Abstract

Background: Wound care is an essential competency which nursing students are expected to acquire. To foster students' competency, nurse educators use high fidelity simulation to expose nursing students to various wound characteristics.

Problem: Little is known about how nursing students react to simulated wound characteristics. Malodor is a wound characteristic which can be particularly difficult for nursing students to manage. To facilitate students' developing skills in managing malodor, nurse educators have designed high fidelity simulations including olfactory realism. However, there is a gap in nursing knowledge about nursing students' reactions to malodor in simulation.

Aim of the Study: The aim of this project was to describe how nursing students reacted to malodor in video recordings of wound care simulation.

Methodology: The project was an observational study using qualitative descriptive methodology to describe nursing students' nonverbal reactions to malodor in simulation. A coding scheme using the Facial Action Coding System (FACS) was drawn from the literature and revised with nonverbal behavior codes which emerged during data analysis. Based on feedback from two expert observers/raters, three coding schemes were developed and tested using NVivo software.

Findings: Content analysis of participants' nonverbal reactions to malodor revealed three themes of reactions: Noticing, Confirming, and Focusing. Additionally, nonverbal reactions embedded in the three themes seemed to cluster into two patterns of behaviors: physical reactions and psychosocial reactions. Two of the coding schemes exhibited inter-rater agreement values of 82%.

Nursing Students' Nonverbal Reactions to Malodor in Wound Care Simulation

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Chapter 1

Wound care is an essential competency which nursing students are expected to acquire during their nursing education. In order to foster students' competency, nurse educators have incorporated high fidelity simulation into their curricula as an important pedagogy (Jeffries, 2005). High fidelity simulation provides nurse educators with the tools they need to expose nursing students to wound characteristics to ensure that students demonstrate skills in wound care prior to assigning students to care for patients with chronic wounds in the clinical practice setting (Huff, 2011; Roberson, Neil, & Bryant, 2008).

Malodor is a particularly difficult wound characteristic for nursing students to manage (Lindahl, Norberg, & Soderberg, 2008; Roberson et al., 2008; Siegel, 2008). To encourage students' development of skills in managing malodorous wound care, nurse educators have designed realistic high fidelity wound care simulations which included the olfactory realism of malodor (Roberson et al., 2008; Vuolo, 2008). However, educators found a gap in nursing knowledge about how nursing students' react to malodor in wound simulations.

Problem Statement

Little is known about how nursing students react to olfactory realism in simulation. Lack of knowledge about nursing students' reactions to malodor posed a problem for educators who had to evaluate and instruct students in professional wound care in the simulation laboratory (Roberson et al., 2008). In nursing literature, educators found no explicit criteria which identified nursing students' nonverbal behaviors in reaction to malodor. Nurse educators valued the importance of olfactory realism during wound care simulation because students needed to be

prepared for the realities of wound care in clinical practice (Roberson et al., 2008; Stephens, 2011).

Roberson et al. (2008) incorporated malodor into simulation because, based on their experiences as nurse educators and their search of the literature, malodorous wound care posed a significant challenge for nursing students in clinical practice (Huff, 2011; Lindahl et al., 2008; Morris, 2008; Siegel, 2008). Stephens (2011), a British nurse educator, noted the importance of the "yuck factor" in simulation for helping to prepare students for the realities of wound care.

Nursing literature discussed the issues confronting nurses when they care for patients with malodorous wounds (Lindahl et al., 2008; Madsen & Reid-Searl, 2007; Morris, 2008; Roberson et al., 2008; Sayette, Cohn, Wertz, Perrott, & Parrott, 2001; Soussignan & Schall, 1996; Vrana, 1993). The authors reported that nurses had to identify the sources of malodor while maintaining close interpersonal relationships with patients who often felt isolated and ashamed of their wounds. Furthermore, nurses had to cope with their own physical reactions to malodor while exhibiting professionalism and being mindful of the emotional distress of their patients and other caregivers (Morris, 2008). In the qualitative study with nurses who cared for patients with chronic wounds, Lindahl, et al. (2008) reported that nurses spoke about feeling the need to vomit and feeling that the malodor lingered in their nostrils long after wound care had been completed. Additionally, the nurses reported that they worried about their patients' sensitivity to the nurses' facial expressions during wound care. Their concerns for their patients were grounded in the core values of caring and integrity which are fundamental to nursing professionalism (NLN, 2011).

