mean of 0.40. Validity of the SDSCA subscale means for diet and exercise was 0.40.[21]

After the second class, participants took home posttest versions of the DHBS and the SDSCA to complete one week later and return in a self-addressed, stamped envelope.

Data analysis

The SPSS Graduate Pack 14.0 for Windows (SPSS Inc, Chicago, IL) was used for statistical analysis. One tailed, paired *t* test was used to test differences between pretest and posttest means of the SDSCA and to compare the two educational programs' impacts on participants' self-care. Multiple linear regression was used to determine whether the participants' diabetes health beliefs predicted their self-care behaviors.

RESULTS

Of the 148 patients invited to participate in the study, 84 agreed to participate and provided demographic information. All of the participants in both groups were men. In the conventional education group, participants had a mean age of 70.7 years, a mean weight of 218.5 lb, a mean body mass index (BMI) of 32.5, a mean education level of some college, and a mean time since diabetes diagnosis of 10.99

Table 3. Differences in self-care behavior gains in the conventional education and instructor-directed, web-based education groups

Self-care behavior	Mean (SD) gain or loss	Paired *t*-value[a]	One-tailed *P* value
Diet			
Conventional group[b]	0.48 (1.22)	0.228	.821
Web-based group[c]	40.00 (1.46)		
Exercise			
Conventional group	0.72 (1.76)	–0.006	.949
Web-based group	0.74 (1.61)		
Blood glucose testing			
Conventional group	0.39 (1.64)	–0.347	.730
Web-based group	0.56 (2.20)		
Foot care			
Conventional group	0.89 (1.75)	3.446	.001[d]
Web-based group	–0.34 (1.12)		
Medication			
Conventional group	0.18 (1.85)	0.165	.869
Web-based group	0.12 (.64)		

[a]*df* = 67. [b]n = 36 for the conventional education group. [c]n = 33 for the instructor-directed, web-based group. [d]Statistically significant at the .05 level.

years (Table 1). In the instructor-directed, web-based group, participants had a mean age of 66.9 years, a mean weight of 223.3 lb, a mean BMI of 33.4, a mean education level of some college, and a mean time since diabetes diagnosis of 9.96 years (Table 2).

Fifteen participants (18%) did not complete the study. The reasons for noncompletion included transportation issues and scheduling conflicts. All of those who completed the study were from the Fort Dix Outpatient Clinic. Of these 69 participants, 33 (48%) were provided conventional education and 36 (52%) were provided instructor-directed, web-based education.

Of the five self-care areas measured, foot care was the only self-care activity that demonstrated significant differences (t = 3.446; P = .001) in mean gain score between the conventional and instructor-delivered web-based education groups (mean [SD] of .89 [1.75] for the conventional group versus mean [SD] of 0.34 [1.12] for the instructor-directed web-based group) (Table 3).

The results further indicated that diabetes health belief gain scores were not effective predictors of diabetes self-care activities. None of the six regression analyses yielded significant (P < .05) amounts of explained variance in any of the self-care activities gain score (Table 4). Only structural elements gain score was found to be an effective significant predictor (β = .394; P = .003) in the equation explaining the variance in diet gain score, although the overall regression analysis was not significant (R^2 = 0.167; F = 1.746; P = .115). Amounts of variance explained by the individual analyses ranged from R^2 = 0.034 to R^2 = 0.167.

DISCUSSION

The results of this study indicate that, except for foot care, there was no significant difference in the impacts of the two educational programs. Overall, neither program had a major influence on participants' self-care behaviors at one week. This finding supports the finding by Nelson and colleagues that many veterans are not ready to change self-management behaviors.[19]

The participants' mean age of 68.8 years also may have contributed to the lack of change in their behaviors. It is likely that most participants were retired and are living on a fixed income, which may have affected the quality of foods they purchased and their adherence to a diet that was different from those of their family members. We also note that information on chronic illnesses, such as ar-

Table 4. Multivariate linear regression analysis of diabetes health beliefs as predictors of changes in study patients' self-care activities gains

