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## A Training Intervention to Improve Information Management in Primary Care

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### Abstract

**Background and Objectives**—Training programs designed to improve information management have been implemented but not adequately tested. Three critical components for information management were tested in a randomized control study: (1) knowledge of valid, synthesized summary information, (2) skills to use Web-based resources that provide access to these summaries, and (3) use of Web-based resources in clinical practice.

**Methods**—Twenty-four primary care practices were provided with computers and high-speed Internet access and then matched, with half randomly assigned to receive training and half to receive training at a later date. Training was designed to address knowledge, skills, and use of Web-based information. Outcomes were assessed by comparing baseline and follow-up questionnaires that focused on five conceptual domains related to Web-based resource use for patient care decisions and patient education.

**Results**—Compared to the delayed training group, the initial training group increased their knowledge and skill of Web-based resources and use for patient care decisions. Some measures of communication with patients about using Web-based resources and of incorporating use of Web-based resources into daily practice increased from baseline to follow-up for all participants.

**Conclusions**—Our findings suggest that training and providing computers and Internet connections have measurable effects on information management behaviors.

Evidence-based medicine (EBM), the “integration of best research evidence with clinical expertise and patient values,<sup>1</sup>” can be difficult to carry out in day-to-day clinical practice.<sup>2–4</sup> Numerous studies have shown that providers have clinical questions that they never answer<sup>5–8</sup> and that there are barriers to the implementation of EBM protocols,<sup>9,10</sup> including not having the knowledge, skills, and time to access and process resources for patient care decisions.<sup>2–4,7,8,10–12</sup>

Family medicine has been at the forefront of promoting EBM in clinical practice by focusing on information management skills,<sup>2–4,13–15</sup> defined as the ability to access and use electronically based summaries of evidence for patient care decisions.<sup>4</sup> These skills are relevant not only for providers but also for patients, who are increasingly accessing health information through the Internet.<sup>16–19</sup> Health care providers are encouraged to assist patients in their use of Web-based resources,<sup>20–24</sup> which is consistent with evidence-based patient choice.<sup>25</sup> Studies suggest, however, that while patients want recommendations of online health resources from their providers,<sup>26</sup> few receive them.<sup>16,18</sup>

The growing availability and use of electronically based resources by patients and providers thus creates both pressure and opportunity for clinical practices to use these health information resources for patient care decisions and patient education.<sup>27</sup> Providers may access resources via a number of technologies, including personal digital assistants (PDAs), but two recent randomized studies found that computers are used two to four times more often at work than PDAs.<sup>28,29</sup> Studies also document an increase in the use of the Web by health care providers, 11·27,<sup>30</sup> but overall prevalence of use to answer clinical questions is still low compared to other resources (eg, textbooks and colleagues),<sup>7,8</sup> which may not be up to date on current evidence.

While one obvious barrier for providers and practices to use Web-based resources in patient care decisions and patient education is lack of computers and high speed Internet access, another important barrier is insufficient knowledge of Web-based resources and skills to efficiently use these resources.<sup>2-4,10,12</sup> Training programs developed to improve information management skills have focused primarily on skills, such as critical appraisal,<sup>31,32</sup> or on a single Web-based resource, such as MEDLINE.<sup>33,34</sup> Additionally, much of the training has been implemented in medical education settings.<sup>35-40</sup> Training programs developed for community-based, primary care settings have not been adequately tested for effectiveness.<sup>37,41,42</sup> One study has assessed training for rural physicians using a randomized design and found increases in frequency of use and comfort level in using Web-based resources between intervention and control groups.<sup>43</sup>

This paper describes and evaluates an intervention designed to promote information management in patient care decisions and patient education via Web-based resources among participants from primary care practices. The intervention addressed three critical components to adopting and maintaining information management behaviors: (1) knowledge of valid, synthesized information,<sup>6</sup> (2) skills to use Web sites and search engines that provide access to these summaries,<sup>44,45</sup> and (3) use of the Web sites and search engines in clinical practice. We hypothesized that the intervention would increase knowledge, skills, and use of Web-based resources among primary care practice participants.

