Effects of Comfort Warming on Preoperative Patients

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Temperature is an integral component of a patient's perception of well-being during the perioperative experience. Memories of thermal comfort or discomfort during surgery have an effect on a patient's overall satisfaction with surgical care. Beginning in the preoperative phase of surgery, patients often remark that they feel cold. The most common nursing approach for addressing this patient discomfort is to cover the patient with warmed cotton blankets. After placing a warm blanket on a patient, the nurse often hears appreciative statements such as "I love getting these warm blankets before surgery. It really helps." The nurse recognizes an increase in overall patient comfort as a result of this warming intervention and, of equal importance, often perceives a decrease in patient anxiety immediately after the patient receives the blanket.

People respond holistically to complex stimuli, so the sensation of feeling cold produces discomfort and can trigger anxiety about

- the impending surgery,
- the anesthesia,
- expected pain, and
- being immobilized.

Interventions to prevent or treat a patient's feeling of being cold, therefore, often have a positive effect on how the patient perceives other threats. Such interventions thereby may reduce a patient's anxiety. The problem addressed in this study is how nurses can intervene successfully to increase thermal comfort and decrease anxiety in the preoperative setting.

WARMING

Recent research has documented the therapeutic effects of warming preoperative patients. Prewarming raises mean body temperature by increasing the energy content in the peripheral thermal compartment of the body. This is important because it is difficult to treat core hypothermia that occurs from an internal core-to-peripheral redistribution of body heat immediately after induction of general and regional anesthesia. Anesthetic agents decrease the vasoconstriction threshold to a level below the current body temperature and thus open arteriovenous shunts. This redistribution is not a clear exchange of heat with the environment, but rather a flow of heat from the body's core to the periphery, thereby reducing the core temperature. The redistribution of body heat can be prevented, however, with prewarming interventions in the preoperative setting.

ABSTRACT

- THERMAL COMFORT IS ONE DIMENSION of overall patient comfort, and it usually is addressed by covering the patient with warmed cotton blankets.
- WARMING HELPS A PATIENT maintain normothermia and appears to decrease patient anxiety.
- AN STUDY WAS CONDUCTED in a preoperative setting to compare the effects of preoperative warming with warmed cotton blankets versus patient-controlled warming gowns on patients' perceptions of thermal comfort and anxiety.
- BOTH WARMING INTERVENTIONS had a positive effect on patients' thermal comfort and sense of well-being. Patients who used the patient-controlled warming gown also experienced a significant reduction in preoperative anxiety. AORN J 84 (September 2006) 427-448. © AORN, Inc, 2006.

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Higher levels of anxiety are linked to tachycardia, hypertension, arrhythmias, and increased levels of pain, which adversely affect patient health and healing.

Traditionally, nurses have used warmed blankets to provide thermal comfort for patients in the preoperative setting. Unfortunately, the warmth from heated cotton blankets dissipates within 10 minutes. Other passive and traditional approaches to providing thermal comfort include the use of insulative-type coverings such as reflective blankets, the placement of socks and head coverings on preoperative patients, and a manual increase in room temperature.

Warming a patient preoperatively is more effectively accomplished by using an active warming method. Examples of active warming methods include the use of convective (ie, warmed air) warming blankets and fluid warming to maintain or increase a patient's body temperature. Active warming to the overall body and to localized areas has been found to be an effective intervention for reducing patient's anxiety and complaints of pain in several recent studies. Perioperative nurses frequently use preoperative warming both as a warming intervention and as a means of providing comfort. There are no published research reports, however, that focus on the benefit of preoperative warming as both a comfort intervention and as a method of decreasing patient anxiety.

ANXIETY

It has been recognized for more than 40 years that patients experience differing levels of anxiety when faced with impending surgery. Preoperative anxiety is commonly associated with:

- loss of independence or control,
- anesthesia concerns,
- unwanted diagnoses,
- postoperative pain, and
- fear of death.

Preoperative anxiety is reported to occur in 11% to 80% of adult patients.

Higher levels of anxiety have been linked to tachycardia, hypertension, arrhythmias, and increased levels of pain, which can affect the entire perioperative period of patient care.

Hormonal activity, known as the stress response, is widely believed to compromise recovery and includes an increase in circulating cortisol, adrenaline, noradrenaline, oxytocin, antidiuretic hormone, and prolactin.

Anxiety was defined by Spielberger as a group of behavioral expressions that can be divided into trait and state anxiety. Trait anxiety is a lifelong pattern of anxiety that is a personality characteristic. People with trait anxiety generally are nervous, hypersensitive to situational stimuli, and psychologically more reactive. State anxiety refers to acute and situationally driven episodes of anxiety that do not continue beyond the situation that triggers them. An impending surgical experience is a good example of state anxiety. State anxiety is emotionally transitory and consists of feelings of tension, apprehension, and nervousness with heightened activity in the autonomic nervous system. This condition varies in intensity and can fluctuate during the specific experience. The definition of state anxiety used in this study is the unpleasant, self-aware feeling of tension and apprehension accompanied by arousal of the autonomic nervous system that is evoked in individuals who interpret a situation as personally threatening.

THE BENEFITS OF REDUCED ANXIETY

A patient who is less-anxious is medically desirable because of the physiological implications of stress. A significant aspect of the perioperative nurse's role is to recognize that preoperative anxiety is a common and distressing problem for most surgical patients. Addressing psychological needs is a valuable contribution to holistic patient care. Simple anxiety management plans are beneficial because of the reduced amount of time available to
nurses and the high turnover of patients in the perioperative arena.

Unfortunately, some health care providers may assume that a surgical patient’s preoperative anxiety and perioperative hypothermia are unavoidable and to be expected. Conventional nursing interventions regarding anxiety and perioperative hypothermia, moreover, may not be best suited to the care of surgical patients. Established beliefs may need to be revised.