While socializing nursing students to the culture of professional nursing, nurse educators have to assess students' nonverbal behaviors to determine which student behaviors meet professional standards during wound care simulation. However, at the present time, there are no explicit descriptions of students' nonverbal reactions to malodor in simulation to guide nurse educators in their evaluations. Specific criteria that identify nonverbal reactions to malodor might help educators determine which nonverbal reactions breech the standards of professionalism.

Purpose of the Study

The purpose of this study was to describe how nursing students reacted to malodor in video recordings of wound care simulation. A description of nursing students' nonverbal reactions to malodor might suggest criteria for assessment of students' reactions and might help nurse educators to determine which nonverbal behaviors meet the standards of professionalism. The phenomena of interest in this study were specific nonverbal behaviors of nursing students' in reaction to malodor. A number of basic concepts were essential to the study: nonverbal behaviors, reaction, reaction to malodor, professional socialization, and culture. These concepts are defined in the following section.

Definitions

This section presents the operational definitions of the major concepts underlying the study of nursing students' reactions to malodor:

- Nonverbal behaviors were significant, culturally mediated components of communication which involved facial expressions, touch, gestures, postures, and voice quality (Bull, 2002; Bull, 2008; Martin, O'Connor-Fenelon, & Lyons, 2010).
- Reaction was defined as a change in nonverbal behaviors in response to a malodorous

stimulus (Merriam-Webster, 2011; Roberson et al., 2008; Soussignan & Schall, 1996). The researcher monitored changes in demeanor, facial expressions, and behaviors as nursing students reacted to malodor within the video recorded simulation scenarios.

- Reactions to malodor included operational definitions based on a coding scheme drawn from the literature and on nonverbal behaviors in reaction to malodor which emerged from the data during qualitative analysis (Bull, 2002; Hager, 2003; Soussignan & Schall, 1996; Vrana, 1993).
- Socialization referred to the process of learning the culture of professional nursing (Reutter, Field, Campbell, & Day, 1997). Nursing students became socialized to the nursing profession by internalizing the core values and tasks of the profession. Students learned through study of the Code of Ethics of Nursing, didactic instruction, clinical laboratory practice, and through clinical engagement with patients in practice during their nursing program (NLN, 2011).
- Culture was a multifaceted concept which encompassed attitudes, beliefs, and other social cognitions, social representations, and socially shared ideas (Kitayama & Tompson, 2010). Nursing students were expected to internalize the attitudes, beliefs, and socially shared ideas of the profession during their nursing education.

Theoretical Model

The Neurocultural Interaction Model, drawn from the field of psychology, provided a framework for collecting and interpreting data generated by the study (Kitayama & Tompson, 2010). The interaction model was selected because a nursing student's reactions to malodor occurred within the context of the student's interactions with a simulated malodorous

wound. During the care of a simulated patient, the student collaborated with another student and a faculty facilitator in a simulation scenario (Roberson et al., 2008). The Neurocultural Interaction Model was developed by Kitayama and Tompson (2010) to synthesize existing knowledge about how brain connectivity changes in response to an individual's active, repeated engagement in culturally-scripted behavioral patterns called practices. The model is presented in