## Methods

The study, conducted since July 2004, involved 24 primary care practices located in New Hampshire and Vermont. The practices were recruited through a previous study,<sup>46</sup> by a hospital computer network expert who knew of practices with few computers or poor Internet access, and through a presentation to a local preceptor board.<sup>47</sup> The study used a randomized, matched-pairs design that allowed us to match practices on factors that could influence training outcomes, such as existing high-speed Internet connections and number of computers with Internet connections in the practice prior to the intervention. Practices were first matched by size, specialty, and location. Then one practice in each pair was randomly assigned to the initial training protocol (initial intervention group) and the other to the delayed training protocol (delayed intervention group). A crossover design ensured that both groups would eventually receive training, as shown in Figure 1. Dartmouth College's Committee for the Protection of Human Subjects approved the study protocol.

## Practices

The 24 practices consisted of nine (37%) family medicine practices and five (21%) each of internal medicine, pediatrics, and multi-specialty practices. Practice size included five practices (21%) with a single provider, 13 practices (54%) with two to five providers, and six practices (25%) with six or more providers (range 6-16 providers). The number of patients seen per week ranged from 50 to 800.

At baseline, 33% of the recruited practices did not have high-speed connections, 54% had limited computer resources, and 38% had electronic medical record (EMR) systems.

To ensure that each of the 24 practices had at least the basic technological resources needed to access Web-based resources, each practice was provided with two computers, high-speed Internet connection (if not already in place), and financial support to maintain Internet connections. The computers and Internet connection were put in place for all practices after baseline data collection but before randomization into either the initial intervention or delayed intervention group.

## Participants

The initial intervention group practices (n=12) selected a team of one to three individuals (providers, clinical, and office staff) for a total of 32, to participate in the initial training protocol. The delayed intervention group practices (n=12), knowing they would participate in the training later, selected similar teams, for a total of 32 participants.

## Intervention

The training provided to the initial intervention group participants focused on two components: knowledge and skills to access and efficiently use a variety of Web-based resources and development of a practice-based plan to incorporate and increase the use of these resources for patient care decisions and patient education in participants' own practice settings. Teaching methods were used that have been shown to be successful in changing behaviors and patient care, such as case studies, hands-on practice, and sequenced sessions (learn-work-learn).<sup>48, 49</sup> As shown in Table 1, the training, conducted by biomedical librarians and faculty experienced in facilitating group learning, consisted of (1) two 6-hour workshops held 2 months apart, (2) two practice-based exercises using Web-based resources between the workshops, (3) a support phone call 1 month after the first workshop, and (4) a site visit 1 month after the second workshop to provide additional support.

## Measure

A questionnaire was developed to assess knowledge, skills, perceptions, and use of Web-based resources for patient care and education. The self-report questionnaire was developed after a review of the literature related to use of Web-based resources in clinical practice and consultations with biomedical librarians. The instrument was pilot-tested with 16 providers and staff not associated with the study and modified prior to use to reflect their feedback.

As shown in Table 2, questions selected for this study were chosen to represent five conceptual domains related to Web-based resource use for patient care decisions and patient education: (1) knowledge of and self-assessed skills for using Web-based resources, (2) frequency of resource use, (3) communication with patients about using resources for health information, (4) perceptions about the use of resources, and (5) incorporating use of Web-based resources into daily practice.

The questionnaire was mailed to the practices for completion before they received their computers and high-speed Internet connection (baseline), 1 year later (follow-up I), approximately 3 months after the initial intervention group completed the training protocol, and 2 years later (follow-up II), approximately 3 months after the delayed intervention group completed the training protocol. While all practice members with patient contact in each of the 24 practices received questionnaires, for this study only participants who participated in the training protocol (initial or delayed) were analyzed to evaluate the effectiveness of that training.

