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By Patricia Flatley Brennan, Laura Burke, Gail Casper, Marge Sebern, Carolyn Krause, Susan Kossman, Delores Severtson, and Judy Murphy

Insuring full benefit of consumer health informatics innovations requires integrating the technology into nursing practice, yet many valuable innovations are developed in research projects and never reach full integration. To avoid this outcome, a team of researchers partnered with a home care agency's staff and patients and their corporate parent's Information Systems and Research group to create a Technology-Enhanced Practice (TEP) designed to enhance care of home bound patients and their family care givers. The technology core of TEP, the HeartCare2 web site, was built in a collaborative process and deployed within the existing patient portal of the clinical partner. This paper describes the innovation and the experience of bringing it into full operation.

Introduction

Gleaning full benefit from consumer health informatics innovations relies on creating robust models of nursing practice that aptly capitalize on the strengths of the nurse, the capabilities of the patient, and the features of the innovation. Early partnership with clinical care facilities that possess strong information technology departments and well-established nursing care practices affords the best chance to insure sustainability of any health informatics innovation. Through this partnership, our academic nursing informatics research team collaborated with a home care nursing service to design and deploy a web-based resource to support an innovative nursing practice model, Technology Enhanced Practice. TEP has two key goals: (1) to meet the needs of home-bound persons with chronic heart failure, and (2) to close a gap among consumer health informatics tools, evidence based nursing practice, and home health nursing practice. We developed HeartCare2, a web site housed within the clinical partner's clinical information system.

Home care nursing is described as the creation of resources through integration of family and community supports, addressing the preventive, health maintenance and health restorative components of the health-illness trajectory, and evidence-based practice [1]. Technology is migrating into the home care arena, and there is increased reliance on both patient monitoring tools and electronic patient records. We sought a systematic way to enhance professional

nursing practice with technology, rather than simply deploying technologies as an add-on to existing practice. We report here the first phase of a work analysis and design activities undertaken by our partnership. We involved a team of researchers, clinical nursing staff, and IT departments to develop a sustainable change in nursing practice within the home care organization.

Our project differs from other work, including the earlier HeartCare project [2], in that from its inception, a philosophy of institutional change guided the efforts to design a new nursing practice model and create an innovative technology to support it. Staff nurses, clinical experts, information systems staff, and academic nurse researchers were fully engaged in every step of the systems life cycle, from the initial proposal through systems analysis and design to system implementation. Such a commitment required ongoing dialogue and reciprocal interaction to insure optimum alignment of the institution's needs, the staff resources, and the functionality of the technology employed to support the new model of practice.

Patients with Chronic Heart Failure (CHF) and their home care nurses are the targets of this Technology-enhanced nursing practice project. CHF is a chronic, fatal disease affecting 4.7 million American adults [3]. Clinical management of CHF involves a partnership between patients, physicians and nurses. Therapeutic nursing interventions may include pharmacotherapy and diet, medication and activity consultation [4, 5] and rely extensively on care provided by home care nurses. Information technology could complement and extend the work of home care nurses, and enhance the patients' abilities to self-monitor, self-manage, and maintain contact with their care team.

Background

Studies have demonstrated that repeated hospitalizations and emergent care use may be preventable. Reported causes of cardiac decompensation in CHF may be related to such factors as nonadherence to the treatment regimen, poor understanding of the condition and the treatment regimen, failure to recognize cardinal signs or symptoms, inadequate discharge planning, and inadequate professional follow-up [6, 7]. Prevention requires correction of health care system problems, but more importantly, nursing interventions focused on educating, empowering, and motivating patients to recognize, monitor, and manage their health and symptom state.

Technological strategies used to support home care home care have included: telephone follow-up by health care professionals; telemedicine interventions that enable physical assessment at a distance by videoconference; and automated monitors (e.g. Health Buddy) to

transmit weight and vital signs to a remote site and provide reminders to take medications or perform other daily self-care activities [8]. In addition, there are numerous web-based programs that provide information, decision aids, and record keeping that are aimed at aiding patients to self-manage and monitor their disease.