Perioperative nurses could be more effective in handling both the patient’s preoperative warming needs as well as the patient’s preoperative anxiety if there were more evidence on which to base interventional decisions. The purpose of this study was to compare the effects of two warming interventions—traditional warmed cotton blankets versus a patient-controlled warming gown—in enhancing thermal comfort and relieving patient anxiety. The following research questions were asked.

• What is the effect of warming methods on the patient’s self-report of thermal comfort?
• What is the effect of warming methods on self-reported preoperative anxiety?

**REVIEW OF LITERATURE**

There are several nursing standards of practice for temperature monitoring that address thermal comfort. In its monitoring standard, the American Society of Anesthesiologists was the first organization to formalize the evaluation of the patient’s temperature when clinically significant changes are intended, anticipated, or suspected. The standard does not specifically address hypothermia, however. The American Association of Nurse Anesthetists (AANA) recommends body temperature monitoring for all patients receiving local, regional, and general anesthesia. Again, no specific information is given in the AANA standards regarding what to do when hypothermia occurs. AORN’s “Recommended practices for safe care through identification of potential hazards in the surgical environment” addresses the importance of temperature monitoring and provides perioperative nurses with some basic interventions for preventing hypothermia. These recommendations, however, do not provide the practitioner with specific clinical information that might impress upon nurses the importance of managing normothermia.

The first clinical guideline for the prevention of unplanned perioperative hypothermia was published by the American Society of PeriAnesthesia Nurses (ASPAN) in 2001. The purpose of the guideline is to give perioperative practitioners an approach to preventing and managing patients at risk for developing unplanned hypothermia. The guideline provides patient assessments, interventions, and evaluations with expected outcomes in addition to well-defined terms of thermoregulatory management. It covers the entire perioperative period beginning with the preoperative phase to phase II recovery postoperatively.

**THERMAL COMFORT RESEARCH.** In a thermally comfortable environment, no heat or cold stress should be experienced. When in thermal neutrality, a person will take no deliberate action to maintain the proper heat balance of the body. Environmental engineers began to study thermal comfort in the early 1900s with the realization that humans have widely varied reactions to thermal conditions. Fanger, a renowned researcher, developed a method for evaluating the thermal comfort of individuals in various environments.
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Fossum et al conducted an experimental study to determine differences in temperatures on arrival in the postanesthesia care unit (PACU) between patients who were warmed preoperatively with forced-air warming blankets and patients who were warmed with traditional cotton blankets. They found that patients in the forced-air warming group had significantly higher temperatures on arrival in the PACU than patients in the warm blanket group (P = .000). They also reported that 66% (n = 33) of the forced-air treatment group reported a comfort level of zero, with zero being most thermally comfortable and 10 being the most thermally uncomfortable. These findings indicated that active preoperative warming provides a high level of thermal comfort. As an incidental finding, patients expressed that they were less anxious when they were warm. Fossum et al stated that temperature is important in the patient's perception of comfort during a surgical experience and that increased patient satisfaction will occur if nurses advocate for patients through thermal-comfort measures.

In 2003, Wilson and Kolcaba conducted a survey of nurses who attended the annual conferences of ASPAN and AORN. A total of 722 nurses completed the survey in which they were asked for their perceptions of the top three comfort concerns of perioperative patients. Warmth was cited most often (ie, 33.3%) as the top comfort concern, followed by pain management after surgery (ie, 18.3%), position during and after surgery (ie, 12.2%), and all others (ie, 36.2%). Participants also were asked how often they considered temperature to be a comfort issue for their patients. The majority (ie, 71%) responded that cold is often a comfort issue; 25% reported that cold is sometimes a comfort issue; and only 4% responded that cold is rarely a comfort issue. These results demonstrate the need for patient-warming interventions,
both in the clinical context of maintaining normothermia and as a means of increasing overall patient comfort in the perioperative setting.

In an interventional study, Robinson and Benton examined the comfort provided by warmed blankets to older adult hospitalized patients and found that the level of discomfort after a patient received a blanket was significantly less \( (P < .001) \). As in numerous other studies, thermal comfort was not defined; but the researchers addressed cold as an uncomfortable sensation that can increase restlessness, aggravate pain, and decrease overall patient satisfaction.

Researchers in one study defined cold as an uncomfortable sensation that can increase restlessness, aggravate pain, and decrease overall patient satisfaction.

In a study in which the researchers investigated the relative contribution of core and skin temperatures to thermal comfort and autonomic responses, Bulcao et al. stated that thermal comfort is responsible for the initiation of behavioral thermoregulation, in which individuals usually are able to control both ambient temperature and the level of body-surface insulation. These researchers found that skin temperature contributed greatly to subjective thermal comfort, whereas core temperature predominately regulated a person’s autonomic and metabolic responses.

In the perioperative setting, patients usually are not able to control the ambient temperature or the level of body-surface insulation. Active warming, whether by use of warmed blankets or forced-air warming methods, therefore should be used to prevent and protect patients from hypothermia.

Preoperative anxiety research. Grieve conducted a qualitative study of 150 patients in an outpatient surgery setting and suggested that nurses lack awareness of the therapeutic potential of the nurse-patient relationship in anxiety reduction. He argued that anxiety-reduction interventions disproportionately emphasize the provision of preoperative information when other interventions may be more appropriate, depending on both the patient’s personality (ie, if he or she exhibits trait anxiety) and coping style.

Mitchell reviewed 34 studies to assess the level of knowledge about and interventions used to treat surgical patient anxiety. The studies that were reviewed were conducted between 1990 and 2002 and included data from 3,754 patients undergoing surgery. Mitchell found that preoperative anxiety began at least 12 hours before surgery, and both female and first-time surgical patients were more anxious than others, although this was not always statistically significant. A consistent finding of this review was that increased anxiety levels were associated with a patient’s lack of preoperative information and with the patient undergoing nonvoluntary surgery. The induction of anesthesia also strongly provoked anxiety in many patients. Mitchell also found that increased patient anxiety levels were associated with the need for an increased level of anesthesia, reduced patient anxiety was viewed as clinically more desirable, and anxiety was closely related to personality type.

