Improving information management in primary care: the proof is in the pudding

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ABSTRACT

Generalists in both the USA and UK have been at the forefront of improving information management skills, defined here as the abilities required to locate and utilise synthesised information for patient care that is accessible, current, relevant and valid. Over the past decade, a variety of interventions designed to improve knowledge and skills relative to information management has been implemented. The goals of training are for learners to demonstrate long-term retention of knowledge and skills gained and to be able to transfer this learning from the context of training into different situations and contexts, such as those encountered in the workplace. Thus, to conclude that learning has taken place, it is essential to study performance after learners have acquired knowledge and skills to see how well those have been retained and generalised.

The current study builds on previous work conducted by the authors that described and evaluated an intervention designed to improve information management knowledge, skills and use of Web-based resources by participants from generalist primary care practices. This cross-over study found that both groups of participants – those who received training initially and those who received training later – showed the same improvements when assessed 15 months and three months, respectively, after training. Given the definition of learning as ‘relatively permanent’, we wondered if these improvements would last.

Participants in the original three phases of the study completed questionnaires during each phase; for the current study they were asked to complete a fourth questionnaire administered 27 and 15 months, respectively, after their original training. All variables showed non-significant differences between participants’ scores at the end of the original study, where learning was assessed as having occurred, and the current administration of the questionnaire. Demonstrated long-term retention of knowledge and skills and generalisation to the workplace show that the goals of training have been met.

Keywords: evidence-based medicine, information management, learning

Background

In 2002, Haux and his colleagues described a vision of health care in 2013 in which health information systems would be crucial for documentation, communication, medical knowledge, decision support, research and reporting. Well before 2013, information and communication technologies have become important in
many capacities in healthcare systems. The term ‘information management’ has been used to describe the role of technology in healthcare systems, including linkages with the National Health Service in the UK, and management of chronic diseases using telemedicine, clinical decision support and home-based monitoring in Australia. Others have described it as a mechanism for establishing large datasets to facilitate research and the application of clinical trial evidence. More narrowly, information management functions have been described as identifying needs, obtaining information to meet those needs and ascertaining the value of the information.

In this last vein, Sackett and Rosenberg noted that ‘as the quantity of valid evidence increases so does the requirement for each of us to develop the skills necessary to assimilate, evaluate and make best use of that evidence for patients’. Slawson and Shaughnessy elaborated on this by defining a broader skill set of information management – the abilities required to locate and utilise synthesised information for patient care that is accessible, current, relevant, and valid – rather than the narrower focus on best evidence alone.

Family medicine and general practitioners have been leaders in focusing on information management skills and have identified lack of knowledge and skills in the use of electronically-based resources as one factor affecting providers’ use of evidence-based resources. Various interventions aimed at improving information management knowledge and skills have been implemented, with most reporting positive findings. In each case, learning was assumed to have occurred. But what is learning? Learning has been defined as ‘relatively permanent change in behavior potentiality which occurs as a result of reinforced practice’. The goals of training are for learners to demonstrate long-term retention of knowledge and skills and to transfer or generalise this learning into different situations and contexts, such as the workplace. Thus, to conclude that learning has taken place, it is essential to study how well learners have retained and generalised knowledge and skills.

Relatively little research has studied retention and transfer relative to information management learning. Various research designs and timeframes have been used, but few have gone beyond 12 months. In a cross-over study, the current authors described improvements in knowledge, skills and frequency of Web-based resource use for two groups of participants when assessed 15 months and three months after training. Given the definition of learning as ‘relatively permanent’, we wondered if these improvements would last.

Method

The original study began in July 2004 and involved 24 primary care practices located in New Hampshire and Vermont. Practices were matched by size, specialty and location. A cross-over design was used, with one practice in each pair randomly assigned to the initial intervention group and one to the delayed training group. Dartmouth College’s Committee for the Protection of Human Subjects approved the human subjects protocol.

Prior to randomisation, each practice completed baseline measures, then received two computers and high-speed Internet connections to ensure that all sites had at least the minimum of equipment and access to the Web. At baseline, 67% of the practices had high-speed connections and 54% had limited computer resources, numbers in line with other descriptions of primary care information technology infrastructure. No differences in resources were found between the groups.