Figure 1 Neurocultural Interaction Model

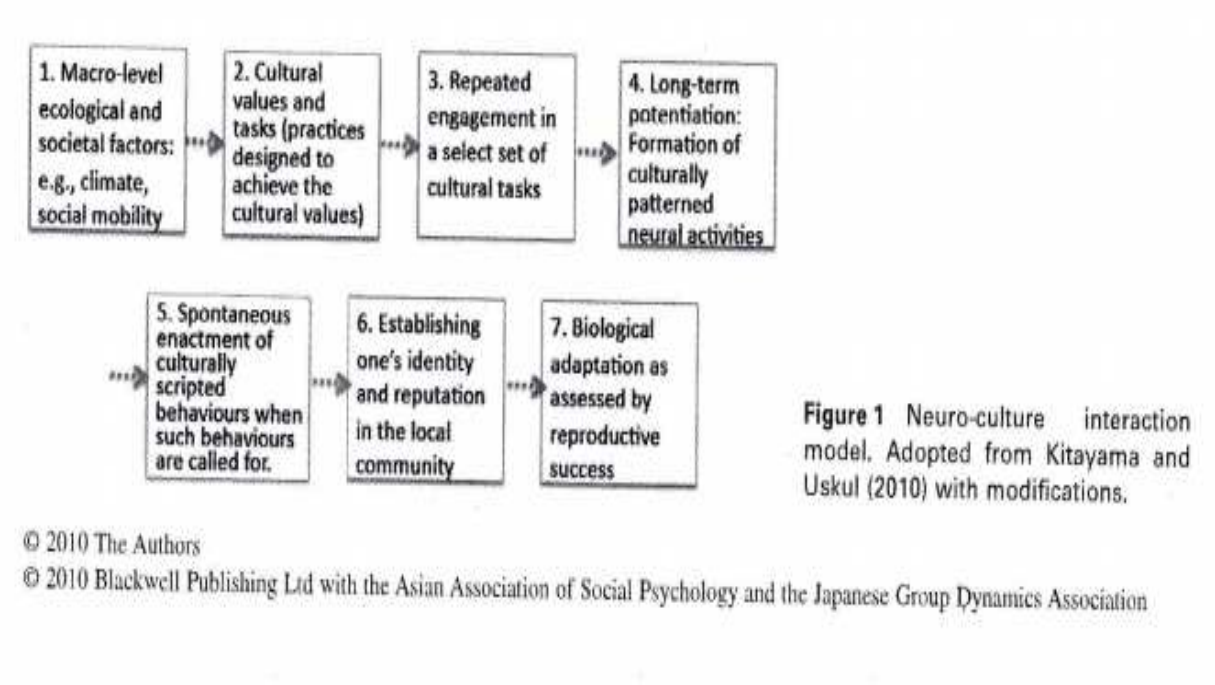

Figure 1. The Neurocultural Interaction Model by Kitayama & Tompson (2010)

The Kitayama and Tompson model was drawn from the seminal work of Paul Ekman in biological psychology. Ekman (1972) proposed the Neurocultural Model of Universal Human Facial Expressions. The Neurocultural Model stated that the biological potentiation to display particular facial expressions, though pre-wired neurologically, may be gradually altered by volitional control which may be governed by display rules based on cultural norms (Ekman & Friesen, 1978; Bull, 2002; Kitayama & Tompson, 2010; Soussignan & Schall, 1996). The Neurocultural Interaction Model proposed by Kitayama and Tompson (2010) provided a

framework based on linear, sequential relationships among the various levels of interaction to explain how these pre-wired neurological responses became adapted to volitional control.

The Neurocultural Interaction Model identified seven levels of adaptation. Each level of adaptation specified factors that mediated the interactions of an individual with cultural expectations. The model suggested how the individual internalized the culture and how the brain changed connectivity through neural links in response to biological adaptation to norms of the culture, in the case of this study, the culture of professional nursing. Two adaptation levels of the interaction model were selected as the areas of focus for this study because they explained the processes involved in nursing education. In nursing education programs, students become socialized to the cultural norms and tasks of nursing through multiple pedagogies, one of which is the simulation laboratory. The two relevant adaptation levels related to the simulation laboratory were Level 2: Cultural values and tasks and Level 3: Repeated engagement in select tasks. Level 2 of the model encompassed the educational outcome of students' practicing and internalizing the values and tasks of the nursing profession. In this study, the students were expected to show caring and respect for the integrity of the simulated human patient while dressing a simulated malodorous wound. Level 3 of the model included the educational practices of repeated engagement in learning activities designed to foster the students' development of skills in the select task of malodorous wound care dressing changes. The utility of the model for guiding interpretation of the data during data collection and analysis will be explored later.

Summary

Lack of knowledge about how nursing students react to malodor in wound care simulation was identified as a problem for nurse educators using high fidelity simulation pedagogy. The significance of the problem was discussed exploring the importance of socializing nursing students to the core values and skills of the culture of professional nursing. Finally, the Neurocultural Interaction Model, drawn from the field of psychology, was presented to explain the context and adaptation processes of nursing students' reactions to malodor during interaction with simulated malodorous wounds in the simulation laboratory.

Chapter 2

The researcher searched the literature to explore a range of topics which constituted the context and the elements of nursing students' reactions to malodor in simulation. The researcher examined how human beings react to malodor with a focus on literature related particularly to nursing students' reactions. An underlying assumption of the literature review was that reactions to malodor involved nonverbal behaviors which communicated information about nursing students' cognitive and affective states (Bull, 2008; Ekman, 2011). Therefore, literature exploring nonverbal behaviors in communication was a focus of the literature search process. Nursing research literature was targeted to locate information about how nurse educators helped students to socialize to the culture and tasks of the nursing profession during wound care instruction and wound care simulation, especially instruction in malodorous wound care. Additionally, the researcher focused on how observation and video recordings have been used in nursing research and in research from other disciplines. The researcher accessed the resources of the university library to sample the literature.