A goal of this project was to create a sustainable resource for nurses and patients. Sustainability is achieved when innovations are integrated into existing workflows. Thus it is important to employ user centered design strategies [9] that first examine existing work, identify where technology could facilitate accomplishment of existing practice goals, and offer new and novel adjuncts to clinical practice. Our user-centered approach to the design, testing and integration of the technology into practice required ongoing collaboration among the research, practice and corporate partners in the project. Participatory design and integration activities should support result in an enduring resource for the organization after completion of the study. Cooperation among the partners was enhanced by the fact that benefits would accrue to all partners, rather than primarily the research group.

The current practice at the home care agency is to provide a prescribed number of visits and “as need” additional visits to enable patients with CHF and their families to self-monitor and manage their chronic illness/CHF. At the termination of home care services, patients and families must assume full responsibility for self-care. Therefore, we sought to develop technology resources that could be used by nurses and patients during the period in which they received home care services as well as by patients alone for the time following the formal service period.

Such a collaborative project involved the merging of diverse, yet complementary goals of the participants. The university-based team focused on quality research outcomes and advancing nursing knowledge. Corporate partners were primarily concerned with issues such as cost-effectiveness of the technology and impact on best practices. Home care agency partners were committed to the integration of best practices, improvement of patient outcomes and effective use of nursing time.

The work reported here is the first phase of a 3-year field experiment comparing the clinical outcomes of patients cared for under a TEP model of nursing practice to those achieved under usual care. We anticipate enrolling 400 patients and 40 nurses in a two-group field study. Patients will participate for their period of home care (about 8 weeks) and have continued access to the technology resource for about 4 additional months. Key outcomes are self-management of symptoms, life quality, health service use, satisfaction with nursing care, and health status.

Methods

Integrating Nursing into the design and implementation

Employing a user-centered design approach [9] we analyzed the practice of home care nursing, focusing on the nurse's role, their use of evidence-based practices, and the environmental aspects key to the care of persons with heart failure. We conducted a work analysis including interviews with key informants, review of organizational documents, and ride-along observations of home care nurses in practice. We developed work flow diagrams and obtained existing clinical practice guidelines.

Following our work analysis we developed a functional requirements document for technology enhanced practice, and used focus groups to involve nurses in refining the functional requirements document. Participants in our focus groups were home care nurses, managers, and advanced practice nurses specializing in heart failure. We conducted 4 focus groups with managers, nurses, and nurse experts for input in how computer technologies could close the gap between the evidenced based practice guidelines and actual home care practice. We conducted 4 follow up focus groups to validate the proposed functional requirements needed to support best practice. Based on the functional requirements document we developed with nurses' input, we proposed a general structure of Technology Enhanced Practice and developed the HeartCare2 web resource as the technology tools to support practice and patient care.

Technology enhanced practice complements and extends the agency's existing care practice guidelines with specific technical supports. For example, an important component of the home care agency's care management of patients with CHF involves mutual goal setting. A technology resource was needed that allows recording of patient goals and monitoring of progress toward them. As daily weights and determining of change from previous weight is another important part of the care management of patients with CHF, it became essential to have a weight recording function available in the TEP technology resource.

Sustainability of information systems innovations is more likely when implementation planning occurs concurrently with systems design activities [10]. Our implementation plan started in our user centered design approach when nurses were involved in the work analysis, provided input and validated the design of the functional requirements. Our implementation plan involved training the clinical staff in the key components of TEP, activating the technology support for TEP, and institutionalizing the change in practice. Our goal for the implementation plan was to keep users involved and prepared to use the new approach to care.

Critical success factors for the TEP implementation and the HeartCare2 website included active and passive participation, training and learning, feedback and project management.

Examples of active participation were nurses' involvement in TEP design meetings and work system analysis. An example of passive participation was providing nurses with information and communication about TEP via voicemail and the written newsletters. Examples of our training and learning activities included training sessions with nurses to train them to mentor other TEP nurses, pocket guides, and TEP user manuals. We solicited feedback on our implementation plan during training sessions, and in usability testing of the TEP tools with nurses and patients. Finally, project management involved continually updating our timeline for implementation of TEP, documentation, and clarification of roles and responsibilities.

Configuration of the Heart Care 2 Technology Core

We developed the HeartCare2 web site within the institution's public access patient portal and web site as the technology resource for TEP. The University team provided design oversight, the home care agency provided all of the patient education and self-monitoring tools, and the corporate IT staff managed the programming.