Measuring preoperative anxiety was a major challenge for the researchers in the studies that Mitchell reviewed, and the researchers employed a mixture of subjective and objective measurements (eg, visual analogue scales; skin conductance showing sympathetic nerve activity; several types of lengthy, self-report
The Cost of Cotton Blankets

In a benchmarking report on the costs of cotton blankets, Senn surveyed 25 US health care facilities and found that the average cost of one blanket, factoring in theft, loss, and cleaning expenses, was $1.08 per use; and an average of nine cotton blankets are used during a patient's perioperative experience. This corresponds to an average cost of $9.72 per patient. With this in mind, it also is important to remember that there are other costs associated with the use of cotton blankets (e.g., nursing time spent filling blanket warmers and retrieving blankets for patients, warming cabinet purchase and upkeep, electricity, laundry staff member labor, storage). The average life span of a cotton blanket is 22 washings, with an average replacement cost of $4.80 per blanket. Senn found that the cost of a forced-air warming blanket was approximately $9 and was a proven optimal warming approach for perioperative patients.


questionnaires). With patients generally spending shorter times in preoperative settings, Mitchell concluded that there should be a more clinically viable approach to measuring preoperative anxiety.

Mitchell identified anxiety management including anxiolytic medications and distraction techniques as the main management approaches taken in the preoperative setting. Most of the studies listed premedication with anxiolytics as a positive management regimen. The studies did not establish an association between extended postanesthesia care and benzodiazepine premedication, however. Pharmacological management of anxiety is gauged by physiological assessments and is a focus of the medical model of care. Distraction methods (e.g., music, television viewing, relaxation) are presented as having a positive effect on preoperative anxiety.

SUMMARY. For decades research has focused on preoperative anxiety, but it remains clear that additional research is needed to identify appropriate interventions and best practices suitable for care of the surgical patient. Thermal comfort also is a complex and perhaps incompletely defined concept in perioperative nursing. The evidence favors use of thermal comfort measures in the preoperative setting. Preoperative warming has been shown to provide basic comfort, decrease anxiety, and possibly prevent postoperative complications. Further research is needed regarding thermal comfort in the preoperative setting, including examinations of the cost-effectiveness of warming methods and examinations of patient outcomes such as comfort and overall satisfaction with perioperative care.

CONCEPTUAL FRAMEWORK

The conceptual framework for this study was derived from Kolcaba's Comfort Theory. Kolcaba proposes an important relationship between patient comfort, a patient's behaviors that move him or her toward a state of well-being, and the institutional outcomes that are relevant in a particular research setting. Kolcaba developed a general comfort questionnaire (GCQ) to measure comfort. The GCQ is a 48-item questionnaire with a six-point, Likert-type response format. The GCQ was pilot tested with 256 participants who were randomly selected from the community and diverse hospital groups, which included the population of interest for this study. The data from the pilot test were factor analyzed, and the analysis revealed three factors. These factors were semantically consistent with the types of comfort in the taxonomic structure and were named:

- relief,
- ease, and
- transcendence.

For preoperative care, the Comfort Theory states that the multidimensional outcome of patient comfort is increased through the nurses’ attention to the patient’s anxiety, the patient’s expectation of postoperative pain and bleeding, and the prevention of shivering and chills, as well as other standard nursing-care measures.

The Comfort Theory is best understood when divided and described in
Nurses assess the physical, psychospiritual, sociocultural, and environmental comfort needs of patients and implement a variety of interventions to meet those needs.

three parts. Part one states that nurses assess the holistic (ie, physical, psychospiritual, sociocultural, environmental) comfort needs of patients in all settings. Nurses further implement a variety of interventions to meet those needs and measure or assess patients' comfort levels before and after those interventions. This aspect of the Comfort Theory also describes positive and negative intervening patient variables over which the nurse has little control but which have a considerable impact on the success of comfort interventions. Examples of intervening variables considered in this study were room temperature, baseline vital signs and temperature, preoperative medications and preparations, comorbid medical problems, routine home medications, and prognoses.

Part two of the Comfort Theory states that enhanced comfort strengthens patients to consciously or subconsciously engage in behaviors that move them toward a state of well-being. These behaviors are called "health-seeking behaviors" and provide a rationale for implementing comfort interventions. For patients in this study, the health-seeking behaviors under consideration were decreased anxiety, normothermia, and stable vital signs.

Part three of the Comfort Theory relates health-seeking behaviors to institutional integrity, which is defined as the quality or state of health care organizations in terms of being complete, whole, sound, upright, professional, and ethical providers of health care.

Many indicators are used to measure institutional integrity, including cost of care; length of stay; turnover rates for staff members; and patient, nurse, and staff-member satisfaction.

Part three was not tested in this study, but recommendations for doing so are included in the "Suggestions for Future Research" section of this article.

METHODS

The researchers used a pretest/posttest experimental design for the study, which was conducted during a five-month period in a large public hospital in the southeastern United States. The study received approval by the institutional review boards at North Georgia College and State University, Dahlonega, Ga, and the research committee at Wellstar Kennestone Hospital, Marietta, Ga. The hospital is a 455-bed, acute care facility with 20 operating suites. A separate preadmission testing area was used to provide privacy and confidentiality during interactions with patients who participated in the study. The preoperative area is sectioned into 40 private rooms. This area also serves as the discharge area for same day surgery patients.