Textbooks, journal articles, internet searches, and the following databases: the Cumulative Index to Nursing and Allied Health Literature (CINAHL by EBSCO), Medline by Ovid, ERIC, PsycINFO and Academic Premier Search were used during the literature review. Based on the range of topics identified earlier, the search terms for the literature review were wound care simulation, wound care instruction, malodorous wound care, nonverbal behaviors, video recording in research, observation in research, odor, and reactions to malodor.

Initially, resources were restricted to English language articles published from 1990-2012. This twenty-two year period represented the timeframe when clinical education was being revolutionized by advanced technologies (Childs & Sepples, 2006; Jeffries, 2005; Jeffries &

Rizzolo, 2006). The term high fidelity clinical simulation came to mean the authentic replication of clinical settings using computerized human patient simulators (HPS) which could interact with students and produce physiological responses mimicking critical health events (Brannan, White, & Bezanson, 2008; Howard, 2007; Nehring & Lashley, 2009).

To further focus the review, the literature search was restricted to peer-reviewed research articles about pre-licensure nursing students. Hundreds of articles were located and the researcher reviewed titles and read abstracts to isolate relevant articles for full review. During review of the articles, the ancestry technique of harvesting relevant articles listed within bibliographies was employed to locate additional references. The findings of the literature review are presented under the following subheadings: odor detection, reactions to malodor, malodorous wound care, wound care education in nursing, wound care simulation in nursing education, and observation and video recording in research.

Odor Detection

The literature results related to the topics of odor and human reactions to malodor are organized into discussions of the physiology of odor detection and neurological expressions of reaction to malodor. Humans have a keen sense of smell mediated by the olfactory system (Yeshurun & Sobel, 2010). Molecules of chemicals are emitted from the odor source into the air. These molecules are inhaled into a person's nose where these molecules contact the olfactory bulbs in the nasal mucosa resulting in the person's detecting odor. The olfactory bulbs translate the chemical stimuli of odor molecules into electrical impulses which are transmitted directly to the cortex of the brain where the impulses are rated by their degree of pleasantness. Neural links trigger patterns of recognition of the odor (Yeshurun & Sobel, 2010). From a neurological

perspective, humans have the capacity to habituate to stimuli, which means that they manifest biological adaptation to the stimuli and no longer react to it. However, research has shown that humans do not habituate to putrescine or cadaverine odors emitted from necrotic tissue. Certain bacteria which infect chronic wounds emit these types of odors (Roberson et al., 2008). Human beings react to detection of malodor with unique nonverbal behaviors.

Reactions to Malodor

There was a large body of literature in the field of psychology which discussed differential facial responses of human beings to odor stimuli. These facial responses were theoretically associated with emotional states of the individual (Hager, 2003; Martin et al., 2010; Morse, Beres, Spiers, Mayan, & Olson, 2003; Murphy, 2005; Sayette et al., 2001; Soussignan & Schall, 1996). Several existing models which attempted to explain the origins of human response to malodor were described in the literature. The most biologically based model was the Reflexive-Hedonic Model proposed by Steiner (1979) who postulated that the stereotypical facial responses to malodor observed in human beings, from neonates to adults, were reflex patterns mediated by the brainstem. As previously stated, the Neurocultural Model presented by Ekman (Bull, 2002; Ekman & Friesen, 1978; Ekman, 2011) stated that the biological potentiation to display particular facial expressions, through pre-wired neurologically, may be gradually brought under volitional control and that volitional control may be governed by display rules based on cultural norms. Display rules are cultural norms that guide the expression of emotion in different social contexts (Bull, 2002b; Bull, 2008). From another perspective, Fridlund (1994, 1997) rejected the Neurocultural Model and proposed the Behavioral-Ecology Model. Fridlund postulated that there were no fundamental emotional states or fundamental facial displays. Fridlund (1994, 1997) explained that there were only behaviors which reflected social context and social intent (Bull,

2002b; Sayette et al., 2001; Soussignan & Schall, 1996). The refinement of the Neurocultural Model into the Neurocultural Interaction Model of Kitayama and Tompson (2010) proposed the processes involved in how biological adaptation was driven through repeated engagement in culturally-scripted behaviors based on cultural norms or display rules of a culture. The Neurocultural Interaction Model, used in this study, explained how nursing students adapted to the cultural norms of the nursing profession through engagement in nursing education activities. The unique facial expressions in reaction to malodor have been linked to emotional states of individuals.

