Nurses’ Responses to Telemedicine in Home Healthcare

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Telemedicine, “the use of electronic information and communications technologies to provide and support health care when distance separates the participants”¹, has been part of the U.S. healthcare system for several decades. Originally designed to address problems of access to care, particularly in rural areas, applications have expanded to include education and administration as well as diagnosis and patient evaluation. Improved technologies and the current emphasis on cost-containment in healthcare have pushed telemedicine to the forefront of healthcare delivery.

Typically the domain of physicians and the academic medical community, telemedicine has moved into nontraditional settings such as home healthcare and prison health. In addition to physicians, nurses, nurse practitioners, and therapists now use telemedicine. This raises the question of end-user acceptance. Anecdotal evidence indicates that physicians have been slow to adopt telemedicine applications.² Although few studies have been conducted on nurses’ attitudes toward telemedicine, empirical studies on computerization in healthcare suggest that nurses’ attitudes play a pivotal role in success or failure of the technology innovation.³

As part of strategic planning and deployment of a telemedicine project, attitudes and responses of end-users must be assessed. In this case study of a current project, we describe home health nurses’ responses to a telemedicine project, based on a qualitative analysis of data from focus groups and results from a survey on attitudes towards computers. We then recommend strategies for enhancing nurses’ responses to telemedicine.

Background

Telemedicine is generally classified into four types of applications: interactive video, store-and-forward teleconsultations, Internet Protocol (IP) video on the Internet, and cable-based video. In the first three categories, data are
transferred over telephone lines—either wide bandwidth such as ISDN or T1 lines, or ordinary telephone lines. The fourth type of application, cable-based video, connects the patient to the healthcare provider through television cable. Although other applications could, theoretically, be included in the definition of telemedicine cited above, we restrict the use of the phrase to mean “patient–clinician” encounters that address a clinical problem and require the use of telecommunications. Clinical problems may be urgent, acute, or chronic, and the process of care may involve prevention, diagnosis, treatment, or rehabilitation.

Telemedicine in home healthcare is a relatively new phenomenon. We use the phrase “telehomecare” to describe telemedicine applications that are specific to the home health industry. Using personal computers and video equipment that transmit data over ordinary telephone lines, home health providers are now able to monitor patients and provide care at a much lower cost than technologies that use wider bandwidth telephone lines and more complex equipment. In addition to observing and interacting with the patient, home health nurses use medical devices attached to the patient’s unit to assess clinical problems and health status. For example, blood pressure measurement is accomplished with a cuff and sphygmomanometer and an electronic stethoscope enables the nurse to listen to the patient’s heart and lungs. Measurement and transmission of temperature, weight, blood glucose levels, and pulse oximetry are all possible with the newest generation of models.

In addition to monitoring patients with chronic diseases such as congestive heart failure and diabetes, telehomecare will create opportunities to provide care to high-risk patients typically cared for in the hospital. Telehomecare can also empower disabled persons, connect socially isolated individuals to their care providers, and support caregivers. The possibilities for improving healthcare are just beginning to be realized. Placing this technology into the patient’s home allows us to gaze into the future.

End-User Acceptance

Despite its potential, telemedicine is not always perceived as a worthwhile innovation. Yet a positive response by the primary end-users is critical for success. Research on end-user responses to telemedicine is scarce, but the literature on responses to computerization in the workplace illuminates some of the critical issues that must be considered when implementing a new technology.

Attitudes towards computer use have been investigated extensively. Both computer anxiety and computer experience are negatively related to end-user acceptance. Individual characteristics such as old age tend to correlate with unfavorable attitudes toward computer use. The effects of individual characteristics may be indirect. For example, age is positively correlated with computer anxiety and negatively correlated with computer experience, suggesting
that as older persons gain more experience with computers, they will feel less anxious regarding their use.

Although early studies on gender and computer use found that women were more likely than men to report computer anxiety, this does not appear to be true today. More recent studies have found that gender is not a predictor of computer attitudes.

In the nursing profession, computer attitudes correlate with prior use, age, education, practice area, and years of experience in healthcare. Henderson, Deane, and Ward investigated attitudes towards a patient management information system of a large New Zealand healthcare organization and found that nurses, as compared to clerical or administrative staff, had significantly more computer anxiety and negative attitudes. A study by Gamm, Barsukiewicz, Dansky, and Vasey of computerized patient records in ambulatory settings found that nurses were significantly more likely to experience computer anxiety than physicians or clerical staff.