The participants consisted of small teams – one to three healthcare providers and clinical and office staff – selected by the practice, making a total of 32 participants in each group. Training focused on knowledge and skills related to information management and on creation of an improvement plan to incorporate information management into the practice via use of Web-based resources for clinical decision making and patient education. The purpose of the teams was to enhance perspectives on care delivery processes in the practice, which helped inform the development of the practice-based improvement plans.

Training consisted of two day-long workshops that utilised a variety of experiential learning methodologies. Workshop I focused on efficiently accessing Web-based resources and on developing initial practice-specific plans to use these resources. Between the workshops, participants completed a practice-specific search exercise and implemented initial plans. A phone call prior to the second workshop was used to answer questions and to review progress. Workshop II focused on reviewing search strategies and on revising and expanding improvement plans. One month after Workshop II, a site visit was made to each practice to review progress.

A questionnaire was developed to measure participants’ knowledge, perceptions, skills and use of electronic evidence-based resources. Items selected represented five conceptual domains related to information management and electronic evidence-based resources: a) self-
assessed knowledge and skills, b) frequency of resource use, c) communication with patients about using resources for health information, d) perceptions about the use of resources and e) incorporating use of resources into daily practice. A self-report questionnaire was utilised mainly for reasons of practicality, with knowledge of the pluses and minuses of such a tool. As indicated in Figure 1, the questionnaire was administered three times during the original study.

In the original study, participants in both initial and delayed training groups reported increases in knowledge, skills and frequency of use of electronic evidence-based resources for patient care decisions that were associated with the training intervention. Participants also reported increases in frequency of resource use for patient education, communication with patients about evidence-based resources and incorporating use of these resources into daily practice. These increases occurred for both groups over the initial timeframe of the study and were not related to training.

To determine whether improvements were sustained (the focus of the current study) the questionnaire was administered a fourth time (follow-up III), as shown in Figure 1. This reflected a period of no further training for approximately 27 months for the initial training group and 15 months for the delayed training group.

Analysis

Prior analyses had examined the differences between initial implementation and delayed implementation participants’ scores at baseline and follow-up I, and scores at baseline and follow-up II. These analyses assessed the equivalency of both study arms, as well as initial learning for both groups of participants. Since both groups reported scores that were substantively the same after training, it was concluded that there was no significant effect of group. As the current question of interest was whether the improvements reported

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**Figure 1** Study design
initially would last, the present analysis utilised paired t-tests to examine the difference between all participants’ scores at follow-up II and follow-up III. Maintenance of learning at follow-up III would be indicated by no change in scores (non-significant t-tests). To ensure that such findings indicated maintenance of learning rather than Type II error due to small N, post hoc effect size and power issues were addressed.

Results

Of the 64 original participants, 40 (63%) completed questionnaires at each of the initial three survey points. Thirty participants (47% of original and 75% of those completing three prior surveys) completed the follow-up III questionnaire. In most cases, participants who had completed the three prior surveys but not the follow-up III questionnaire had left the practice.

The participants were predominately female (74%) and averaged 50 years of age (standard deviation (SD) 9.3). They had been with their current practice for an average of 10.5 years (SD 8.2).

Table 1 displays the mean scores, standard deviations, and paired t-test results for all variables.

No paired t-tests were significant, indicating that scores at follow-up III did not differ significantly from scores at follow-up II. Specific results for each conceptual domain are described below.

Knowledge and skills

These items asked participants how well they could do particular Web tasks. In the original study, each of the four items representing knowledge and skills showed improved scores associated with training. In the present analysis, there were no significant differences between scores at follow-up II and follow-up III for any of the items: a) finding information on the Web, b) finding educational material on the Web for patients, c) a sum of specific search skills and d) skills using a variety of Web-based resources.

Frequency

These items asked participants to estimate how often in a typical month they used a variety of Web-based resources for patient care decisions and patient education. In the original study, the item indicating how often participants reported using a variety of Web-based resources for patient care decisions showed improved scores associated with training. All participants reported a significant increase in the frequency with which they used Web-based materials for patient education; this occurred over the initial timeframe of the study and was not related to training. In the current analysis, there were no significant differences between scores at follow-up II and follow-up III for either item.

Communication

This item asked participants to estimate how often they referred patients to specific Web sites. In the original study, all participants reported a significant increase; this occurred over the initial timeframe of the study and was not related to training. In the current analysis, there was no significant difference between scores at follow-up II and follow-up III for this item.