## Analysis

To evaluate the effectiveness of the training, we used a linear mixed model analysis to assess whether the initial intervention and delayed intervention groups were significantly different from each other and whether the measures differed significantly at baseline and follow-up I. Thus, there were two fixed factors to consider: group (initial intervention versus delayed intervention) and time (baseline versus follow-up I). While the participant completing the questionnaires was considered a random factor, participants work within practices where they share aspects of the environment unique to the practice. Thus, to avoid violating the statistical assumption of independence, a nesting function was used in the model to identify which participants were from the same practice, with the model making the appropriate adjustments in the error term.

The two-factor model created an interaction term that was the main item of interest in this study. This interaction term assessed whether the rate of change from baseline to follow-up I for the initial intervention group was significantly different from the rate of change for the delayed intervention group. Significant interaction terms, those reaching a *P* value less than or equal to .05, were further investigated with paired and independent *t* tests to determine the nature of the interaction. The interaction term had four possible pairwise contrasts; since multiple comparisons can increase the likelihood of Type I errors, the significance levels of these tests were adjusted using the Bonferroni adjustment.<sup>50</sup> Thus, to reach a significance level equivalent to .05 unadjusted, the adjusted *P* value required for significance was .0125. If the interaction term was not significant, then the factor term comparing baseline to follow-up was examined to determine whether there was a significant effect of time. A significant effect of time indicated that the average score at follow-up I for all participants was significantly different from the average score at baseline for all participants.

The crossover design of the study allowed for replication of the training intervention. To assess the equivalency of both arms of the study, a linear mixed model analysis using a single fixed factor, group (initial intervention versus delayed intervention) was used to examine differences in the scores of participants from baseline for follow-up II. Again, a nesting function as described above was used to account for the fact that participants were clustered within practices.

## Results

Of the 64 participants, 45 (70%) completed both baseline and follow-up I questionnaires: 78% (25/32) in the initial intervention group and 63% (20/32) in the delayed intervention group. Forty participants (63%) completed questionnaires at all three of the survey points: 72% (23/32) in the initial intervention group and 53% (17/32) in the delayed intervention group.

As shown in Table 3, there were no significant differences between the initial intervention and delayed intervention group participants at baseline. Most of the participants were female, and most were either a provider or clinic support staff member. There were no significant differences between those workshop participants who completed all questionnaires and those who did not. There were also no differences between initial intervention and delayed intervention group practices on these resources at baseline: (1) high-speed Internet connections ( $\chi^2=.540$ ,  $P=.462$ ), (2) adequate computer resources ( $\chi^2=.691$ ,  $P=.431$ ), or (3) presence of an EMR ( $\chi^2=.097$ ,  $P=.756$ ).

Table 4 displays the mean scores and standard deviations for the variables that had significant interaction terms and the results of the post-hoc pairwise comparisons. Table 5 displays the means and standard deviations for the variables that had a significant time effect for all participants.

## Knowledge and Skills

There were significant group by time interactions for each of the four variables: (1) finding information on the Web, (2) finding educational material on the Web for patients, (3) a sum of specific search skills, and (4) skills using a variety of Web-based resources. In each case, pairwise comparisons revealed a significant increase from baseline to follow-up I for the initial intervention group, as shown in Table 4. For the variable, skills using a variety of Web-based resources, there was also a difference between the groups at follow-up I, with the initial intervention group indicating significantly more skills to use resources than the delayed intervention group.

## Frequency

As shown in Table 4, while there was a significant interaction term for how often the participants reported using a variety of Web-based resources for patient care decisions ( $P=.017$ ), the results of the comparison of baseline to follow-up I for the initial intervention group was not significant when adjusted for multiple comparisons ( $t_{10}=-2.3$ ,  $P=.041$ ) since this adjustment required a  $P$  value of .0125 for significance. As shown in Table 5, all participants reported a significant increase from baseline to follow-up I in how often they used Web-based materials for patient education.

## Communication

All participants' reports of how often they referred patients to specific Web sites showed a significant increase from baseline to follow-up I, as shown in Table 5.

## Perception

Analysis of participants' liking when patients bring in Web-based information revealed a significant interaction term, as shown in Table 4. Pairwise comparisons showed a significant increase from baseline to follow-up I for the initial intervention group. There were no significant results for participants' reports of feeling the Web could help them provide better clinical care or better health education materials to patients.