A review of the literature found only one study that used a sample of home health or community nurses to investigate responses to information technology. In their qualitative study of home health nurses, Wilson and Fulmer describe the experiences of eight nurses who piloted a wireless, pen-based computing system in the homecare environment. Despite some initial reluctance and technical problems during the transition, these nurses exhibited an overall positive response to the new technology. More important, they “demonstrated a consciousness that they had crossed into a new arena of communications in homecare and did not desire to go back.” But the opposite effect may also occur. Murphy, Maynard, and Morgan conducted a three-year study to evaluate the transition into a computerized clinical information system. In this study of 224 nursing personnel, respondents indicated positive attitudes at the outset, but their attitudes became less positive during the actual start-up period. These studies underscore the importance of investigating attitudes and responses during all phases of the implementation to facilitate timely interventions by managers.

**Project Description**

The TeleHomecare Project is a partnership of Pennsylvania State University, The Visiting Nurses Association of Greater Philadelphia, and American Telecare, Inc. Funded through the Telecommunications Information Infrastructure Assistance Program (TIIAP), the project began in March 1998. The purpose of the project is to test the effects of telemedicine on quality of care and financial costs associated with home health services. As of August 1999, the project is in its fourteenth month, with four remaining months to completion.

The equipment used in this project was designed and manufactured by American Telecare, Inc. The patient station is based on a Pentium, Windows 95 platform. The medical sensors (sphygmomanometer and stethoscope) are
modified commercial-off-the-shelf devices. The human interface consists of two large buttons (no keyboard) for patient response to audio or visual cues. A camera, speaker system, and LCD display complete the system. The clinician station is also Pentium, Windows 95-based. A keyboard and mouse allow the nurse to manipulate the image acquired by the patient camera and capture still images for medical use. The patient and clinician stations are linked together over ordinary telephone lines via a standard modem.

The project is evaluating outcomes of diabetic patients who are discharged from the hospital and referred to the VNA of Greater Philadelphia (VNAGP). Patients are randomly assigned to either the intervention group or to a control group. Patients in the intervention group receive video visits in addition to skilled nursing visits, while patients in the control group receive skilled nursing visits only. A standardized diabetes clinical pathway is used for patients in both groups.

Management chose nine staff nurses from the VNAGP specifically for the project based on their clinical acumen with diabetic patients. The nurses have a mean age of 41.6 and an average of 4.4 years of experience using computers. All of the nurses are female. Of the original nine, seven nurses remained with the project after one year.

Prior to beginning the project, a three-day training session was held at the VNAGP. Staff reactions during the training sessions were generally positive. There was considerable excitement about the potential for extending the frequency of care to high-risk patients using this technology, as well as enthusiasm about participating in something new and different. Some fear was expressed about using a “computer.” Several of the nurses had no experience with computers; others were not sure how to use the mouse. These fears quickly dissipated as it became apparent that the central station is very user-friendly and operates on a point-and-click system.

Because an organizational downsizing was occurring around the time that the project began, we were concerned about nurse resistance due to fear of job loss. The VNA nurses had the opposite reaction and seemed to view their involvement in this project as giving them additional job security.

**Methodology**

In order to capture the evolving experiences of the nurses as they developed their roles in telehomecare, an action research approach was used. Action research is problem-focused, context specific, participative, and involves a process of change based on continuous interaction between research, action, reflection, and evaluation. It involves all the individuals as active, collaborative participants in the change process and through fact-finding and reflection leads to change and improvement. Within the action research strategy, focus groups were used to elicit interaction among the participants. Qualitative content analysis was used to analyze the results of the focus groups.
Qualitative research is the appropriate framework to use when the number of participants is small and when the investigators desire a deeper level of understanding than is typically achieved from survey data alone.

**Focus Groups.** Focus groups are group interviews that are based on topics supplied by the researcher who typically takes the role of moderator. The hallmark of focus groups is the “explicit use of group interaction to produce data and insights that would be less accessible without the interaction found in a group.” Focus groups were held every three months with the project nurses. The sessions lasted between sixty and ninety minutes and were moderated by the principal investigator of the study. (This person is not an employee of the VNA, an important requirement for obtaining unbiased remarks.) The sessions were audiotaped for later transcription. A research assistant took written notes to corroborate the taped notes. In this study, the purpose of the focus groups were to explore nurses’ reactions and feelings about the new system in a semistructured manner, to describe successes and challenges experienced by the nurses, to identify actual and potential problems associated with different components of the system, and to develop an identity and sense of cohesiveness among the nurses who worked on the project.