Perception

These items asked participants how they felt about their experiences, given their current patients and practice setting. In the original study, the item indicating the degree to which participants like it when patients bring in Web-based information showed an increase associated with training. Additionally, there were two items with non-significant findings: participants reported no difference in feeling the Web could help them provide patients with either better clinical care or better health education materials. In the present analysis, there were no significant changes between scores at follow-up II and follow-up III for any of these items.

Incorporation

These items asked participants how they felt, given their current practice setting. In the original study, participants reported a significant increase in their belief that there was leadership at their practice that encouraged using Web resources for patient education. This increase was associated with training. Additionally, all participants reported significant increases in their belief that there was leadership at their practice that encouraged the use of Web resources for patient care decisions, and for the frequency with which they used the Web at work for patient education and for patient care decisions. These reported increases occurred over the initial timeframe of the study and were not related to training. In the current analysis, there were no significant changes between scores at follow-up II and follow-up III for any of these items.
Table 1 Mean scores, standard deviations and paired t-tests between follow-up II and follow-up III

<table>
<thead>
<tr>
<th>Measures</th>
<th>Follow-up II</th>
<th>Follow-up III</th>
<th>t (df)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge and skills</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ability to find information on the Web</td>
<td>3.83 (0.91)</td>
<td>3.70 (0.75)</td>
<td>0.78 (29)</td>
<td>0.442</td>
</tr>
<tr>
<td>Ability to find educational materials on the Web for patients</td>
<td>3.36 (1.22)</td>
<td>3.36 (1.11)</td>
<td>0.00 (24)</td>
<td>1.000</td>
</tr>
<tr>
<td>Composite of skills for finding information on the Web for patients</td>
<td>11.62 (5.05)</td>
<td>12.08 (4.33)</td>
<td>−1.13 (25)</td>
<td>0.269</td>
</tr>
<tr>
<td>Skills in using a variety of Web-based resources</td>
<td>21.88 (7.66)</td>
<td>19.47 (9.78)</td>
<td>1.61 (33)</td>
<td>0.117</td>
</tr>
<tr>
<td>Frequency of resource use</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How often in a typical month I use Web-based materials for patient care decisions</td>
<td>12.35 (3.41)</td>
<td>12.50 (4.52)</td>
<td>−0.21 (25)</td>
<td>0.833</td>
</tr>
<tr>
<td>How often in a typical month I use Web-based materials for patient education</td>
<td>2.16 (1.14)</td>
<td>2.52 (1.00)</td>
<td>−1.89 (24)</td>
<td>0.071</td>
</tr>
<tr>
<td>Communication with patients about using resources for health information</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How often I refer patients to specific Web sites</td>
<td>2.93 (1.05)</td>
<td>2.89 (1.03)</td>
<td>0.25 (27)</td>
<td>0.802</td>
</tr>
<tr>
<td>Perceptions about the use of resources</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I like it when patients bring in information they find on the Web</td>
<td>3.88 (0.67)</td>
<td>3.72 (0.89)</td>
<td>0.70 (24)</td>
<td>0.491</td>
</tr>
<tr>
<td>I feel that the Web does or could help us provide better health education materials to patients</td>
<td>4.17 (0.59)</td>
<td>4.00 (0.83)</td>
<td>1.04 (29)</td>
<td>0.305</td>
</tr>
<tr>
<td>I feel that the Web does or could help us provide better clinical care to patients</td>
<td>3.97 (0.63)</td>
<td>3.90 (1.01)</td>
<td>0.34 (28)</td>
<td>0.738</td>
</tr>
<tr>
<td>Incorporating use of resources into daily practice</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I use the Web during my work hours at this practice for patient education</td>
<td>3.04 (1.06)</td>
<td>3.32 (1.11)</td>
<td>−1.43 (24)</td>
<td>0.166</td>
</tr>
<tr>
<td>I use the Web during my work hours at this practice for patient care decisions</td>
<td>3.39 (1.31)</td>
<td>3.70 (1.11)</td>
<td>−1.50 (22)</td>
<td>0.148</td>
</tr>
<tr>
<td>I think there is leadership at this practice that encourages using Web resources for patient education</td>
<td>3.50 (0.89)</td>
<td>3.67 (0.92)</td>
<td>−0.81 (23)</td>
<td>0.426</td>
</tr>
<tr>
<td>I think there is leadership at this practice that encourages using Web resources for patient care decisions</td>
<td>3.36 (0.86)</td>
<td>3.68 (1.03)</td>
<td>−1.40 (24)</td>
<td>0.175</td>
</tr>
</tbody>
</table>
Discussion