The HeartCare2 core features enhance instruction and reinforce patient self-monitoring, access to relevant information, self-management strategies and communication. (See Figure 1) Features are designed to promote patient care delivery consistent with the home care agency's Heart Failure Guidelines. Health Tracker functions for weight, fluid intake, blood pressure, food, and activity prompt patients to enter daily data for these parameters. The Weight Tracker, the most critical feature for all patients with CHF, prompts patients to enter their weight each day. Patients are encouraged to self-monitor CHF symptoms by completing a Daily Symptom Checklist. A stoplight icon labeled Your Health Status Today produces a dropdown menu of symptoms when the cursor is over each of the lights. When users click on a light an interpretive and actionable message is displayed; for example, red means stop – call doctor right away or 911 if an emergency. My Goals prompts patients to record personal goals and strategies to achieve these goals; this feature can be used collaboratively by nurses and patients together. Helpful Resources provides links to health system approved teaching materials related to monitoring and self-management of CHF as well as other resources to promote self care. The Health Record permits patients to record current and past medications, immunizations, past surgeries and family history. The Teaching Log is another collaborative tool that enables nurses and patients to establish a plan of learning and document learning goal achievement. The Teaching Log includes a list of general goals, learning content and post-care referrals. These core features support TEP goals of enabling nurses to promote patient self-management.

To enhance communication, patients and nurses each have a bulletin board where they

can share information within their respective groups. Patients also can exchange electronic messages with their home care nurse, allow family members to view their records, schedule appointments and reorder supplies. Through the health system website, nurses and patients have access to vendor-supported information resources on health conditions and medications.

Results

The TEP process is in place and the HeartCare2 web site is operational. All nurses have completed the work analysis, and implementation training. We present now a summary of the critical elements of the partnership that created these accomplishments.

Strategies for success

Critical to developing a successful study in a practice setting is a strong partnership between the research team and the agency leadership. Without this partnership, front-line managers would be reluctant to participate in the study due to the many demands on their time. In addition, they may also be reluctant to provide the time for staff to participate in the study.

In this study it has proven to be advantageous to have the co-principal investigator (co-PI) of the project be from the corporate healthcare organization. The co-PI has extensive local knowledge of the organization and access to key system resources which otherwise may have gone unused. The co-PI initially presented the study to the home care agency staff. The agency nurse executive also attended as many of those initial meetings as possible and introduced the rationale of why the agency was participating in the study. This co-presenting demonstrated the partnership between the research team and agency administration.

During study design the co-PI spent many hours meeting with managers and staff as well as observing the home care agency processes. This was essential in order to understand the pressures on the agency from daily workload demands, which continue unabated during the study, and to identify how the study protocol would interact with agency processes. This also provided the co-PI the opportunity to develop relationships with agency staff, which assisted in developing trust between the research team and agency staff. Flexibility of the research team and the agency staff helped accommodate changes in the agency computer system, staff turnover and role changes.

The introductory meetings with staff were held as special in-service education meeting. Refreshments were provided to create a pleasant and low-key atmosphere. Selected staff was involved in detailed discussions of the intervention and staff also volunteered to participate in observation of their visits. As often as possible, meetings with staff regarding the study were

conducted as part regular staff meetings in order to minimize the need for extra meeting time.

There is a necessity for continual goal alignment between the research team and the agency. Fortunately, the population of patients with CHF is a major care initiative for the agency. The agency was in the process of developing guidelines for care of these patients and educating staff about best practices. Experts in CHF and agency nurses provided guidance in the design of the website. The research study provided additional incentive to examine the possibilities of providing technology-enhanced care.

The corporate information technology staff worked with the research team to enhance an existing product to meet the needs of the study. Weekly meetings and sometimes daily telephone calls facilitated the extensive negotiations needed to match the technical capabilities with the functional requirements.

Throughout the planning and development of the study, there was the need for both the research team and the agency staff to make compromises when possible and to be upfront when change could not be accommodated for either the integrity of the study or the operational needs of the agency. The continual need for this type of discussion demonstrates the importance of the relationship between the study and agency leaders.