	Self-care activities				
Diabetes health beliefs	Diet	Exercise	Blood glucose testing	Foot care	Medication
Perceived susceptibility, β[a]; *P* value	–0.114; .405	–0.080; .565	0.010; .943	–0.033; .821	–0.072; .610
Perceived benefits, β; *P* value	0.083; .518	–0.022; .863	–0.072; .597	–0.009; .948	0.282; .037
Perceived severity, β; *P* value	0.139; .291	0.254; .056[b]	0.004; .976	0.007; .961	0.009; .949
Perceived barriers, β; *P* value	0.081; .530	–0.084; .518	0.066; .628	0.102; .461	0.015; .904
Cues to action, β; *P* value	0.061; .629	0.261; .046	0.210; .123	0.077; .574	0.017; .897
Structural elements, β; *P* value	0.394; .003[c]	0.018; .890	0.067; .621	0.041; .763	0.130; .326
General health motivation, β; *P* value	0.074; .581	0.047; .720	0.036; .803	0.103; .476	0.146; .297
Constant	1.983	2.957	1.596	1.171	0.190
R^2	0.167	143.000	0.059	0.034	0.098
F score	1.746	1.451	0.549	0.302	0.945
P value	.115	.202	.794	.950	.479

[a]β = standardized coefficient. [b]Not significant at the .05 level, yet indicates a trend. [c]Statistically significant at the .05 level.

thritis, or other competing demands, such as caring for a spouse, was not collected in this study. Such illnesses and demands are common in this age group and may have had an impact on participants' level of activity. Finally, the study participants had a mean time since diabetes diagnosis of 10.5 years, with a maximum of 31 years. Participants might have found it difficult to change their preprogram self-care behaviors because they were so accustomed to those behaviors.

The foot care mean gain score indicated that, on average, participants in the conventional education group showed a significant gain when compared with those participating in the instructor-directed, web-based group. In fact, foot care scores obtained on the posttest for the instructor-directed, web-based group were lower than those participants obtained on the pretest.

A possible explanation for the significant difference in mean foot care gain score is that good foot care habits can be attended to less frequently over the long term when managing a condition such as diabetes—especially because one can see the immediate effects of improved diet and exercise habits by better blood sugar testing results. The foot care information that the participants in the conventional education group received may have prompted their increased self-care activity in foot care. In addition, foot care requires less effort than the other self-care activities. Perhaps the posttests would have shown positive changes in other self-care activities if the participants had completed them one month or six months—rather than only one week—following the educational programs.

With regard to the study's secondary objective, its results indicate that diabetes health belief gain scores are not effective predictors of diabetes self-care activities. Only the structural elements gain score (which assess the participant's understanding of and family support for the treatment regimen[18]) was an effective predictor in the equation explaining the variance in diet gain score. This supports the finding by Nagelkerk and colleagues that lack of knowledge and understanding of the diet plan affect adherence to diet.[22] Other barriers to treatment adherence (such as depression, quality of life and lifestyle

issues, income, race and competing demands such as chronic pain) that were not accounted for in the study may account for the unexplained 80% of variance. A longer period of time than one week later for the posttest might have resulted in a significant finding for the regression analysis between structural elements and diet gain score.

Limitations of this study include its a small sample size, the older age of its participants, and the number of years the participants had diabetes. Unintended interventional effects by the teaching styles of the educators also may have impacted outcome measures. An investigation of the barriers to treatment adherence may account for the 80% of variance that is unaccounted for in this study. Results of this study cannot be generalized.

Suggestions for further studies include those with a larger sample size, a younger age population, a longer time for posttest, and inclusion of patients with newly diagnosed diabetes. Additionally, a study involving individual use of the VA Diabetes Program web site is suggested. Because this web site is intended for individual patient information, the effectiveness of individual use of the web site needs to be investigated for patients who have transportation issues or difficulties attending a conventional classroom-conducted diabetes education class.

CONCLUSIONS

This study showed no significant difference in the impact of diabetes education depending on whether it was delivered by the conventional method or by the instructor-directed, web-based method. Although this study did not demonstrate that either method had a major impact at one week, it is likely that both methods can be used to educate patients to influence positive behavior change over the long run. Providers can direct the many veterans with diabetes who are already using the internet to the web site. Patients and families who have access to the internet and are unable to attend education classes also can be directed to the site for information to complement the education provided in the clinical setting. At follow-up visits, patients can review or clarify information they access on the internet.

It is important that health care providers in the clinical setting counsel patients with diabetes about foot care in addition to all the other self-care activities that are essential in the management of patients with diabetes. Furthermore, it is important to include family members in diabetes education as much as possible. They should be invited to attend diabetes education classes with the patient. ●

Although this study did not demonstrate that either method had a major impact at one week, it is likely that both methods can be used to educate patients to influence positive behavior change over the long run.

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