Designing a Technology Enhanced Practice for Home Nursing Care of Patients with Congestive Heart Failure

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Abstract

This paper describes the process we used to design the HeartCare website to support Technology Enhanced Practice (TEP) for home care nurses engaged in providing care for patients with Congestive Heart Failure (CHF). Composed of communication, information, and self-monitoring functions, the HeartCare website is aimed at supporting best practice nursing care for these patients. Its unique focus is professional practice, thus the scope of this project is greater and more abstract than those focusing on a task or set of activities. A modified macroergonomic analysis, design work system analysis, and focus groups utilizing participatory design methodology were undertaken to characterize the nursing practice model. Design of the HeartCare website required synthesizing the extant practice model and the agency’s evidence-based heart failure protocols, identifying aspects of practice that could be enhanced by supporting technology, and delineation of functional requirements of the Enhanced HeartCare technology. Validation and refinement of the website and planning for user training activities will be accomplished through a two-stage usability testing strategy.

Introduction

Patients benefit from access to Internet-based health information and communication resources, but the maximum clinical benefit of consumer health informatics applications awaits integration of these tools with formal clinical services. Therefore, the purpose of the HeartCare II: Custom Computer Support for Home Care project is to expand the successful WWW-based information and communication network, HeartCare, from a patient targeted home-care service to a technology enhanced practice (TEP) that augments the clinical care provided by home care nurses with electronic information and communication resources. This technology will provide nurses and patients with relevant information and will aid nurses in engaging patients with CHF in active self-monitoring and self-management of their disease.

Background

Congestive Heart Failure (CHF) has been described as an emerging epidemic among older Americans.1 CHF is a chronic, progressive disease affecting approximately 5 million American adults, with 550,000 new cases identified annually.2 In addition, the cost of CHF in the U.S. was recently estimated at $27.9 billion. Deaths from CHF increased 35.3 percent from 1992 to 2002.3 The condition threatens longevity as well as quality of life.

Management of CHF often includes pharmacological interventions, fluid and nutritional restrictions, and recommendations for lifestyle modifications. A variety of multidisciplinary interventions targeted at improving patient outcomes have been demonstrated to be more effective in improving quality of life and reducing health care service utilization, and these are increasingly being delivered in the home.4 As a result of the site of care transitioning from acute care settings to their homes, patients are required to assume greater responsibility for managing their often complex treatment regimens, evaluating their symptoms, and initiating referrals to professional care when deemed necessary. Thus, a major goal of home care nursing is to educate, support and enable patients with CHF to self-monitor and self-manage this complex disease and its treatment regimen, yet the optimal strategies to achieve this goal are still being explored.

Technologic strategies that support the health care provider role such as telemangement programs5,6 and automated monitoring tools (e.g. Health Buddy, HomMed Systems)7,8 have been demonstrated to improve disease management. Web-based disease management and consumer health informatics interventions that focus on patients with
CHF are also available, but are less likely to be used without coaching from a health care provider.

To date, computer support for home care nurses consists primarily of efficient records management systems. The nature of information technology needed to better support the nurse-patient relationship, or the manner in which information technology could augment or complement the activities involved in providing care to patients with CHF remains unknown. Thus the TEP may enhance existing clinical interactions as well as extend beneficial ones and may provide timely reassurance and coaching for self-management.

The need for such an intervention is amplified by the challenges facing the home care industry and home care nurses. While home care nurses are encountering sicker patients with greater needs for more complex care and the care delivery process is labor intensive, the nursing shortage and the initiation of a prospective payment system place greater demands on home care agencies to identify more efficient and cost-effective means of providing care in the home. These circumstances call for innovative and technology-based alternatives to traditional care to insure the delivery of effective home care services for patients with CHF. Under the prospective payment system, incentives exist to balance in-home visits with alternatives such as telephone or web-based patient education, coaching, and support. Such technologies could assist nurses in providing effective home care services in a more time- and cost-efficient manner. Complementing home visits with online support for self-monitoring and self-management could improve patient care and lead to better patient outcomes.

HeartCare II: Custom Computer Support for Home Care

The HeartCare II project is built upon three major areas: advances in consumer health informatics, challenges in the care of patients with CHF, and developments in human factors and industrial engineering in fitting technology to work. The result of this work will be evidence-based strategies to guide the design and deployment of information and information technology to support specific clinician-patient treatment plans.

This project is a randomized field experiment being conducted within a large, integrated health care delivery network in Wisconsin involving approximately 30 nursing care delivery teams and 400 patients. The first phase of the study, the design phase, reported here will answer the question “What configuration of a Technology Enhanced Practice results from the application of human factors techniques to the work of home care nurses?” The second phase of the study to be initiated in July, 2005 will implement the HeartCare website and examine its impact on nurses’ workflow and patient outcomes including clinical status, quality of life, self-monitoring, satisfaction with care, and health care service utilization.