## Incorporation

As shown in Table 4, there was a significant interaction term for participants' beliefs regarding leadership at the practice that encourages using Web resources for patient education. Pairwise comparisons revealed a significant increase from baseline to follow-up I for the initial intervention group. As shown in Table 5, all participants reported significant increases from baseline to follow-up I for their beliefs regarding leadership at the practice that encourages using Web resources for patient care decisions and for how often they use the Web at work for patient education and for patient care decisions.

## Replication of the Training Intervention

Given that the participants were randomized to either the initial intervention or delayed intervention groups, one would expect there to be no differences attributable to early or late training. Differences in the mean scores of participants from baseline to follow-up II are shown in Table 6. Results of the analyses showed a single significant effect of group, for the variable assessing how often in a typical month participants used Web-based materials for patient education, with participants in the delayed intervention group reporting a greater gain in use than participants in the initial implementation group ( $P=.047$ ). These results indicate that the training intervention in both arms of the study produced substantively similar results.

## Discussion

The major findings of this crossover study for improving information mastery in primary care settings were reported increases in knowledge and skills about Web-based resources and frequency of use of these resources for patient care decisions, all of which were associated with the training intervention. Additionally, the study found that all participants reported increases in frequency of Web-based resource use for patient education, communication with patients about these resources, and incorporating resource use into daily practice. These increases were associated with all practices receiving additional computers and high-speed Internet connections through this study after baseline data collection.

Although several changes from baseline to follow-up were statistically significant, the magnitude of the follow-up scores warrants further discussion. For instance, the use of information management behaviors by participants could still be considered quite low (eg, on average, resources were “seldom” used during work hours or for patient education). Other measures did not change, such as participants' perceptions about the usefulness of the Web for providing better health education materials or clinical care for patients, although on average they agreed that it does (3.9 on a 5-point scale). In sum, significant room remains for improvement in information management skills, knowledge, and behaviors even after this fairly intensive training and support protocol.

Given these results, how do we move forward to improve information mastery in primary care settings? Theoretical approaches, such as the theory of reasoned action,<sup>51</sup> would posit that behavior proceeds from knowledge, skills, and attitudes or perceptions. In this instance, increased knowledge and skills and already-positive, existing perceptions (3.9 on a 5-point scale) about the usefulness of Web-based resources have produced only a slight increase in behavior. This leads us to believe that other factors operating in the organizational environment are not currently reinforcing and/or attracting providers and staff members to information mastery behavior, at least in the case of Web-based resources. Factors may include perceived lack of time to use resources,<sup>7</sup> the experience of not finding answers using Web-based resources or taking too long to find the answer,<sup>52</sup> and the habit of established behaviors (eg, talking to colleague to find answers to questions). Training that occurs in primary care practice settings as clinical and patient education questions arise, although potentially resource intensive, may be more effective for addressing or improving some aspects of the organizational environment for information management.<sup>53-55</sup> In addition, improvements in the structure and content of existing Web-based resources may go far to increase their use in practice.<sup>7,29,56,57</sup>

While a limitation of this study is the relatively small sample size that constrains the generalizability, selection bias is not a limitation because the carefully matched crossover design controlled for the desire to participate. Use of self-report questions as proxies for information mastery measures might be considered a limitation. While actual observation of participant skills might provide more objective measures, this would be both impractical and artificial. Although self-report has been thought of as less accurate than assessment by others, Shrauger and Osberg<sup>58</sup> have noted that, given the appropriate circumstances, judgments of one's own behavior can be as effective as those made in other ways. While it is possible that response bias could have occurred among workshop participants, their responses did not show increases in all measures.

Three critical components for improving information management behaviors were tested in a randomized control study. While the findings suggest that both the training protocol and provision of computers and high-speed Internet access have measurable impacts, important questions remain to be explored.