Psychology literature provided detailed descriptions of a method for identifying basic emotional states based on facial expressions. The procedures were founded on the assumption that a person's facial expression would be associated with the person's emotional state. The Facial Action Coding System (FACS) is a comprehensive, anatomically based technique for measuring minimally observable facial changes or action units produced by facial muscles as wrinkles, bulges, and pouches of skin (Ekman & Friesen, 1978; Morse et al., 2003; Sayette et al., 2001; Soussignan & Schall, 1996; Vrana, 1993). In the FACS scale, there are forty-four discrete facial actions units (44 AUs) which can be monitored to identify six universal emotional states: anger, fear, disgust, surprise, happiness, and sadness (Figure 2). In research, the negative emotional state of disgust (picture #3) has been associated with noxious imagery and malodor (Sayette et al., 2001; Soussignan & Schall, 1996; Vrana, 1993). In two reported studies, FACS was used to measure response to malodor (Sayette et al., 2001; Soussignan & Schall, 1996). In these studies, the FACS malodor facial reactions were unique and were measured by upper lip raising (AU 10 = levator labii superioris) and nose wrinkling (AU 9 = alesque nasi region)

(Soussignan & Schall, 1996; Vrana, 1993). The FACS measurement of readily identifiable facial changes stimulated by malodor exposure provided the researcher in the current study with a method for analyzing nursing students' nonverbal reactions to malodor.

1 2 3

4 5 6

Figure 2 Universal Facial Expressions of Emotions (Ekman & Friesen, 1978)

In nursing literature related to nursing students' reactions to malodor, Roberson et al. (2008) conducted a quasi-experimental, descriptive study to explore nursing students' perceptions of the impact of adding malodor in wound care simulation. Student participants were video recorded participating in wound care simulation scenarios including malodor. When reviewing the video recordings, Roberson et al. noted several nonverbal behaviors in reaction to malodor in the simulation scenarios: crossed arms, frowning, nose wrinkling, not speaking to the patient during the dressing change, inappropriate laughter, pauses or hesitancy to act. The researchers described these behaviors as inappropriate nonverbal reactions. The researchers considered the reactions to be indicators that the students needed additional instruction to become socialized to

the culture of the nursing profession and to learn professional standards (Roberson et al., 2008). The nonverbal behaviors reported by Roberson et al. in conjunction with the FACS analysis process were used in this research project to develop an a priori coding scheme of nonverbal behaviors in reaction to malodor.

In communication literature, nonverbal communication behaviors have been described as facial expressions, touch, gestures, postures, and voice quality exhibited by individuals (Bull, 2002a; Bull, 2008; Martin et al., 2010). In relation to nonverbal behaviors, fit or congruence was an important concept which referred to how well the verbal and nonverbal messages matched. At its core, communication involves the transmission of a message from a sender to a receiver. With effective communication, the words and the nonverbal behaviors of a message match (are congruent or fit). When there is congruence, the message is reinforced. Based on these communication principles, the lack of socialization displayed by nursing students during malodorous wound care has the potential to negatively impact the messages being conveyed to patients about the core nursing values of caring and integrity in clinical practice (Lindahl et al., 2008; Martin et al., 2010; Morris, 2008; Roberson et al., 2008). Therefore, nursing students must adapt to professional standards of malodorous wound care.

Malodorous Wound Care

Several authors have documented the challenges of managing malodorous wounds (Fletcher, 2010; Lindahl et al., 2008; McIntosh & Ousey, 2007; Siegel, 2008). In the practice setting, caregivers have to identify the sources of the malodor while maintaining close interpersonal relationships with patients who may feel isolated and ashamed of their malodorous wounds. Nurses have to cope with their own physical reactions to malodor while considering the emotional distress of their patients and other caregivers (Morris, 2008). Psychologically,

malodorous wounds compromise the patient's body image, self-esteem, and social interactions. Physically, patients and caregivers struggle with malodor, exudates, pain, bleeding, and inflammation of the surrounding tissues. During wound care, nurses have to apply the nursing process at three levels. First, they have to collect baseline data about the characteristics of the wound through detailed observation and description of the wound and its exudates. Next, the nurses have to apply critical thinking skills to determine how to manage symptom control of the wounds while considering the patients' and their caregivers' priorities. Finally, nurses have to develop a wound care management plan that is realistic, therapeutic, and cost effective (Morris, 2008).

