

Technology Anxiety as a Potential Mediating Factor in Response to Medical Technology

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Technology anxiety, defined as a fear of working with medical equipment, was measured via the use of the Technology Response Questionnaire. Nurses (N = 414) working on nine types of nursing units at two hospitals participated in the study. Nurses working on psychiatric units were found to be most anxious about working with medical equipment, while nurses working on surgical and adult intensive care units were least anxious. A comparison of the nurses who were highest and lowest on technology anxiety indicated that those who were most anxious about technology were less positive toward computers, felt more stressed by their work, were lower on job satisfaction, less positive toward the physicians they worked with, lower on personality scales of autonomy and adaptability, were less likely to do care planning regularly or to use nursing diagnoses, and tended to be older than less anxious nurses.

INTRODUCTION

The hospital environment is becoming increasingly technological in nature with a wide array of medical equipment used as part of routine care including fetal monitors, infusion pumps, respirators, cardiac monitors, and hospital information systems. Medical technologies in current use are continuously being updated and replaced. In addition new medical equipment, procedures, and information technologies are frequently introduced as part of a general and continuous effort to improve patient care and hospital management. Physicians, nurses, pharmacists, respiratory therapists, and other members of the health care team must learn to use equipment differently when it is updated and replaced, must learn to use new equipment as it is introduced, and new procedures when the old way of doing things is changed.

The introduction of new technologies in the health field are often met with resistance in one form or another. In a series of studies of physicians Anderson and colleagues

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documented low physician utilization rates of a hospital information system.¹⁻⁴ This system was intended, at least in part, to decrease error rates, particularly as concerns medication orders. Despite intensive efforts to increase physician interaction with the system over the course of several years, less than 15% of the physicians became regular users of the system.

In a study of the implementation process of a pharmacy information system there was a substantial increase in turnover of pharmacy department employees during the first eight months after implementation of the computer system. A comparison of those who left versus those who stayed indicated that the strongest predictor of leaving was a negative attitude toward computers, measured prior to system implementation.⁵

For some individuals complex technologies may elicit feelings of anxiety or discomfort. For the average person this may not be a particular handicap, but for those working in the health care field, discomfort with complex technologies may be related to difficulties learning to use new technologies, show patterns of adoption of specific technologies, and errors using these technologies. Abramson *et al.*⁶ studied adverse occurrences which were potentially life threatening to patients, occurring in a medical-surgical intensive care unit during a five year period. Nearly a third of these adverse occurrences were attributed to human error in the use of medical technology.

This paper presents a study conducted to examine factors related to a generalized fear of working with medical equipment among hospital nurses. A survey instrument was developed by Pillar⁷ to measure self-reported anxieties concerning working with medical equipment found in the hospital setting. Pillar utilized the term "technology anxiety" to refer to a general anxiety or fear concerning working with medical equipment.

METHOD

Setting

This study was conducted at two tertiary care teaching hospitals, one on the east coast of the United States and the other on the west coast. The hospital on the east coast is a 785 bed inner city hospital which has 20,000 inpatient admissions per year. There are approximately 800 registered nurses employed at this hospital. There are 39 units, with an average of 20 beds per unit. The west coast hospital is a 663 bed suburban hospital. There are 23,000 inpatient admissions per year. There are 1082 registered nurses employed at this hospital. There are 25 units, with an average bed size of 27 beds per unit.

Participants

An extensive questionnaire was given to nurses working on nine units at each hospital. The response rate at the east coast hospital was 93% for a total of 219. The response rate at the west coast hospital was 60% for a total of 195. The nine types of participating nursing units at the east coast hospital were as follows: psychiatric, postpartum, oncology, adult intensive care, pediatric intensive care, pediatric, surgical, medical, and medical/surgical. The same types of nursing units participated in the west coast hospital except that a compromised host unit was substituted for the medical unit. The

medical unit at the west coast hospital was in the process of changing leadership and elected not to participate in this study. These types of nursing units were chosen on the basis of two criteria: (1) Units were chosen which differed markedly from each other in terms of nurse demands and type of nursing required, and (2) units were chosen which were relatively large in terms of nursing staff in order to be able to make adequate unit level comparisons. Every nurse working on each of the study units at each site was given a copy of the questionnaire and asked to participate. This included full time, and part time nurses working across all shifts.

Procedure

The study was described to nurses at staff meetings or in individual meetings with a research assistant. Questionnaires were distributed and participants were asked to fill out the questionnaires at home and return them in sealed envelopes to be placed in a box on each unit. The questionnaire took approximately 35 min to complete. Individuals were identified by a code number and names were not placed on the questionnaires.

Measures

Several background questions were asked including unit primarily worked, shift and rotation patterns, age, education, and previous work history. Attitudes toward computers was measured using a scale called Attitudes Toward Computers in General.⁸ In addition, knowledge of computers and experience with computers was measured with an instrument developed by Shields.⁹ Several subscales from the Work Relations Inventory¹⁰ were used to measure work satisfaction, stress and frustration, organizational stress (the extent to which the work environment is a source of stress), perception of one's supervisor, and nurse/physician collaboration.