The research question of interest in this study was whether the improvements in information management knowledge and skills that occurred in the original study had persisted. All items showed non-significant differences between participants’ scores at follow-up II and follow-up III, indicating that the improvements were maintained.

These findings are subject to a number of limitations. The first is the small sample size combined with an overall response rate of 47% of the original participants. Three-quarters of those who completed the first three questionnaires also completed the fourth questionnaire. Given that the study was conducted over more than three years, turnover in practices was expected. The major concern of the small sample size is assuring that the findings of non-significant differences support the conclusion of maintenance of learning rather than Type II error. Thus, it is important to consider issues of effect size and power. Cohen has described parameters of small (0.2), medium (0.5) and large (0.8) effect sizes, and has suggested that a power level of 0.80 is the conventional level needed when an \( \alpha \)-level of 0.05 is used to denote significance. Using the scores from baseline and follow-up III (a conservative estimator for the original study due to the smaller \( N \) available at follow-up III), we calculated the actual effect size of items. These calculations showed that nearly all of the effect sizes achieved, based on our actual sample of 30 participants at follow-up III, were >0.5, indicating at least a moderate effect. In these instances, the actual power level was well above the recommended level of 0.80 for all items where we indicated that change had taken place in the original study. The results of these calculations provide assurance that the small sample size did not unduly bias the findings.

Another potential limitation to the study concerns internal validity. It is likely that changes in expectations and the environment for use of Web-based healthcare resources occurred over the 37 months of the study. The original study’s findings, illustrated in Figure 2, show two types of increases: those associated with training and those not related to training that were likely due to passage of time and enhanced computer technology in the practices. The findings from the current study, also schematically represented in Figure 2, show no reported change over the intervening time. Given adequate statistical power, these patterns of change provide some evidence that the intervention had an effect and that other changes were associated with the practices having enhanced computer equipment.

Another limitation of the study concerns generalisability. Many practices in New Hampshire and Vermont are rural and may not be representative of practices in other areas.

Self-reports are often considered a limitation. Shrauger and Osberg have noted that, given the appropriate circumstances, judgements of one’s own behaviour can be as effective as those made in other ways. This opinion has been seconded by others who have observed that self-report can provide valid and valuable measures when employed in sensible research designs, such as

![Figure 2 Schematic drawing of results](image-url)
longitudinal studies, and where observational or other more objective measures would be obtrusive and impractical. Howard and his colleagues reported on a series of studies aimed at testing and comparing behavioural and self-report measures. They noted that while self-report measures may be ‘contaminated’ by a variety of response style effects, behavioural measures are subject to distortion due to variety of types of variance. They noted both that it was costlier and less efficient to collect behavioural measures than self-report measures, and that behavioural measures yielded information that was of no better quality.

It is possible that social desirability or response bias could have played a role in participants’ responses. It has been noted that self-deception is minimised by use of behavioural items, such as those used in the study questionnaire. As noted earlier, relatively little research has addressed retention and transfer of knowledge and skills relative to information management. Schmitt has opined that it is appropriate in newly developing areas of research to use methods and research designs that might be less appropriate in more mature areas of research.

The goals of training are long-term retention of knowledge and skills, and transfer of learning into other environments, such as the workplace. Workplace performance is influenced by many factors including learner characteristics, the type of skills learned and workplace culture and environment. It has been argued that successful learning and transfer in organisations requires: a) knowledge of guiding principles, culture and purpose; b) infrastructure including time and support to learn; c) tools needed to do the job. These are among the factors that should be considered for educational interventions focused on information management in clinical practices. That said, the proof is in the pudding: in this study, demonstrated long-term retention of knowledge and skills and generalisation to the workplace show that the goals of training have been met. Further work will explore the relative contributions of the educational intervention and the organisational culture to this success.

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REFERENCES


CONFLICTS OF INTEREST

None.

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