Siegel (2008) wrote about the challenge of an involuntary gag reflex in response to malodor. Caregivers, who experienced this reflexive response, struggled with wound care. The author suggested strategies to help mediate the perception of malodor. For example, putting a few drops of perfume in a face mask which could be worn by the caregiver during wound care or using odor control topical medications that could be applied to the wound to lessen the perception of malodor (Siegel, 2008).

Lindahl et al. (2008) conducted a qualitative study with caregivers who were experienced in providing malodorous wound care. These researchers discovered that nurses struggled with their professional duty to provide malodorous wound care because of their feelings of being exposed to contamination, of having to maintain proximity to the patient and the wound, and of caring about the integrity of the patient during wound care. Based on analysis of the participants' interviews, Lindahl et al. isolated four themes. The first theme was "Facing the Wound" which involved revealing 'what was meant to be concealed' as the dressings were removed. The nurses worried about the patient's sensitivity to the nurses' facial expressions when the wound was

exposed. The second theme was "Facing One's Own Defenselessness" which referred to the nurses feeling unable to escape from the malodor. Nurses spoke about feeling the need to vomit and feeling that the malodor lingered in their nostrils long after wound care had been completed. The theme of "Feeling Helpless" described nurses' experiences of not knowing what to say to the patients or what to do about the malodor. "Striving to Endure" was the final theme that described nurses' intentions not to abandon their patients and to find the courage to do what had to be done (Lindahl et al., 2008). This final theme was grounded in the nursing profession's core values of caring for the patient and respecting the integrity of the patient (NLN, 2011). Since coping with malodor is an important clinical skill, nurse educators must consider how to prepare nursing students for this clinical challenge

Wound Care Education in Nursing

The literature review related to wound care education in nursing examined the topics of textbook content about wound care, standard instruction in wound care, the adequacy of wound care instruction, and issues of educational standards and models of wound care in nursing practice. The exploration began with evidence about the quality of wound care information contained in fundamental nursing textbooks. Because textbooks are primary sources of information on wound care which nursing students are required to read, the content of these textbooks was an important factor to examine. The literature search located an original study and a replication study that explored the content of nursing textbooks related to pressure ulcers, a particular type of wound which nursing students must learn to manage (Ayello & Meaney, 2003; Vogelpohl & Dougherty, 1993). Vogelpohl and Dougherty (1993) reported the original study based on their survey of ten (n10) undergraduate nursing textbooks. A predetermined list of factors related to pressure ulcers was used to evaluate each textbook. They found that nursing

textbooks varied greatly in how they presented content on pressure ulcer assessment and wound management and that several textbooks provided minimal and occasionally inaccurate information. In the intervening years, Ayello and Meaney (2003) noted, in the replication study, that the science of pressure ulcer management had evolved rapidly. In Ayello and Meaney's study, only eight (*n*8) of the original ten textbooks were still in publication. A primary inclusion criterion for their study was that the textbooks which they examined had to have been reviewed in the original research by Vogelpohl and Dougherty. Ayello and Meaney's (2001) findings indicated that in recent editions of the texts, the terminology related to pressure ulcers was more consistent. However, Ayello and Meaney found significant variability in the amount of information provided to nursing students. Some of the textbooks had as few as 45 lines devoted to pressure ulcers while others presented over 1300 lines of text. Ayello and Meaney noted that the newer editions of nursing textbooks presented more information on all factors compared to the findings of Vogelpohl and Dougherty (1993). However, in some of the texts, the information was fragmented over several different chapters. As a result of their study, Ayello and Meaney recommended that at least one whole chapter of a fundamental nursing textbook should be dedicated to the prevention, assessment, and treatment of pressure ulcers (Ayello & Meaney, 2003).

In another study, Madsen and Reid-Searl (2007) explored how well wound care standards of practice were reflected in nursing education textbooks to discover poor compliance with the latest standards. The researchers commented that there was currently no theoretical framework to guide wound care in nursing practice (Madsen & Reid-Searl, 2007). Consequently, the lack of a theoretical framework complicated wound care instruction.

Although there was no theoretical framework for wound care management located in the literature, there were multiple clinical practice guidelines. These practice guidelines were developed by various health care organizations to enhance the consistency of wound care, to reduce morbidity and mortality from wound complications, and to improve the quality of life of patients suffering with chronic wounds (Langemo et al., 2008). However, the authors noted that clinical practice guidelines required constant updating because of improved products and treatments and new research evidence (Langemo et al., 2008). The challenge of constantly requiring updating of the guidelines may explain why Madsen and Reid-Searl (2007) found outdated information in nursing textbooks. There was no literature located that indicated how nurse educators incorporated clinical practice guidelines into nursing education. Perhaps a nursing theoretical framework for wound care could provide nurse educators with a more enduring model of wound care factors to guide wound care instruction (Madsen & Reid-Searl, 2007).