Structured, open-ended questions were used to solicit feedback on specific issues but still allow the nurses to express their own thoughts and feelings. This format permitted targeted questioning but allowed for deviations from the questions on the agenda. The first focus group for project nurses was held three months after the project began and addressed technical and procedural issues. The second session was conducted six months into the project. The topic for this session was the frequency, duration, and content of video visits. The third session was held nine months into the project and focused on the relationship between the nurse and the patient, and the patient and the physician. The fourth session explored reasons for patient refusal to participate.

Tape-recorded transcripts from the focus groups were content analyzed. Content analysis is defined as a procedure for the categorization of verbal or behavioral data, for the purposes of classification, tabulation, and summarization. Transcripts from the focus groups were categorized and coded using constant comparative analysis. Codes were assigned to conversational bits that emerged from the content analysis with the same idea or thought pattern. Codes generally corresponded to one to two sentences, but sometimes described more text. After codes were assigned, they were grouped into themes that represented a more general pattern of meaning.

**Surveys.** A survey on attitudes towards computers was administered to the nurses at the beginning of the project (Survey #1) and after one year (Survey #2). A final survey (Survey #3) will be administered at completion of the project. At that time, a pre- and post-test analysis of attitudes towards computers will be conducted. For the purposes of this case study, specific items were extracted from Survey #2 to compare with the qualitative results. The
survey, developed and validated by Gamm and associates, consists of fifty-four items on attitudes towards computer use in healthcare, as well as items on demographic information and computer experience. The items on attitudes measure responses to different dimensions of computer use in healthcare organizations and are scored with five response categories, ranging from 1 (strongly disagree) to 5 (strongly agree). Seven items were extracted for this study to corroborate with qualitative findings. The seven items were selected because their constructs were similar to the themes identified in the content analysis. These items, with their mean values, are shown in Table 1.

In addition to the focus groups and computer survey, we also collected anecdotal information in a less structured manner (staff meetings, informal conversations, and observations) to identify problems associated with the different components of the system. The nurses were asked to inform the clinical coordinator as soon as problems occurred. Thus, data on nurses’ attitudes and concerns were obtained from three different sources: focus groups, a survey, and anecdotal information. In keeping with the action research approach, steps were taken to resolve problems as soon as they were identified.

**Results**

Five major themes emerged from the content analysis of focus groups: patient care issues, management obstacles, effects on nursing staff, technology issues, and project barriers. The attitudes, concerns, and comments specific to each category are displayed in Table 2 and described here.

**Patient Care Issues.** This category encompassed the largest number of comments and has been further divided into seven sub-categories: added dimensions to caring, knowledge, motivation, psychosocial effects, caregiver role, communications with physician, and clinical issues. Among these subcategories, the “added dimensions to caring” may be the most significant

<table>
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<tr>
<th>Table 1. Nurses’ Attitudes—Survey Results</th>
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<tr>
<td>Mean Values</td>
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<tr>
<td>The TeleHomecare system will enable professionals to make better clinical decisions.</td>
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<td>The addition of the TeleHomecare system will be perceived positively by the patient.</td>
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<td>The TeleHomecare system will contribute to changes in the nature of the work and/or my job.</td>
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<td>The TeleHomecare system will be worth the investment.</td>
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<td>VNA management will support and encourage the use of the TeleHomecare system in the delivery of care.</td>
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<tr>
<td>The TeleHomecare system will contribute to my productivity.</td>
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<td>I feel apprehensive about using a computer.</td>
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Six nurses participated in the survey.
<table>
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<tr>
<th>Patient Care Issues</th>
<th>Management Obstacles</th>
<th>Effects on Nursing Staff</th>
<th>Technology Issues</th>
<th>Project Barriers</th>
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<tr>
<td>Added dimensions</td>
<td>Scheduling issues</td>
<td>Commitment</td>
<td>Equipment modifications</td>
<td>Barriers to recruitment</td>
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<td>Knowledge</td>
<td>Time issues relative to installation</td>
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<td>Motivation</td>
<td>Frustration about management issues</td>
<td>Satisfaction with</td>
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<td>Psychosocial</td>
<td>Management misunderstands need for time</td>
<td>new dimensions of caring to offer</td>
<td>Getting patients oriented to</td>
<td>Hard of hearing</td>
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<td>Caregiver role</td>
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<td>patients</td>
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<td>Physician issues</td>
<td>Management questions importance</td>
<td>Expanded skills</td>
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<td>Clinical issues</td>
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<td>Coverage</td>
<td>Referral problems or miscommunication</td>
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<td>Importance of project</td>
<td>Need coordination of referral and</td>
<td>Enrollment issues</td>
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contribution to this study. These comments were very personal and offer new insights into the nurse–patient relationship. For example, nurses mentioned that this technology adds a new communication dimension, creates a new “bond,” and increases patient rapport. This relationship is viewed as a partnership. “Excitement” was mentioned frequently, with regards to both nurses and patients. This special relationship fostered patient empowerment: “The patients start out saying they can’t do this and the next thing you know, they’re slapping your hand out of the way!” The nurses feel that the use of the technology has helped some patients feel more capable of managing their disease. They noticed a parallel thought pattern used by some patients: “If I can manage this equipment, then I can manage my diabetes.” Learned success in one domain of disease management (use of the computer) may carry over into self-efficacy for other behaviors (such as monitoring blood glucose).