Four subscales from the Jackson Personality Research Form¹¹ were used to measure several aspects of personality including a desire for autonomy, a need for social recognition, cognitive structure (a need for structured information), and a willingness to accept change, or adaptability.

A modified version of an inventory developed by Overton *et al.*¹² was used to measure the type of nursing required on each unit. Four subscales were derived measuring uncertainty of task information, patient variability, patient instability, and communication with patients and patient's families.

In addition, the Nursing Information Processing Questionnaire was given to measure general patterns of information processing activities.¹³ On the basis of factor analysis subscales were developed to measure nursing care planning, discharge planning, use of the nursing diagnosis, time with patients and communication with other health team members.

Several unit characteristics were also measured including average patient acuity, percent understaffing, nurse/patient ratio, and perceived quality of unit clerk coverage.

A 16-item version of the Technology Response Questionnaire⁷ was used to measure technology anxiety. This questionnaire is composed of statements, with a five point Likert response format ranging from "Strongly Agree" to "Strongly Disagree." Some example items are "It makes me anxious to work around equipment.", "I am reassured when

patients are on monitors because the equipment is so reliable.’’, ‘‘I don’t always trust the readings from the equipment.’’, and ‘‘I would never refuse to be a substitute nurse on a unit that had a great deal of equipment.’’ This questionnaire was designed to measure a generalized response to technology found on nursing units. Specifically, technology was defined as ‘‘the different kinds of medical equipment that are used to treat and care for patients.’’ Total scores were derived, with a high score indicating a high level of technology anxiety. Pillar reported evidence for the validity and reliability of the instrument.⁷ The Cronbach’s Alpha in the present study was 0.88, indicating good internal consistency reliability for the Technology Response Questionnaire.

RESULTS

Total scores on the Technology Response Questionnaire (TRQ) could range from a low of 16, indicating a very low level of technology anxiety, to a high of 80, indicating a very high level of anxiety. A score of 48 would represent a neutral response to technology. The overall mean for the 217 participating nurses from the east coast hospital was 44.65 and the overall mean for the 194 participating nurses at the west coast hospital was 45.20. These means were not significantly different. The lowest observed score across both hospitals on the TRQ was 25, while the highest score was 69.

One way analysis of variance (ANOVA) with post hoc comparisons was used to examine unit differences in technology anxiety for the nine study units at each hospital. The means for the nine study units at each hospital are presented in Table 1. At both hospitals the unit most anxious about technology was the psychiatric unit, while the two units least anxious about technology were the surgical and adult intensive care units.

The one way ANOVA comparing TRQ means across the nine study units at the east coast hospital was highly significant ($p = 0.001$). The one way ANOVA comparing TRQ means across the study units at the west coast hospital was also highly significant ($p = 0.004$). The post hoc comparisons (Student–Newman–Keuls) for the east coast hospital indicated that the nurses working on the psychiatric unit were significantly more anxious about technology than the nurses working on the surgical or adult intensive care units.

Table 1. Technology Response Questionnaire Means for Nine Study Units at Two Hospitals

East coast hospital		West coast hospital	
Study units	TRQ means	Study units	TRQ means
Psychiatric	49.30	Psychiatric	53.19
Post-partum	48.21	Pediatrics	46.82
Medical	47.39	Pediatrics ICU	46.80
Pediatrics	45.00	Compromised host	46.00
Pediatrics ICU	44.88	Post-partum	45.98
Oncology	44.55	Medical/surgical	44.35
Medical/surgical	43.56	Oncology	43.88
Adult ICU	41.87	Surgical	43.42
Surgical	41.79	Adult ICU	42.42

Post hoc comparisons (Student–Newman–Keuls) for the west coast hospital indicated that the nurses working on the psychiatric unit were significantly more anxious about technology than the nurses working on the pediatric, post partum, medical/surgical, oncology, surgical, and adult intensive care units.

In order to examine more closely individuals who were particularly anxious about technology those nurses scoring in the upper quartile of the TRQ were compared to the nurses in the lower quartile. Because the overall means for the two hospitals were not significantly different, data from the two hospitals were combined for this comparison. There were 104 nurses in the lower quartile and 101 nurses in the upper quartile. The mean TRQ score for nurses in the lower quartile was 35.72 and the mean TRQ score for nurses in the upper quartile was 55.16. Discriminant Analysis was used to compare the nurses in the upper and lower quartiles. Eleven variables entered significantly into the equation. These were as follows: age, attitudes toward computers, the two personality variables of autonomy and change, job satisfaction, organizational stress, stress and frustration, nurse–physician collaboration, patient instability, care planning, and use of the nursing diagnosis. *T*-tests were also used to compare the upper and lower quartile for these 11 variables. Variables which were not significant were as follows: education, length of time working at the hospital, the personality variables of cognitive structure and social recognition, the Index of Task Dimensions subscales of uncertainty, variability and communication with patients, and the Nursing Information Processing Questionnaire subscales of discharge planning and communication with other health team members.