SAMPLE. Norwood's computations were used to determine sample size. Power analysis was based on a type I error rate of .05, a type II error rate of .2, and a medium effect size for the thermal comfort instrument based on Kolcaba's past research. This power analysis determined that 62 data sets were needed in each group to demonstrate significant differences between the two interventions for thermal comfort and anxiety. The inclusion criteria were ability to read, write, and hear English; mental competency; being 18 years of age or older; and being scheduled for surgery on a day that a researcher was available. Patient exclusion criteria were paralysis.
presence of known paresthesia, or fever (ie, a temperature above 37° C [98.6° F]). The final sample included 126 patients between 18 and 80 years of age. There were missing data when a patient was taken to the OR before Time 2 data could be retrieved. Researchers did not delay surgery to complete data retrieval, and only complete data sets were used for analysis (ie, treatment group n = 60, control group n = 58 [Figure 1]).

**Instruments.** Room temperatures were taken by indoor thermometers with a digital readout. Researchers also recorded
- start times for warming interventions with the patient-controlled warming gown for the treatment group;
- time for placement of warmed blankets for the control group;
- blanket warmer temperatures;
- pulse oximetry; and
- vital signs, including measurement of body temperature.

Identical study thermometers were purchased to increase the reliability of readings, and these were used to take oral temperature measurements throughout the study. The facility’s engineering department inspected and approved all study devices before their use. Documentation of preoperative medication and IV fluid administration also was included on the second questionnaire.

**Thermal Comfort.** The thermal comfort inventory (TCI) tool that was used was a composite questionnaire concerning a patient’s subjective sensation of body temperature. The researchers created the TCI tool by modifying Kolcaba’s original GCQ, which has been adapted for many comfort studies in diverse populations.

The TCI tool consisted of 13 questions on a Likert-type scale of one to six, where one was “strongly disagree” and six was “strongly agree” with a statement. Eight of the statements were directly related to temperature perception. In addition, one statement focused on the patient’s perception of the nurses’ care for him or her, and one statement addressed the patient’s level of anxiety. The total possible range of answers to the TCI tool was 13 to 78. After the statements that were negatively worded were reverse scored, the higher scores represented a greater level of thermal comfort.

A second instrument that was used to measure a patient’s thermal comfort was a numeric visual analog scale (NVAS). Scores for thermal comfort ranged from zero (ie, extreme cold) to 10 (ie, extreme heat). Thermal neutrality (ie, thermal comfort) was identified by the midrange mark of five. Participants were asked to place a dot on the NVAS corresponding to their perception of their thermal comfort.

Thermal comfort NVASs have been used in numerous studies to evaluate the subjective thermal comfort of patients in comparison with physiologic measurements to establish a correlation between them. The NVAS for thermal comfort was expected to be negatively correlated with anxiety (ie, it was expected that higher thermal comfort would be associated with less anxiety). The NVAS was implemented in this...
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study, although no documentation of its reliability had been reported in previous studies or in the current study.

**Anxiety.** An NVAS for anxiety also was used to measure a patient’s level of anxiety. Participants were asked to place a dot on the NVAS corresponding to their perception of their anxiety at that time. The subjective scores for anxiety ranged from zero (ie, no anxiety) to 10 (ie, extreme anxiety) on the NVAS. In addition to the NVAS, item number nine on the TCI stated “I am anxious.” Participants responded on the six-point Likert-type scale, ranging from one (ie, strongly disagree) to six, (ie, strongly agree). Lastly, anecdotal information from the patient regarding anxiety and thermal comfort was documented on the comment section of the form to further validate a patient’s responses.

The three main instruments used by researchers to measure anxiety are the Amsterdam Preoperative Anxiety and Information Scale (APAIS), the Spielberger State-Trait Anxiety Inventory (STAI), and the anxiety visual analog scale (VAS). The APAIS is a six-question, Likert-type inventory that focuses on fears of anesthesia and surgery. The STAI has demonstrated reliability and validity in previous studies, however, it is a 20-question instrument and therefore is cumbersome as an anxiety screening tool in the preoperative area. The VAS has shown to have significant and positive correlation with the STAI ($r = 0.64; P = .0001$ and $r = 0.55; P < .01$).

Elkins et al studied the utility of a numeric visual analog anxiety scale using a zero to 10 scale when identifying preoperative anxiety in patients scheduled for colorectal surgery. Participants ($n = 36$) completed both the NVAS and the STAI. This visual analog scale instrument correlated significantly with the STAI instrument ($P < .0001$). On the basis of this evidence of the measurement reliability and validity, the researchers in this study decided to use an NVAS to measure anxiety in surgical patients.

**Procedures**

Surgical nurses and OR staff members participated in an inservice program about the study. Surgeons and anesthesia care providers were informed through letters of intent outlining the purpose of the study. Data collection forms were pilot tested by representatives of the target population—a sample of approximately 10% of the desired sample size (ie, 12 data collection sets)—to determine the usability and clarity of the forms.

After the principal investigator instructed the coinvestigator and a hired data collector on the data collection procedures and forms, the coinvestigator and data collector observed one another during pilot data collection and compared observational notes to establish structured approaches to data collection. No interrater reliability statistical analysis was performed.

**Participant selection.** Patients typically arrived at the preadmission and testing department several days to one week before their scheduled surgery date. On the days and during the hours that research investigators were available, all surgical patients in the preadmission testing area were given a printed flyer briefly describing the nursing study and asking for interested participants. If a patient indicated an interest in participating in the study, an investigator approached the patient to further describe...
Participants in the treatment group used a patient-controlled warming gown which they put on approximately 30 to 60 minutes before the anticipated start of the surgical procedure.

the study and to ascertain if the patient met the inclusion criteria. When appropriate, informed consent and demographic information then were obtained.

On the day of surgery, when the patient arrived in the preoperative holding area, he or she was randomly assigned to one of two groups through the use of a set of computer-generated blocks of random numbers. Randomization was not based on prior gender separation. The assignments were kept in sealed, sequentially numbered envelopes until used. From the block randomization numbering, the envelopes were marked either with blue dots to designate the control group or red dots to designate the treatment group. Colored forms also were used to maintain organization and to ensure that Time 1 and Time 2 documents were clearly distinguishable.