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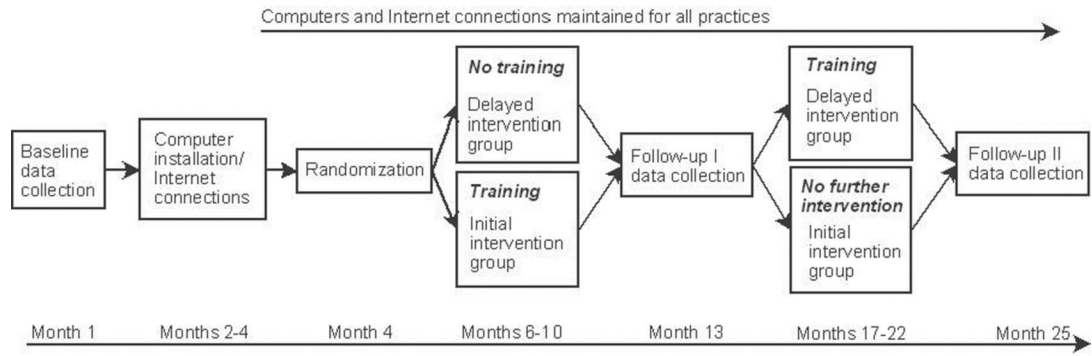
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**Figure 1.**  
Study Design

**Table 1**

Overview of Training Intervention and Resources Provided

| Activities                 | Accessing/Efficiently Using Resources   | Practice Improvement Plan  |
|----------------------------|---|--|
| Workshop I                 | <ul style="list-style-type: none"> <li>• Search assignment based on a clinical case/exploration of several online resources through hands-on exercise<sup>HO, SG</sup></li> <li>• Report findings<sup>SG, LG</sup></li> <li>• Review of resources and search strategies by librarians using Finding EBM Answers Quickly and Efficiently chart as guide (<a href="http://www.dartmouth.edu/~biomed/resources.html/guides/find_ebm.shtml">http://www.dartmouth.edu/~biomed/resources.html/guides/find_ebm.shtml</a>)<sup>LG, HO</sup></li> <li>• Practice search strategies for each resource using second clinical case<sup>HO, SG</sup></li> <li>• Give and review handouts to aid in locating and using resources<sup>LG</sup></li> <li>• Review between-workshop exercise: identify and answer one clinical or patient education question using Web-based resources covered in workshop<sup>LG</sup></li> </ul> | <ul style="list-style-type: none"> <li>• Discuss experiences using Web-based information in practice for patient care decisions and patient education<sup>LG</sup></li> <li>• Review baseline data on current Web-based resource use by providers (summary) and patients (per practice)<sup>TW</sup></li> <li>• Create patient care flow diagram<sup>TW</sup></li> <li>• Brainstorm ideas on how to change the process of care to use Web-based resources for patient care decisions and patient education<sup>TW</sup></li> <li>• Share findings/ideas<sup>LG</sup></li> <li>• Review of potential tools available to promote use of Web-based resources (eg, NLM information prescription pads [<a href="http://www.informationrx.org/Splash.html">http://www.informationrx.org/Splash.html</a>])<sup>LG</sup></li> <li>• Develop initial improvement plan to increase use of Web-based resources in day-to-day practice<sup>TW</sup></li> </ul> |
| Between-workshop exercises | <ul style="list-style-type: none"> <li>• Complete and send back clinical or patient education question exercise<sup>I</sup></li> </ul>  | <ul style="list-style-type: none"> <li>• Implement initial improvement plan<sup>TW</sup></li> </ul>  |
| Workshop II                | <ul style="list-style-type: none"> <li>• Discuss/address search strategy issues identified in clinical question exercise<sup>LG</sup></li> <li>• Review online resources again based on participant questions<sup>LG, HO</sup></li> </ul>   | <ul style="list-style-type: none"> <li>• Share experiences from implementation of improvement plans<sup>SG, LG</sup></li> <li>• Revise/expand improvement plan<sup>TW</sup></li> <li>• Develop measures to evaluate goals<sup>LG, TW</sup></li> </ul>  |
| Phone call/site visit      | <ul style="list-style-type: none"> <li>• Answer questions about resources</li> <li>• Provide additional materials to aid in use of resources</li> </ul>   | <ul style="list-style-type: none"> <li>• Review progress on improvement plan</li> <li>• Review of practice goals/successes/plans to improve; offer support/suggestions</li> </ul>  |