The HeartCare website is an innovative resource in that it is designed to provide services for both nurses and patients within the context of a formal care delivery system. We anticipate that nurses in the experimental condition will plan individualized TEP for each CHF patient based on their own skills and preferences and on their assessment of patient needs. In other words, we expect the actual delivery (e.g. type of service, frequency, and duration) of the TEP may vary within individual nurses between patients, and among nurses due to differences in level of clinical expertise, preferences, and experience with technology, and over time. Thus the HeartCare website will provide a standard suite of services that will likely be utilized in a different ways that meet the specific needs of nurses and patients across time.

However, experiences within and outside of health care have revealed that success is greater when the information system is designed mindful of key aspects of the work process the technology is intended to support. Effective information technology design and implementation necessitates consideration of the range of actors involved and the context in which the technology is placed. In this project, we set out to systematically examine the actors and the context of home care of patients with CHF to best integrate the HeartCare II suite of services.

Characterizing the Nursing Practice Model: The Work Analysis

A modified macroergonomic analysis and design work system analysis was undertaken in two phases. The first phase involved rides-along observations of eight nurses during home visits for collection of the work elements. Two trained researchers observed the home care nurses providing care for patients with CHF. The researchers were non-participant observers, recording information on a notepad during observations. Nine open-ended questions were asked after the nurse and researchers left the patients’ homes to identify clinical knowledge, policies, and procedures that guided nurses’ actions and to clarify the observations.

In the second phase, in-depth telephone interviews with six home care nurses were conducted. Semi-structured questions were used to
increase the depth and breadth of the information obtained about the processes of care delivery. The open-ended questions addressed different aspects of home health care delivery (e.g. need for information, nurse-patient communication, and self-monitoring).

Two industrial engineering researchers translated the information from the observations into a set of flowcharts showing the flow of work. A nursing researcher participated in synthesizing a composite flowchart showing the integrated information from all of the observations. A second experienced nurse then validated the information in the composite flowchart. Responses to post-observation questions and phone interviews were transcribed into word processing format as a summary report. The nurse who validated the composite flowchart also validated this summary report.

The composite flowchart enumerated 166 steps involved in a nursing visit, beginning when a nurse obtained his/her schedule and ending when the nurse left the patient’s home. Major processes identified included scheduling the visit, confirming the visit, providing direct care to the patients, and coordinating care provided by other disciplines (e.g. dietary consultation, physical therapy, and social work). Some of the identified elements of providing direct care to the patients included physical and psychosocial assessment, physical care, educational interventions promoting adherence to the prescribed treatment regimen, and counseling/support.

The compilation of the results of the telephone interviews provided a more in-depth perspective on the processes of providing care to patients with CHF. Review of these transcripts confirms that although nurses have a common goal to facilitate patient self-monitoring and self-management, their approaches to achieving this goal are varied.

**Characterizing the Nursing Practice Model:**

**The TEP Design Focus Groups**

Two main objectives guided the development and conduct of the TEP Design Focus groups: 1) to seek feedback on the proposed HeartCare website functions (communication services, information resources, and self-monitoring tools) and 2) to seek input regarding which aspects of these functions would be most needed and beneficial to their practice. Two groups of five to six home care nurses each were convened. The purpose and proposed functions of the website were presented by an industrial engineer researcher who is experienced in participatory design approaches. A structured set of questions was used to guide the discussion and detailed notes were taken by two trained researchers.

The notes were compiled and organized around the key questions.

Participants validated that the proposed functions would be beneficial to their patients and their practice. Examples of problem areas they identified that could be targeted by the TEP included: communication with collaborating health care providers, transfer information from referral sources, communication, drug/drug interaction information, and tools that could increase patient adherence to self-monitoring recommendations.

**“Best Practices Model”: The CHF Guidelines**

The collaborating home care agency developed the CHF guidelines in response to the growing evidence that costly (in terms of quality of life and fiscal expenditures) health service utilization can be reduced and patient outcomes can be improved by strategies aimed at increasing patient adherence to their treatment regimen. Because no clinical guidelines specific to home care setting exist, the agency’s guidelines represent a synthesis of best evidence available. They also were validated by the agency’s “local experts” in the care of patients with CHF across the continuum of care.

The CHF guidelines are organized around a nine-visit plan and each visit is structured by the following seven nurse functions: ‘assessment’, ‘medications’, ‘instruction’, ‘recall and review’, patient ‘homework’, ‘mutual goal setting’, and ‘other’. The guidelines are displayed in a table composed of 7 rows representing the nurse functions and 9 columns representing the visits. Specific interventions are identified within each cell of the table. As an example, one cell of the guideline table is illustrated in Table 1.