The discriminant analysis was highly significant with a canonical correlation of 0.6637, $p < 0.000$. The significant variables are presented in Table 2 along with the means for each variable for the upper and lower quartiles, and the individual *T*-tests.

As can be seen in Table 2, the following variables significantly discriminated between those who were high and low on technology anxiety. They are ordered on the basis of the size of the correlation within function as indicated by the discriminant analysis. The strongest discriminator was attitudes toward computers, with those who were more anxious about technology being less positive toward computers. The next strongest discriminator was the stress and frustration subscale of the Work Relations Index. Individuals

Table 2. Significant Discriminators Between Upper and Lower Quartile of Distribution of Scores on the Technology Response Questionnaire

Variable	Upper quartile (high anxiety)	Lower quartile (low anxiety)	<i>T</i> -test Sig.
Attitudes toward computers	92.45	106.71	$p < 0.000$
Stress and frustration	19.13	16.24	$p < 0.000$
Patient instability	12.66	16.33	$p < 0.000$
Organizational stress	9.52	8.17	$p < 0.000$
Nurse/physician collaboration	13.32	14.23	$p < 0.01$
Use of nursing diagnoses	6.75	7.51	$p < 0.001$
Care planning	17.05	18.78	$p < 0.012$
Autonomy	2.42	2.88	$p < 0.007$
Change	7.52	8.21	$p < 0.049$
Job satisfaction	26.45	28.03	$p < 0.007$
Age category	3.52	3.00	$p < 0.023$

high on technology anxiety were more likely to feel stressed and frustrated by their work than those low on technology anxiety. The instability subscale of the Index of Task Dimensions indicated that individuals low on technology anxiety were more likely to have patients high on instability. This is most likely related to the fact that the least anxious nurses were more likely to work on the intensive care and surgical units, which have less stable patients than the other units. Organizational stress, a subscale of the Work Relations Index, was the next most discriminating variable. Individuals high on technology anxiety were more likely to view their work environment as a source of stress and frustration than individuals low on technology anxiety. The nurse/physician collaboration subscale of the Work Relations Index was also a significant discriminator, with those high on technology anxiety less likely to view the physicians they work with positively. The nursing diagnosis and care planning subscales from the Nursing Information Processing Questionnaires were significant discriminators and indicated that nurses high on technology anxiety were less likely to use nursing diagnoses on a regular basis or to do care planning on a regular basis. Two personality subscales from the Jackson Personality Research Form were significant discriminators between those who were high and low on technology anxiety. These subscales were autonomy and change. Nurses high on technology anxiety scored lower on autonomy and lower on change or adaptability. The satisfaction subscale of the Work Relations Index was also a significant discriminator, with those nurses high on technology anxiety being less satisfied with their jobs than those low on technology anxiety. The last significant discriminator was age category, with older nurses being more anxious about technology than younger nurses.

DISCUSSION

The comparison of the nurses in the upper and lower quartile on technology anxiety reveals portraits of two distinctly different types of individuals. The nurse who is more anxious about working with medical equipment is also less positive about computers, lower on job satisfaction, experiences more work related stress, is less positive toward the physicians on their unit, less likely to follow current guidelines for nursing care as exhibited by the lower scores on the care planning and nursing diagnoses subscales, is lower on general adaptability and older than nurses who do not feel anxious working with medical equipment. There were however, no differences on the patient communication or communication with coworkers subscales, indicating no obvious differences in interpersonal skills between the two groups. In addition, the groups did not differ in terms of educational background.

The unit comparisons at the two hospitals revealed remarkably similar patterns of nursing unit differences. At both hospitals nurses working on the psychiatric units were highest on technology anxiety, while the nurses working on the surgical and intensive care units were the lowest across the nine types of units. These results lead one to wonder whether nurses who are more anxious about technology tend to choose to go into less technological areas of nursing, or whether nurses who work on less technological units are more anxious about technology because they are less likely to work with medical equipment. A study done with undergraduate senior nursing students¹⁴ indicated that even prior to the beginning of nursing practice choice of area of specialization was related to attitudes

toward computers and technology anxiety. Senior nursing students could choose one of five areas to specialize in during their last year of nursing school: medical/surgical, critical care, psychiatric, pediatric, and obstetrical/gynecological. It was found that nursing students with a critical care specialty were significantly more positive toward computers and lower on technology anxiety than those with a pediatric specialty. This suggests that orientation toward medical technology begins quite early in a nurse's career.

A fear of working with technology among individuals working in such a highly technological field as health care may limit the versatility and quality of care that can be rendered for patients, and make the introduction of new technologies more difficult that need be.

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