Using the technology reminded patients to prepare for nurse visits by making sure their records (logs of blood sugar notations) were up to date and by reviewing educational packets. According to the nurses, patients in the project report that they bring their logs to physician office visits. Changes in patients’ attitudes were reported frequently: “Originally she was in her pajamas all the time, but then with the video visits, she started doing her hair.” Nurses spoke more positively about the technology when they had specific examples of its use to improve patient care. One nurse stated, “The caregiver came on the video and said the patient stuck herself three times and could not do the accu-check (sic) today. I was able to talk the patient through the procedure via video and had her successfully check her blood sugar. Now, that’s what makes this all worthwhile.”

This theme is consistent with the survey item, “The addition of the TeleHomecare system will be perceived positively by the patient,” which had a mean value of 3.8.

**Management Obstacles.** Frustrations with management were identified frequently and often with great intensity. Problems included scheduling issues, the amount of time needed for installation, and the perception that management did not understand the need for extra time. The nurses also commented that management did not recognize the importance of the project. They often felt underappreciated for their time and efforts to make the project work.

One survey item measured attitudes towards management: “VNA management will support and encourage the use of the TeleHomecare system in the delivery of care.” The mean for this item was 3.5 (range 1–5), a weak positive response. This finding is not consistent with focus group results, which found lack of management support to be a recurring theme. This inconsistency reinforces the importance of collecting data from multiple sources and at several points in time.

**Effects on Nursing Staff.** Other than frustration about management issues, themes that emerged in this category were all positive. Increased commitment and dedication were mentioned as effects on staff, as well as satisfaction with
new dimensions of caring. They recognize that their skills have expanded. The nurses believe in the importance of the project and identify strongly with it.

Three survey items correlate closely with this theme: “The TeleHomecare system will enable professionals to make better clinical decisions” (mean = 4.17); “The TeleHomecare system will contribute to changes in the nature of my work and/or job” (mean = 3.83); and “The TeleHomecare system will be worth the investment” (mean = 3.83).

**Technology Issues.** Many technical problems were identified in the focus group sessions. The nurses expressed frustration with the number and complexity of technical problems with the telehomecare equipment. They experienced difficulty connecting with patients and discovered details that affected audio and video transmission, such as the quality of the phone lines, the time of day, the speed of the connection, and the location of the patient’s home. Nurses also expressed anxiety related to their keyboarding skills when using the central station. Several nurses were reluctant to switch to type-written nurse’s notes and preferred to document video visits with handwritten notes.

The closest item to this theme was “I feel apprehensive about using a computer.” This item had a mean value of 2.5, which is inconsistent with the focus group results. One possible explanation for this difference may be the reluctance to admit to anxiety on the survey form. By contrast, this attitudinal response is obtained much more subtly in the focus group discussions. The item “The system will contribute to my productivity” had a mean of 3.5, reflecting some degree of uncertainty regarding the efficiency of the system.

**Project Barriers.** The problems identified in this category related primarily to recruiting patients into the study. From the onset, nurses were given the autonomy to determine if patients were able to participate. Problems that precluded patient admission included cognitive impairments, hearing impairments, and severe mental health problems. The nurses were anxious to include as many patients as possible but realized that these and other conditions would make video visits difficult or impossible. The nurses expressed frustration when they found patients who were eligible for the study but were overlooked during the intake procedure. They began to examine patient referral records themselves to avoid having the intake personnel inadvertently assign the patient to a nurse who was not participating in the study. There were no survey items that correlated with this theme.