**Table 1: Example of CHF Guideline Cell**

<table>
<thead>
<tr>
<th>Nurse Function</th>
<th>Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medication</td>
<td>•Assess adherence</td>
</tr>
<tr>
<td></td>
<td>•Instruct on 1-3 meds: schedule, purpose, side effects, action. (provide written materials when available)</td>
</tr>
<tr>
<td></td>
<td>•Instruct on “How to use prescription meds”</td>
</tr>
<tr>
<td></td>
<td>•Instruct on pulse taking</td>
</tr>
</tbody>
</table>

As in this illustration, a visit will typically include interventions that rely on communication, information, instruction or reinforcement of self-monitoring, and self-management strategies.

**Development of the Functional Requirements**

After reviewing and exploring the composite
work analysis flowchart, transcripts from nurse interviews, notes from the focus groups, and the CHF guidelines, scenarios portraying how nurses and patients might use the HeartCare website resources were developed and discussed. The research team formulated a preliminary functional requirements document from these scenarios. We enlisted the aid of our CHF consultants (nurse experts in the care of patients with CHF) to expand on and further refine the requirements. The working group then expanded to include the developer of the locally built platform on which the website would be delivered. In an iterative process, with key stakeholders providing input, the final document was prepared and priorities were established by group consensus.

Mapping the TEP to the Functional Requirements

We began this design process with the question “how do we identify and articulate the intersection between technology and nursing practice? This question drove the next steps of the design process. The CHF guidelines prescribed agency “best practice”, findings from the work analysis and the focus groups informed us about the extant practice model, and we had an enumeration of our view of the functional requirements for the HeartCare resource. Examination of these documents revealed that we needed to map the proposed functions to the steps of the composite work analysis flow chart and to the CHF guidelines. An example of this mapping is presented in Table 2. This mapping could reveal any major omissions in the functions we proposed as well as validate the priorities we had initially established. To date, no significant omissions were detected, but priorities have been altered as a result of this process.

Table 2: Example of Mapping TEP Functions against CHF Guidelines

<table>
<thead>
<tr>
<th>Nurse Function</th>
<th>Interventions</th>
<th>TEP Functions</th>
</tr>
</thead>
</table>
| Medication     | • Assess adherence  
                • Instruct on 1-3 meds: schedule, purpose, side effects, action.  
                • Instruct on “How to use prescription meds”  
                • Instruct on pulse taking | • Medication list  
                • Drug information utility (vendor provided)  
                • Drug interaction checker (vendor provided)  
                • Agency’s “For Your Well Being (FYWB)”  
                • FYWB |

Next Steps in the Design Process: Usability Testing and User Training Plans

Usability testing and development of a plan for user training will proceed in two stages. The first stage will engage six nurses in reviewing and evaluating screen mock ups of select features of the HeartCare website. An investigator-developed structured questionnaire will solicit ratings of each screen on aspects such as the quality of graphics, screen layouts, appropriateness for the users (nurses and patients), and readability. Open-ended questions will address perceived usefulness of the proposed function, comments on quality, and nurse’s intent to use the function with patients.

After completion of the functional prototype of the website, the second stage of usability testing will engage at least three nurses and three patients in activities that will enable them to evaluate the resources “in action”. Again, a structured survey will be used to elicit quantitative as well as qualitative feedback. A researcher will work one-to-one with each user to observe the technology in use and to document these observations. Interviews will also be conducted to obtain qualitative data about usability.

User training strategies will be informed by individual interviews and focus group interactions with the intended users. Prior experience with technology and training to use technology will be explored in these sessions. We anticipate that user training will incorporate elements of training-the-trainer approaches including the identification of super users to serve as resources and motivators to all users.

Discussion/Conclusion

The steps we have taken have been invaluable in enabling us to design a technology enhanced practice aimed at providing communication, information, and self-management tools for the home care nurses and the patients with CHF to whom they provide care. Substantial resource commitment was required to perform the in-depth work analysis and participatory design activities. These strategies have enabled us to examine not only a detailed description of the aggregate workflow of the nurses, but also have highlighted individual variations in nursing practices.

Although there was congruence among the various inputs to the design process, a gap was identified between the recommendations of the CHF guidelines and the observed nursing practice. This may be attributed to the fact that the guidelines were first introduced to the nurses during the time in which
we were observing and interviewing them. Through these design activities we were able to identify the need to explicitly incorporate these guidelines and the resources they require in the HeartCare resource. The resulting technology is one that can promote the structure of clinical guidelines while accommodating the different levels of expertise among the nurses and the different needs and strengths that patients present.

Finally, we have engaged the users of the technology from the beginning of the design phase. We are optimistic that the technology will not only have a good fit with the nurses’ work, but that their enthusiasm for the design process will carry over to its use in clinical practice.

References

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