For both groups, Time 1 vital signs, including temperature measurements, the TCI tool, and both the thermal comfort and anxiety NVAS tools were collected immediately before the commencement of the warming intervention. Time 2 data were gathered after a minimum of 30 minutes but before the patient entered the OR suite or underwent anesthesia induction. Patients again completed the TCI and both NVAS tools for thermal comfort and anxiety, and physiological data also were collected. Throughout the study, the researchers kept a journal documenting their decision-making processes, contextual variables, and the participants’ anecdotal comments.

**TREATMENT GROUP.** After the initial set of measurements (ie, Time 1), those in the treatment group put on identical patient-controlled warming gowns, which were donated by the manufacturer. This occurred approximately 30 to 60 minutes before the anticipated start of the surgical procedure. The patient then was covered with one nonwarmed, cotton blanket, if he or she desired. After it was initiated, the warming gown was used until just before the patient was transferred to the OR. The gown’s warming level was documented at the start of treatment and at the time of the second data collection (ie, Time 2). The patient controlled the warming gown, and if he or she chose not to turn on the gown to receive any warming treatment, this was documented at each measurement time. Subsequent anesthesiology and surgical-management decisions were made at the discretion of the attending physicians.

**CONTROL GROUP.** After Time 1 measurements were taken, patients in the control group put on a regular cotton hospital gown approximately 30 to 60 minutes before the anticipated start of surgery, and they were covered with one warmed blanket from one of two warming cabinets. Time 2 data were gathered at least 30 minutes after Time 1 measurements. Temperature readings of the specific warming cabinet were documented on the patient’s data sheet. If a patient asked for another blanket, a warmed cotton blanket was supplied as requested. This was the usual practice at the facility. The total number of warmed blankets that were provided to a patient was documented. If a patient chose not to receive any warming treatment, this also was documented at each measurement time.

**DATA ANALYSIS**

Data analysis was performed using a computer-based spreadsheet analysis program, with the exception of Cronbach’s alpha and descriptive statistics data, which were computed using a computer-based statistical and data analysis system. By combining all category responses, the reliability of the TCI instrument was assessed using Cronbach’s alpha. All analyses were performed on an intention-to-treat basis using two-sided P values (P < .05). To obtain additional information, relative change was computed for individual
items on the TCI. These data were not normally distributed, so nonparametric analyses with continuity correction were conducted. Data from the composite TCI were normally distributed; data from the NVAS tools were not. Nominal data were compared using a chi-square test, and numeric measures were compared using Student’s t test. For analyses of the NVAS tools, the nonparametric Wilcoxon rank sum test was used. Difference data between the TCI and NVAS tools were not normally distributed, so a Wilcoxon rank sum test was used with continuity correction to compute significance levels. To evaluate the variables more extensively, comparisons were made of the relative changes within each variable from Time 1 to Time 2 values.

FINDINGS

Table 1 illustrates the baseline characteristics of the study participants according to group. Women comprised approximately 73% of the entire sample. There were no significant differences between the two groups except for height. When this was analyzed separately for men and women, height was not found to be significantly different between the treatment and control groups.

Cronbach’s alpha for the TCI was .82, showing respectable internal consistency and reliability for a new instrument. At Time 1, the range of data on the TCI was from 25 to 78, and the standard deviation was 10.7. At Time 2, the range of data on the TCI was from 38 to 78 and the standard deviation was 9.2. Table 2 summarizes the reliability contribution of each Likert-type scale item of the TCI instrument.

The significance levels for the relative change for all the individual scale items on the NVAS and TCI are shown in Table 3. A significant value (P = .014) was found in the anxiety NVAS with the treatment group experiencing less anxiety than the control group. Significance was noted between groups with four items on the TCI Likert-type scale scores, demonstrating that the treatment group had higher levels of thermal comfort in relation to:

- their overall body temperature (P = .016),
- room temperature (P = .049),
- shivering (P = .010), and
- chest warmth (P = .003).

Mean TCI scores are shown in Table 4. A number of the individual scores demonstrated the same trend as the population comparisons. There were no significant differences between the initial and final “I am anxious” scores between the two groups (control P = .01 and treatment P = .00); however, there was a trend toward decreasing anxiety in both groups. The same trend was seen in the NVAS anxiety scores.

Table 5 shows that the mean values for the TCI and NVAS for thermal comfort were significantly different at baseline; however, anxiety scores were similar. Specifically, at Time 1, the two groups experienced significant initial differences in their TCI (t = 2.07, P = .04) and NVAS thermal comfort scores (t = 2.24, P = .034),
### TABLE 2
Reliability Analysis of the Thermal Comfort Index

<table>
<thead>
<tr>
<th>Patient-reported variable</th>
<th>Item values</th>
<th>If this item is omitted ($R^2$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Standard deviation</td>
</tr>
<tr>
<td>Body temperature feels fine</td>
<td>4.83</td>
<td>1.31</td>
</tr>
<tr>
<td>Chair/bed feels cold</td>
<td>4.87</td>
<td>1.47</td>
</tr>
<tr>
<td>Room temperature is warm enough</td>
<td>4.24</td>
<td>1.61</td>
</tr>
<tr>
<td>Feels confident</td>
<td>4.96</td>
<td>1.22</td>
</tr>
<tr>
<td>Has enough privacy</td>
<td>5.38</td>
<td>0.93</td>
</tr>
<tr>
<td>Is shivering</td>
<td>5.46</td>
<td>1.12</td>
</tr>
<tr>
<td>Arms are cold</td>
<td>4.40</td>
<td>1.70</td>
</tr>
<tr>
<td>Feels that nurses are caring</td>
<td>5.67</td>
<td>0.75</td>
</tr>
<tr>
<td>Feels anxious</td>
<td>3.55</td>
<td>1.72</td>
</tr>
<tr>
<td>Feet are cold</td>
<td>4.41</td>
<td>1.73</td>
</tr>
<tr>
<td>Chest is warm</td>
<td>4.77</td>
<td>1.44</td>
</tr>
<tr>
<td>Feels cold in general</td>
<td>4.65</td>
<td>1.58</td>
</tr>
<tr>
<td>Feels out of control</td>
<td>5.21</td>
<td>1.24</td>
</tr>
</tbody>
</table>