**Conclusions**

The nurses’ responses to this technology can be summarized as generally positive. The initial start-up period was a time of excitement and enthusiasm. As they became immersed in the operations, they experienced anxiety and frustration with using the equipment but these reactions did not deter the nurses from participating in the project.
Job responsibilities changed in a number of ways. The nurses were required to learn how to install, calibrate, and operate the equipment, as well as to recognize and fix technical problems. Installation required that the nurse connect the unit to the existing telephone system in the patient's home, a task that often included splicing wires. They responded to these challenges with acceptance and humor. Initially, a technician was assigned to accompany a nurse on an installation visit. As they gained experience and confidence, however, they preferred to perform these tasks themselves. Although they had access to service support provided by the vendor, the frequency of technical problems caused them to identify and correct many problems independently. The accomplishment of these mechanical activities resulted in the project nurses being identified by their peers as technical experts.

During the process of organizational learning, not all VNA members were comfortable with the project. The most frequently identified challenge was the conflict generated between the nurse and her manager regarding additional work responsibilities without adding more time. Time sheets indicate that productivity declined, due to increased time involved in home visits and video visits. An additional challenge was the need for nonproject nurses to complete some of the required forms when a diabetic was admitted during the weekend. Lack of communication resulted in some alienation between project nurses and nonproject nurses.

On the positive side, community interest generated from this project resulted in involving the nurses in community activities, media events, demonstrations, and professional presentations. The nurses report that they enjoy this expanded role.

Although implementation of the project went well, there are opportunities for improvement. Assessment of end-user attitudes and responses during all phases of the project is critical for success. The action research approach that we used was particularly beneficial for addressing problems as soon as they occurred, although other types of organizational assessment and feedback could be used. Training occurred early and involved all potential end-users, although not everyone who was trained participated in the project. In retrospect, training should have included team-building exercises, as the project nurses became a clearly identified team and would have benefitted from training to build rapport and develop problem-solving skills as a group. Computer anxiety should also be addressed during early training periods. Giving the nurses opportunities to use a computer prior to the project and during its initial stages may lessen this anxiety. Finally, a “champion” can help get the project off the ground and sustain interest when problems occur. Several of the nurses involved in the project were true “champions.” Their enthusiasm and dedication were inspiring.

We note that results from the survey should be interpreted with caution because the sample consisted of only six individuals. An additional limitation of using survey data is that we may have inadvertently missed some important
dimensions that were not reflected in focus group results. After completion of
the project, final analysis of nurses’ responses will include a review of all items
in the survey as well as a comprehensive qualitative analysis of all focus groups.

The Future of Telemedicine in Home Healthcare

The 1997 Balanced Budget Act has drastically altered the financing of home-
care by mandating an interim payment system for Medicare homecare benefi-
ciaries. Beginning July 1, 1998, home health agencies are reimbursed at
2 percent lower than 1993–94 levels.20 The average number of home health
visits per user for the period 1995–2000 is expected to increase from sixty-five
to eighty-two.21 Therefore, home health agencies must meet increased demand
for quality care while staying within the financial limitations imposed by recent
budget changes. Agencies can no longer meet patients’ needs in traditional
ways and must explore new options for access to care.

Telehomecare is possibly one way to provide cost-effective nurse–patient
contact under the current budget constraints. One study estimated telehome-
care costs at $300–$400 a month for each patient. Conversely, home visits by
a registered nurse cost at least $500 a month for just three visits a week.2 The
telehomecare technology can provide voice or video contact with fifteen to
twenty-five patients a day while, on average, a driving visiting nurse can only
see 5.2 patients per day.2 It also means the same patient can be monitored two
or more times a day.

As the use of telehomecare increases, there is much to learn about its
impact on end-users, patients, and home health agencies. Further research is
needed on the content of the video visits and an analysis of patterns of use to
determine the types of patients and nurses who respond well to telehomecare.
As additional medical peripheral devices are added, an analysis of their impact
on patient care is needed as well. Evaluating the impact of this technology on
nurses and their jobs is the first step in understanding the effects of using tele-
homecare as a tool for the interdisciplinary management of acute and chronic
conditions in the home.

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