Challenges and how they were managed

Conducting a study of this scope in a practice setting presents both the research team and agency staff with many challenges. Awareness of the potential allows for a flexible approach to meeting them. Due to the necessary time lag between writing a proposal and funding, many changes may occur in the practice setting, which must later be reconciled during the design phase. Examples of this include management and staff turnover, information system changes, and organizational structure changes. The need for approval by two Institutional Review Boards creates the need for special planning and understanding of the different processes.

In this study, on the agency side, the structure of the clinical teams was in a state of fluctuation. Turnover of staff and/or movement of staff between teams led to instability in the structure. Nurses and managers may perceive participating in a research study as extra work. Implementation of a new computerized documentation system created additional stress to the clinical system and to the staff. This occurred at the time of orienting staff to the website and the study protocol, and necessitated renegotiating of the launch date of the experiment.

Meeting these challenges required continual communication between agency staff and research team members. The co-PI played a critical role in resolving significant roadblocks to progress by bringing them to the attention of the home care Chief Nurse Executive with

resolution by compromise as the goal. The academic PI played a critical role mentoring the co-PI as well as providing technical and scientific oversight. Communication was enhanced by emails, monthly videoconference team meetings linking all sites, research team trips to the clinical site, exchange of meeting minutes and use of conference calls, use of a shared server and establishing secure access to selected corporate IT resources.

There have been numerous benefits to the agency by participating in this study including; opportunity for staff development by interacting with expert researchers, careful examination of nursing practice, exposure to working with other disciplines to better understand nursing practice, developing innovative solutions for common patient problems and documenting the relevance of home care nursing to achievement of patient outcomes.

Discussion

Effective partnerships are key to a sustainable technology innovation but are challenging to build and maintain. They require time, patience and effective communication from all partners. Successful partnering was built on sharing leadership between research and clinical partners, and aligning needs, resources, goals and tasks among all partners. Aligning needs and goals ensured buy-in by all groups; aligning resources and tasks fostered effective work teams. Frequent scheduled and as-needed communication ensured that partners' collaboration for project success. Each partner was integral to project development and deployment, thus fostering joint ownership of the project, enhancing its sustainability.

This project employed concepts from user-centered design in several ways. First, all stakeholders in TEP – the nurses and patients engaged in care, the IT staff who will support the technology core and the researchers who will evaluate TEP impact - participated in all of the design activities. Second, we developed the HeartCare2 technology core as adjuncts to the way the various use groups were likely to use the system. Finally, because we carefully considered the skills and constraints on each of our design team members, the concepts of user-centered design we employed user centered design shaped the actual conduct of the project establishing minimal burden communication strategies and capitalizing on the existing roles held by team members to facilitate local acceptance. Most importantly we were guided by a patient centered focus that deferred to the home care practice group to insure that care decisions, content development, and study conduct were aligned with agency practice

Conclusion

The TEP practice model, supported by the HeartCare2 web resource, is in place and

operational and study accrual is progressing. A strong partnership has launched a sustainable approach to technology-enhanced management of home care patients.

Acknowledgments

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Appendix

Figure 1: Configuration of the HeartCare 2 Technology Core

Welcome Congestive Heart Failure Patients

Thursday, September 29, 2005

Did you remember to take your medications today?

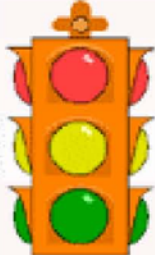
- [Weight tracker](#)
- [Symptom checklist \(past 7 days\)](#)
- [My goals](#)
- [Helpful resources](#) (For Your Well Beings & links)
- [My journal](#)
- [Teaching log](#)

Tip of the day: Try sauteing foods in a nonstick pan coated with nonstick vegetable cooking spray.

Your weight monitor	
Today's weight:	155.3lbs
Yesterday's weight:	150.4lbs
Two days ago weight:	167.3lbs

Conclusion: You have gained 3 or more pounds in two days. Please call your physician within 24 hours. You have lost 5 or more pounds in two days. Please call your physician within 24 hours. [[Weight tracker](#)]

Your health status today



Rollover the light colors to view symptoms. When you see the choice that best reflects how you're feeling click on that color.