### TABLE 3
Relative Change for Individual Scale Items

<table>
<thead>
<tr>
<th>Variable</th>
<th>Control group (n = 58)</th>
<th>Treatment group (n = 60)</th>
<th>Z value*</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal comfort/numeric visual analog scale (NVAS) score</td>
<td>mean</td>
<td>mean</td>
<td>-0.059</td>
<td>.953</td>
</tr>
<tr>
<td>Anxiety NVAS score</td>
<td>-0.03</td>
<td>0.27</td>
<td>2.466</td>
<td>.014**</td>
</tr>
<tr>
<td>Thermal comfort inventory score</td>
<td>-0.09</td>
<td>-0.13</td>
<td>-0.759</td>
<td>.448</td>
</tr>
</tbody>
</table>

**Thermal Comfort Inventory Likert-type scale scores**

| My body temperature feels fine | -0.32 | -0.47 | -2.403 | .016** |
| The chair/bed feels cold | -0.01 | 0.11 | -0.099 | .921 |
| The room temperature is warm enough | -0.31 | -0.49 | -1.969 | .049** |
| I feel confident | -0.23 | -0.06 | 1.714 | .0865 |
| I have enough privacy | -0.05 | 0.02 | 0.362 | .718 |
| I am shivering | -0.11 | 0.15 | 2.562 | .010** |
| My arms are cold | -0.15 | -0.03 | 1.362 | .173 |
| The nurses care about me | -0.02 | -0.12 | 0.864 | .388 |
| I am anxious | 0.00 | 0.16 | 1.608 | .108 |
| My feet are cold | 0.11 | 0.00 | -0.507 | .612 |
| My chest area is warm | -0.01 | -0.43 | -2.985 | .003** |
| In general, I feel cold | 0.15 | 0.23 | 0.623 | .534 |
| I feel out of control | -0.16 | -0.19 | -0.904 | .366 |

*Wilcoxon rank sum test with correction for ties and continuity (difference < 0 [ie, a two-tailed analysis]; df = 121)

** Significant values
with the treatment group scores being higher. There was no difference, however, in the anxiety scores ($t = 0.596, P = .746$) or other initially measured variables. At Time 2, the treatment group had scores that were significantly lower on anxiety ($f = 1.87, P = .06$), higher on NVAS thermal comfort ($f = 2.84, P = .005$), and higher on the TCI ($f = 3.77, P = .002$). On relative change, the treatment group experienced a significantly greater relative reduction in NVAS anxiety scores compared to the control group ($f = 2.77, P = .007$). The control group did not experience a significant reduction in anxiety scores ($t = 0.790, P = .431$). The relative change in both the NVAS thermal comfort ($f = 0.047, P = .963$) and TCI ($f = 0.913, P = .363$) were not significant.

There were no significant differences between groups when comparing changes in outcome variables. There were no significant differences observed in body temperatures between the two groups, even when they were

### Table 4

Differences in Thermal Comfort Index Scores Between Groups

<table>
<thead>
<tr>
<th>Variable</th>
<th>Time 1 Thermal Comfort Index Mean</th>
<th>Time 1 Standard Deviation</th>
<th>Time 2 Thermal Comfort Index Mean</th>
<th>Time 2 Standard Deviation</th>
<th>$t$ Value</th>
<th>$P$</th>
</tr>
</thead>
<tbody>
<tr>
<td>My body temperature feels fine</td>
<td>Control Group 4.4 1.5</td>
<td></td>
<td>Treatment Group 4.5 1.5</td>
<td></td>
<td></td>
<td>.067</td>
</tr>
<tr>
<td></td>
<td>$t**$ 0.6</td>
<td></td>
<td>$p$ .573</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The chair/bed feels cold</td>
<td>Control Group 2.8 1.7</td>
<td></td>
<td>Treatment Group 2.2 1.6</td>
<td></td>
<td></td>
<td>.035#</td>
</tr>
<tr>
<td></td>
<td>$t**$ 2.1#</td>
<td></td>
<td>$p$ .002#</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The temperature in the room is warm enough</td>
<td>Control Group 3.8 1.6</td>
<td></td>
<td>Treatment Group 4.2 1.7</td>
<td></td>
<td></td>
<td>.018</td>
</tr>
<tr>
<td></td>
<td>$t**$ 1.4</td>
<td></td>
<td>$p$ .153</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I feel confident</td>
<td>Control Group 4.5 1.4</td>
<td></td>
<td>Treatment Group 5.2 1.1</td>
<td></td>
<td></td>
<td>.004#</td>
</tr>
<tr>
<td></td>
<td>$t**$ 2.9#</td>
<td></td>
<td>$p$ .065</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have enough privacy</td>
<td>Control Group 5.3 1.0</td>
<td></td>
<td>Treatment Group 5.4 0.9</td>
<td></td>
<td></td>
<td>.0994</td>
</tr>
<tr>
<td></td>
<td>$t**$ 0.3</td>
<td></td>
<td>$p$ .788</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am shivering</td>
<td>Control Group 1.9 1.4</td>
<td></td>
<td>Treatment Group 1.5 1.2</td>
<td></td>
<td></td>
<td>.0002#</td>
</tr>
<tr>
<td></td>
<td>$t**$ 1.6</td>
<td></td>
<td>$p$ .108</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My arms are cold</td>
<td>Control Group 3.0 1.7</td>
<td></td>
<td>Treatment Group 2.6 1.8</td>
<td></td>
<td></td>
<td>.4192</td>
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<tr>
<td></td>
<td>$t**$ 1.6</td>
<td></td>
<td>$p$ .003</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SEPTEMBER 2006, VOL 84, NO 3  
Wagner — Byrne — Kolecka