HO—Hands-on Internet searches (each participant had own computer to work on)

LG—Large-group presentation/discussion

SG—Small-group work (made up of individuals from different practices)

TW—Work by practice teams, with assistance from workshop faculty

I—Individual work

**Table 2**

## Composition of Domains Analyzed

| Domain   | Questionnaire Item(s)   |
|--|---|
| <b>Knowledge and skills</b>  |   |
| Scored from 1=not at all to 5=extremely  | • How well you can find information you need on the Web   |
| Scored from 1=not at all to 5=extremely  | • How well you can find educational materials for your patients on the Web  |
| Score=sum of four items scored from 1=not at all to 5=extremely ( $\alpha=.93$ )                   | • How well you can do the following Web tasks:<br>- develop an effective online search strategy from my patient care questions<br>- narrow search results using limits (eg, English only, age of patients, etc)<br>- use terms such as "or" and "and" to widen or narrow my search<br>- use subject headings (eg, MeSH terms) to develop a search   |
| Score=sum of eight items scored from 1=not at all well to 5=extremely well ( $\alpha=.92$ )        | • How well you know how to use the following Web-based resources:<br>- Internet search engine (eg, Yahoo, Google)<br>- MEDLINE (eg, via PubMed or OVID)<br>- online clinical resource (eg, UpToDate, MDConsult)<br>- online evidence-based review resource (eg, Cochrane)<br>- online practice guidelines (eg, National Guidelines Clearinghouse, Institute for Clinical Systems Improvement)<br>- medical professions Web site (eg, American Academy of Family Physicians)<br>- medical organization Web site (eg, American Heart Association, Centers for Disease Control and Prevention)<br>- patient-oriented health information Web site (eg, MedlinePlus, WebMD)                              |
| <b>Frequency of resource use</b>   |   |
| Score=sum of seven items scored from 1=never or seldom to 4=daily or almost daily ( $\alpha=.80$ ) | • How often in a typical month you use each resource listed to find information for making specific patient care decisions (your own decisions or to help someone else make a decision):<br>- Internet search engine (eg, Yahoo, Google)<br>- MEDLINE (eg, via PubMed or OVID)<br>- online clinical resource (eg, UpToDate, MDConsult)<br>- online evidence-based review resource (eg, Cochrane)<br>- online practice guidelines (eg, National Guidelines Clearinghouse, Institute for Clinical Systems Improvement)<br>- medical professions Web site (eg, American Academy of Family Physicians)<br>- medical organization Web site (eg, American Heart Association, Centers for Disease Control) |
| Scored from 1=never or seldom to 4=daily or almost daily   | • How often in a typical month you use (eg, show to a patient, give to a patient, tell a patient about) Web-based materials (online and/or printed and kept on file for patients)   |
| <b>Communication with patients about using resources for health information</b>                    |   |
| Scored from 1=never to 5=daily or almost daily   | How often you refer patients to specific Web sites  |
| <b>Perceptions about the use of resources</b>  |   |
| Scored from 1=strongly disagree to 5=strongly agree  | • I like it when patients bring in information they find on the Web   |
|  | • I feel that the Web does or could help us provide better health education materials to patients   |
|  | • I feel that the Web does or could help us provide better clinical care to patients  |
| <b>Incorporating use of resources into daily practice</b>  |   |
| Scored from 1=never to 5=very often  | • I use the Web during my work hours at this practice for patient education   |

| Domain  | Questionnaire Item(s)  |
|---|--|
|   | <ul style="list-style-type: none"><li>• I use the Web during my work hours at this practice for patient care decisions</li></ul>                               |
| Scored from 1=strongly disagree to 5=strongly agree | <ul style="list-style-type: none"><li>• I think there is leadership at this practice that encourages using Web resources for patient education</li></ul>       |
|   | <ul style="list-style-type: none"><li>• I think there is leadership at this practice that encourages using Web resources for patient care decisions.</li></ul> |