In a research report by Huff (2011), the standard wound care education that nursing students routinely received was described. This standard education included assigned readings from their textbooks coupled with a classroom lecture on the many types of wounds. Additionally, in the clinical laboratory, nursing students practiced wound care interventions before they were evaluated for competency on basic dressing changes using aseptic technique (Huff, 2011). For her intervention study, Huff (2011) had the participants receive the routine wound care instruction described above prior to the research interventions. The participants in the intervention group were given specific educational information related to pressure ulcer care using a lecture with PowerPoint presentation, which students printed off for reference and study (Huff, 2011). A second intervention involved practice in the clinical laboratory where nursing

students applied advanced wound care products to simulated wounds. Finally, the intervention group participants were given handouts on pressure ulcer locations and staging instructions for rating wound severity. Using a pre-test/post-test format based on a researcher developed questionnaire, Huff (2011) measured baseline knowledge of both the comparison group and the intervention group prior to routine instruction and the interventions. Immediately following instruction and after the interventions, changes in the participants' knowledge were measured with a post-test, which was also repeated two months after the instructional and intervention activities (Huff, 2011). Although the study findings reported a significant improvement in the intervention group's scores, there were serious limitations to the study.

The first limitation was the inequality of the two groups. The intervention group consisted of baccalaureate nursing students and the comparison group consisted of associate degree nursing students. The inequality of the groups potentially introduced confounding factors which might have affected the study results. Research evidence suggests that there are substantive differences between baccalaureate nursing students and associate degree nursing students. For example, associate degree students tended to be nontraditional adult learners who differed in experience, age, and motivation as compared to baccalaureate students (Simon & Augustus, 2009). Two other limitations were potential sharing of information among students and the fact that some of the participants had prior health care experience with pressure ulcers (Huff, 2011). Most educators would anticipate an improvement in students' knowledge scores after the students had received supplemental instruction and resources on a particular topic. However, the fact that statistically significant improvement on scores measuring knowledge of pressure ulcer management persisted for the intervention group on the post-test two months following the intervention was a compelling finding of the study.

Moore and Clark (2011) conducted an international study to explore how professional caregivers evaluated their educational preparation for wound care. In this study there were 68 respondents (*n*68) from 35 countries. The results indicated that 87% of respondents were dissatisfied with the amount of time spent on wound care in their basic education programs. Eighty-three percent (83%) of respondents reported that they believed that they had received insufficient education on wound care (Moore & Clarke, 2011). One strength of this research was that it provided an international perspective on wound care education.

Additionally, Fletcher (2010), a health educator in the United Kingdom, noted that although community health nurses reported spending fifty to sixty percent of their patient contact time caring for patients with chronic wounds, the nurses stated that they had received only a few hours of wound care instruction in their basic nursing education programs. Fletcher (2010) commented that despite the existence of national and international clinical practice guidelines, the impact of these guidelines on education practices remained undocumented. Fletcher (2010) observed that there were no minimum education standards to guide educators in developing wound care instruction for health care providers. A limitation of Fletcher's report was that the observations were drawn from the health care system in the United Kingdom; therefore, the observations may not generalize to the health care system in the United States. However, the issue of lack of educational standards for wound management instruction internationally was addressed in the literature.

The literature included an international eDelphi study which identified research and education priorities for wound management (Cowman, Gethin, Clarke, Moore, Craig, Jordan-O'Brien, McLain, Strappk, 2011). The researchers used a four round eDelphi procedure to conduct an internet-based survey of three hundred and sixty (*n*360) multidisciplinary health care providers.

Eighty percent (80%) of the respondents were nurses. The respondents listed the need for standardization in wound management education as an international priority. The respondents listed the areas of selecting appropriate dressings, preventing and treating pressure ulcers, and managing wound infections as domains needing educational focus and standardization. The limitations of the study were that only participants with internet access could respond to the survey. Additionally, the questionnaires were only available in English and Spanish. Finally, the respondents did not give the rationales behind their responses, thereby limiting the researchers' understandings of the meanings of the responses.