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Differences in Thermal Comfort Index Scores Between Groups (Continued)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Control Group</th>
<th>Treatment Group</th>
<th>t**</th>
<th>p</th>
<th>Control Group</th>
<th>Treatment Group</th>
<th>t**</th>
<th>p</th>
<th>Time 1 Thermal Comfort Index mean*</th>
<th>Time 1 standard deviation</th>
<th>Time 2 Thermal Comfort Index mean*</th>
<th>Time 2 standard deviation</th>
<th>t value**</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>The nurses care about me</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Control Group</td>
<td>Treatment Group</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control Group</td>
<td>5.6</td>
<td>5.6</td>
<td>.8</td>
<td>.422</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am anxious</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Control Group</td>
<td>Treatment Group</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control Group</td>
<td>3.8</td>
<td>3.7</td>
<td>.3</td>
<td>.728</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My feet are cold</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Control Group</td>
<td>Treatment Group</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control Group</td>
<td>3.0</td>
<td>2.9</td>
<td>.6</td>
<td>.555</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My chest area is warm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Control Group</td>
<td>Treatment Group</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control Group</td>
<td>4.7</td>
<td>4.6</td>
<td>.2</td>
<td>.851</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In general, I feel cold</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Control Group</td>
<td>Treatment Group</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control Group</td>
<td>3.3</td>
<td>2.3</td>
<td>.34</td>
<td>.001</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I feel out of control</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Control Group</td>
<td>Treatment Group</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control Group</td>
<td>1.8</td>
<td>1.6</td>
<td>2.0</td>
<td>.053</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Mean Thermal Comfort Index (TCI) scores (df = 121)
** Nonpaired t test to compare TCI responses between groups; paired t test to compare TCI responses within groups
# Significant values

normalized to body mass index, body surface area, or body mass. Of interest, there was a slight increase in temperature found in both groups. The number of blankets received by the control group averaged just slightly more than two, which is considerably fewer than was observed in a study by Senn.6 Lastly, there were no significant differences between the initial ambient room temperatures between groups. The ambient temperature, however, changed significantly (ie, an increase in Time 2 room temperature reading) for the treatment group (t = 3.05, P = .0007).

**DISCUSSION**

The treatment group experienced a significant decrease (ie, t = 3.85, P = .0002) in anxiety compared to the control group. This effect demonstrated that the patient-controlled warming gown had psychological effects in addition to providing thermal comfort. It may be that the patient-control feature of the gown contributed to the decrease
Mean Time Variable Time 1

<table>
<thead>
<tr>
<th>Variable</th>
<th>Control group</th>
<th>Treatment group</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal comfort numeric visual analog scale (NVAS)</td>
<td>4.24</td>
<td>4.8</td>
<td>.034*</td>
</tr>
<tr>
<td>Anxiety NVAS</td>
<td>4.5</td>
<td>4.34</td>
<td>.746</td>
</tr>
<tr>
<td>Thermal comfort inventory</td>
<td>57.8</td>
<td>61.7</td>
<td>.04*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time 2</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal comfort NVAS</td>
<td>4.88</td>
<td>5.49</td>
<td>.005*</td>
</tr>
<tr>
<td>Anxiety NVAS</td>
<td>4.23</td>
<td>3.35</td>
<td>.06*</td>
</tr>
<tr>
<td>Thermal comfort inventory</td>
<td>61.9</td>
<td>67.7</td>
<td>.0002*</td>
</tr>
</tbody>
</table>

* Significant value

Relative change in each item on the TCI provided further information about the effects of the patient-controlled gown on subfactors related to total comfort. Of particular interest is that the treatment group demonstrated a greater relative improvement on four important items:
- self-perception of body temperature,
- perception of room temperature,
- shivering, and
- warmth in the chest area.

This seems to indicate that the patient-controlled gown has the desired effect on the subfactors most closely associated with holistic thermal comfort. These effects were somewhat diluted in the total score by other items that had no apparent effect on the total score.

Another interesting observation is that participants who were assigned to the treatment group experienced significantly higher levels of thermal comfort and TCI scores even before the warming unit was activated. This finding suggests that the patient-controlled warming gown itself produces significantly greater levels of thermal comfort and preoperative satisfaction. Another possibility related to this finding may be that the control group participants expressed decreased thermal comfort due to a compensatory rivalry effect. Brink and Wood describe compensatory rivalry as when respondents in the control group believe they are receiving a less-desirable treatment than the experimental group and thus are motivated to compete for equity. The knowledge that they did not have the “new technology” for warming may have been a contributing factor to more negative responses on the study instruments.

The TCI instrument demonstrated strong reliability as evidenced by moderately strong internal consistency (ie, alpha = 0.82); and all of the items apparently integrated well. Examining changes in each individual item provided a greater understanding of the unique and specific effects of the patient-controlled gown. Both NVAS tools displayed concurrent validity with the anxiety and total comfort scores on the TCI at both time points.

**STUDY LIMITATIONS**

Reliability of the NVAS tools for thermal comfort was not tested before study was conducted. The NVAS format, however, has been tested by Kolcaba on her web site, and these results have been published. The NVAS was found to be moderately sensitive to self-report. Additional testing of the tool’s vertical, 10-cm format is indicated. In the current study, the NVAS tools demonstrated the same results as the TCI, which provided preliminary evidence of concurrent validity. In designing this study, the researchers may have given undue credit to the holistic effects of the patient-controlled gown by including questions not directly related to...
thermal comfort (eg, privacy, nurses' caring, confidence); however, all patients in the study were told that the research was the evaluation of a new thermal therapy, not an anxiolytic therapy.