**Table 3**

## Descriptor Variables at Baseline

|   | Delayed Intervention Group | Initial Intervention Group |
|---|----------------------------|----------------------------|
| Number of participants who completed both surveys   | 20<br><i>n (%)</i>         | 25<br><i>n (%)</i>         |
| Gender  |                            |                            |
| Male  | 3 (15%)                    | 7 (29%)                    |
| Female  | 17 (85%)                   | 17 (71%)                   |
| Role in practice  |                            |                            |
| Provider (MD, DO, PA, NP)   | 8 (40%)                    | 10 (40%)                   |
| Clinic staff (RN, LPN, MA, SW)  | 6 (30%)                    | 7 (28%)                    |
| Administrative support  | 2 (10%)                    | 3 (12%)                    |
| Other   | 4 (20%)                    | 5 (20%)                    |
|   | <i>Mean (SD)</i>           | <i>Mean (SD)</i>           |
| Age (years)   | 43.6 (11.1)                | 46.0 (12.7)                |
| Work at practice (years)  | 6.3 (6.9)                  | 8.8 (8.6)                  |
| Hours work per week   | 37.9 (9.7)                 | 41.2 (8.4)                 |
| A computer with Web access is available at work.<br>Scored from 1=never to 5=most of the time | 4.5 (1.1)                  | 4.6 (0.9)                  |
| Computer at work has fast Internet connection.<br>Scored from 1=never to 5=most of the time   | 4.1 (1.4)                  | 4.3 (1.1)                  |
| Frequency of Web use at work for any reason.<br>Scored from 1=never to 6=several times a day  | 4.8 (1.4)                  | 4.8 (1.6)                  |

**Table 4**  
Mean Scores, SDs, and Post-hoc Pairwise Comparisons for Significant Group by Time Interactions

| Measure   | Delayed Intervention Group |                              | Initial Intervention Group |                              | F     | P Value $\leq .05$ |
|---|----------------------------|------------------------------|----------------------------|------------------------------|-------|--------------------|
|   | (a) Baseline<br>Mean (SD)  | (b) Follow-up I<br>Mean (SD) | (c) Baseline<br>Mean (SD)  | (d) Follow-up I<br>Mean (SD) |       |                    |
| <b>Knowledge and skills</b>   |                            |                              |                            |                              |       |                    |
| Ability to find information on the Web  | 3.4 (1.0)                  | 3.5 (1.0)                    | 3.1 (.9) d                 | 3.8 (.8) c                   | 5.45  | .025               |
| Ability to find educational materials on the Web for patients                         | 2.4 (1.3)                  | 2.4 (.8)                     | 2.1 (1.0) d                | 3.1 (1.0) c                  | 7.25  | .012               |
| Composite of skills for finding information on the Web for patients                   | 10.6 (5.0)                 | 10.4 (4.8)                   | 7.6 (3.8) d                | 11.0 (4.2) c                 | 6.11  | .019               |
| Skills in using a variety of Web-based resources                                      | 13.9 (9.0)                 | 13.9 (7.4) d                 | 10.0 (6.6) d               | 21.2 (6.9) b,c               | 25.51 | <.001              |
| <b>Frequency of resource use</b>  |                            |                              |                            |                              |       |                    |
| How often I use the Web for patient care decisions                                    | 10.1 (3.5)                 | 8.9 (3.2)                    | 7.8 (2.9)                  | 10.0 (3.1)                   | 6.59  | .017               |
| <b>Perceptions about the use of resources</b>   |                            |                              |                            |                              |       |                    |
| I like it when patients bring in information they find on the Web                     | 3.4 (1.0)                  | 3.5 (1.0)                    | 3.2 (.7) d                 | 3.8 (0.5) c                  | 4.19  | .05                |
| <b>Incorporating use of resources into daily practice</b>                             |                            |                              |                            |                              |       |                    |
| I think there is leadership that encourages using Web resources for patient education | 2.9 (1.2)                  | 2.9 (1.2)                    | 2.6 (1.1) d                | 3.5 (0.9) c                  | 4.66  | .038               |

SD—standard deviation

Note: Lower case letter denotes that, for a given row, the cell value is significantly different from the values in column denoted by the letter. Tests of differences for time (column a and b, c and d) used paired-means *t* test. Tests of intervention differences (columns a and c, b and d) were independent means *t* tests. A Bonferroni adjustment was used to control overall Type I error.