Another study limitation is the possibility of compensatory rivalry as a threat to internal validity. This may explain the higher level of thermal comfort at the start of Time 1 in the treatment group. This was not a double-blind study and it was obvious that new technology was replacing the usual gown, so the control group was aware that they were not receiving the experimental treatment. Randomization was used to assign individuals to either the control or treatment groups, and patients in the treatment group scored higher on both total thermal comfort and the NVAS for total comfort at Time 1 than patients in the control group. These differences at Time 1 render findings about total comfort inconclusive. The fact that there were no significant differences in the relative changes of the thermal variables may be explained by compensatory rivalry; but because the participants were told that the research was evaluating a new thermal therapy, it is less likely that bias played a role in the evaluation of anxiety.

The significant difference in ambient room temperature at Time 2 for the treatment group also is a limitation of this study. The small preoperative rooms are enclosed spaces, so it is possible that the use of the warming unit and the warm air flow coming from the warming gowns actually changed the environmental temperature. This unknown variable was not accounted for in the study design, but it should be considered in future studies.

**Suggestions for Future Research**

Future research might be better served by a quasiexperimental design, where patients on day A receive only one type of thermal comfort intervention (eg, usual care) and patients on day B receive only another type of thermal comfort intervention (eg, the patient-controlled heated gown). A third type of comfort intervention (eg, warmed IV fluids) then could be offered on day C. This rotation could be repeated until the desired sample size for each group is achieved. This would reduce the possible compensatory rivalry effect on patients that may have been present in the current study.

The relationship between preoperative warming, intraoperative normothermia, and postoperative normothermia needs to be examined as well. In doing so, it will be important for all measures of body temperature to be conducted with the same type of equipment and with the same calibration protocol. It would be helpful to track other outcomes of interest, such as postoperative infections, bleeding, pain, and other complications related to perioperative hypothermia in any or all of the perioperative phases. Further studies also are warranted to address thermal comfort as a nurse-sensitive and institutional outcome, and to measure the impact of thermal comfort on

- overall patient satisfaction with preoperative care,
- improved outcomes, and
- shorter length of stay in the PACU.

Kolcaba's Comfort Theory is based on the assumption that patient comfort is germane to the discipline of nursing and health care. In this study, the immediate outcome of enhanced thermal comfort in the preoperative setting was assessed. Specific relationships between preoperative interventions for thermal comfort, intraoperative normothermia, and postoperative normothermia needs to be examined as well.
and postoperative normothermia need to be explored further. Future studies are warranted to test the theoretically positive relationship between thermal comfort and other relevant health-seeking behaviors, such as a quick and uneventful recovery from surgery and anesthesia, as well as the desirable institutional outcomes of

- patient satisfaction with care as revealed by institutional patient care surveys,
- fewer complications or readmissions, and
- shortened length of stay in the operative and postoperative areas.

The specific relationships between preoperative interventions for thermal comfort, intraoperative normothermia, and postoperative normothermia also need to be explored. A comparison of the types of interventions and their relationship to health-related and institutional outcomes has not yet been undertaken.

**Implications for Perioperative Nursing**

This study was conducted to determine the effects of preoperative warming with patient-controlled warming gowns versus warmed cotton blankets on a patient's perception of thermal comfort and anxiety in the preoperative setting. Findings suggest that comfort warming is a positive intervention for both temperature management and anxiety reduction. Both types of comfort warming interventions demonstrated a positive effect on thermal comfort and the general sense of well-being of preoperative patients. Though body temperature was not significantly different between the groups as an outcome measure, measurements obtained during Time 2 of both groups were higher than the initial readings. This corroborates other research that has shown that prewarming patients can be a therapeutic intervention in perioperative temperature management.\(^1,4,6,7\)

Only the treatment group experienced a significant reduction in preoperative anxiety, however. This finding suggests that there is a benefit to using new technology and devices that provide a patient with more control over their thermal comfort to both decrease anxiety and potentially increase overall patient satisfaction. A wider knowledge base concerning the benefits of thermal comfort measures perioperatively could potentially provide evidence for best practices during the entire perioperative experience.\(^7\)

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Katharine Kolcaba, RN, PhD, is an associate professor, University of Akron College of Nursing, Akron, Ohio.

The researchers thank the perioperative RNs of Wellstar Kennestone Hospital, Marietta, Ga, for their support and interest in this study. The researchers also gratefully acknowledge the assistance of Moim Hatch, RN, Wellstar Kennestone Hospital, Marietta, Ga, for data collection.

**Editor's note:** This research was financially and technically supported by Arizant Healthcare, Inc, Eden Prairie, Minn.

**Notes**


Hospitals Develop Methods to Improve Patient Hand Offs

New procedures are being developed to address the communication breakdown that sometimes occurs when a patient is transferred between units or during a shift change, according to a June 28, 2006, article from The Wall Street Journal Online. There is evidence that this breakdown in communication is the single greatest source of medical errors that occur in health care settings.

The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) has begun requiring hospitals to implement formal standards for communicating patient information during hand offs. If a health care facility fails to respond to JCAHO's directive, it risks losing accreditation. Health care organizations are starting to respond, but few facilities have an established, comprehensive transfer-of-care system in place.

The Institute for Healthcare Improvement has developed a communication tool for the health care industry known as SBAR (ie, situation, background, assessment, recommendation). This hand-off program was developed from one used in military applications and can be used by nurses and physicians to organize and convey a patient's critical information in approximately 60 seconds. Another available solution is the use of electronic medical records with automated transfer logs, but facilities with access to this technology are rare.