**Table 5**

Mean Scores and SDs for Significant Effects of Time for All Participants

|  | Delayed Intervention Group | Initial Intervention Group |      |         |
|--|----------------------------|----------------------------|------|---------|
| Measures   | Baseline                   | Follow-up I                |      |         |
| Frequency of resource use  | Mean (SD)                  | Mean (SD)                  | F    | P Value |
| How often in a typical month I use Web-based materials for patient education                                   | 1.6 (0.9)                  | 2.0 (0.8)                  | 6.6  | .016    |
| <b>Communication with patients about using resources for health information</b>                                |                            |                            |      |         |
| How often I refer patients to specific Web sites   | 1.8 (0.9)                  | 2.5 (0.8)                  | 17.0 | <.001   |
| <b>Incorporating use of resources into daily practice</b>  |                            |                            |      |         |
| The degree to which I think there is leadership that encourages using Web resources for patient care decisions | 2.5 (1.2)                  | 3.5 (0.9)                  | 16.1 | <.001   |
| How often I use the Web during work hours for patient education  | 1.8 (1.0)                  | 2.3 (1.0)                  | 12.0 | .002    |
| How often I use the Web during work hours for patient care decisions   | 2.4 (1.2)                  | 2.9 (1.1)                  | 7.0  | .013    |

SD—standard deviation



**Table 6**

Mean Differences and SDs between Scores at Baseline and Follow-up II

| Measures  | Delayed Intervention Group | Initial Intervention Group |
|---|----------------------------|----------------------------|
| <b>Knowledge and skills</b>   | <b>Mean (SD)</b>           | <b>Mean (SD)</b>           |
| Ability to find information on the Web  | 0.8 (1.0)                  | 0.7 (1.0)                  |
| Ability to find educational materials on the Web for patients   | 1.2 (1.4)                  | 1.4 (1.1)                  |
| Composite of skills for finding information on the Web for patients   | 11.0 (6.9)                 | 11.7 (8.4)                 |
| Skills in using a variety of Web-based resources  | 3.6 (2.8)                  | 3.2 (4.8)                  |
| <b>Frequency of resource use</b>  |                            |                            |
| How often in a typical month I use Web-based materials for patient care decisions                           | 2.6 (3.5)                  | 4.3 (3.3)                  |
| How often in a typical month I use Web-based materials for patient education                                | 1.1 (1.3)                  | 0.2 (0.9)                  |
| <b>Communication with patients about using resources for health information</b>                             |                            |                            |
| How often I refer patients to specific Web sites  | 1.2 (1.2)                  | 0.7 (1.0)                  |
| <b>Perceptions about the use of resources</b>   |                            |                            |
| I like it when patients bring in information they find on the Web   | 0.4 (0.7)                  | 0.6 (0.8)                  |
| I feel that the Web does or could help us provide better health education materials to patients             | 0.3 (0.8)                  | 0.2 (0.6)                  |
| I feel that the Web does or could help us provide better clinical care to patients                          | 0.2 (0.8)                  | -0.1 (1.0)                 |
| <b>Incorporating use of resources into daily practice</b>   |                            |                            |
| I use the Web during my work hours at this practice for patient education                                   | 1.5 (0.9)                  | 0.9 (1.2)                  |
| I use the Web during my work hours at this practice for patient care decisions                              | 0.9 (1.3)                  | 1.2 (1.2)                  |
| I think there is leadership at this practice that encourages using Web resources for patient education      | 1.0 (1.2)                  | 0.8 (1.3)                  |
| I think there is leadership at this practice that encourages using Web resources for patient care decisions | 1.1 (1.5)                  | 1.1 (1.2)                  |

SD—standard deviation