Wound Care Simulation in Nursing Education

Nursing literature included discussions of how high fidelity simulation involving wound care has been implemented. Practice-based education literature supported the importance of realism in simulation (Childs & Sepples, 2006; Jeffries & Rizzolo, 2006; Jones, 2011; Stephens, 2011). One publication stated that a professional make-up artist was involved in creating realistic wounds for a nursing education program. The artist explained how he had used silicone to form the wounds and then added fake blood and fake pus (Jones, 2011). In the report, a nurse educator in the nursing program commented on the importance of the "yuck factor" in helping to prepare students for the realities of wound care in clinical practice (Stephens, 2011). In an effort to provide realism, nurse educators have incorporated malodor into simulation (Roberson et al., 2008).

Roberson et al. (2008) reported on their efforts to introduce olfactory realism into wound care simulation. Based on research into which cheeses emitted malodor, the researchers identified the similarities between the pungent odor of certain cheeses, particularly Limburger cheese, and the malodor of infected wounds, for example pseudomonas infection, encountered in

clinical practice. The researchers designed a quasi-experimental, descriptive study to explore the perceptions of nursing students of the impact of adding malodor to wound care simulation.

For the intervention group, baccalaureate nursing students (*n*49) worked in pairs (a nurse educator paired with a student who needed a partner) within malodorous wound care simulation scenarios. This sample was drawn from a population of 137 students who had completed wound care simulations without malodor for skills competence evaluation earlier in the week. After the earlier evaluation simulations, all students completed the Laerdal's Simulation Experience Evaluation Tool which asked students to rate their simulation experiences on a Likert scale. The subscales measured students' perceptions of their levels of participation in the scenarios, the realism of the simulations, their abilities to identify patient problems and to intervene, and their abilities to incorporate theory into hands-on practice. Additionally, students were asked about how well they could determine their strengths and weaknesses while performing in the scenarios and their senses of safety during the simulations. Next, the students reported their perceptions of the level of participation during the debriefing sessions and how valuable they perceived debriefing to be. Finally, students were asked how prepared they felt to perform wound care in the clinical practice setting. From the pool of 137 questionnaires which had been completed after wound care evaluation simulations, the researchers randomly selected 50 surveys to function as a comparison group to questionnaires completed by the intervention group (Roberson et al., 2008).

After the malodorous wound care simulations, the intervention group participants were asked three additional questions on the questionnaires. They were asked to evaluate the level of realism of the simulations with malodor compared to the routine wound care simulations without malodor in which they had participated several days earlier. The participants were asked if they

believed that the malodorous wound care simulations improved their abilities to perform wound care in clinical practice. Finally, the participants were asked if the malodor was a distraction from performing the dressing change skills (Roberson et al., 2008).

The findings of the study showed that the participants rated the malodorous wound care simulations higher on eight of the twelve survey subscales. The participants reported that malodor improved the realism of the simulations and that they felt better prepared to perform wound care in the clinical practice setting (Roberson et al., 2008).

A major limitation of this study was that during routine simulations for evaluation, students had worked in groups of six or more students per scenario. Performing wound care in a larger group may have affected students' perceptions of their levels of participation when compared to working with only one other student during the research simulation scenarios. A procedural challenge faced by the researchers was the time required to set up the simulation scenarios between student participants. Nurse educators had to remove the dressing and reapply the malodorous cheese to the wound before the next pair of students entered the simulation laboratory.

In the Roberson et al. (2008) study, nursing students were video recorded while they performed wound care. The current research study was a secondary analysis of these video recordings for the purpose of developing nursing knowledge about how nursing students reacted to malodor during the wound care simulations. Observation of the students' nonverbal behaviors in the video recordings was the primary method of data collection.

Observation and Video Recording in Research

Observation has a long history in education as a strategy for evaluating students' knowledge, skills and behaviors (Daston & Lunbeck, 2011; Jeffries, 2005). Observation has been an

educational practice used by nurse educators to assess nursing students in the laboratory, in the clinical setting, and in the research environment. Historically, Kohut argued that introspection and empathy were adequate tools to allow an observer to apprehend the inner experiences of individuals being observed (Daston & Lunbeck, 2011). Over time educators have come to define empathy as knowledge of human nature. Consequently, empathy has been classified as a scientific mode of knowing in relation to observation (Daston & Lunbeck, 2011). Currently, observation has been transformed by video recording technology which can preserve indefinitely a situated time-space-persons event exactly as it occurred.

In the groundbreaking report of the National League for Nursing (NLN) and Laerdal project designed to foster the incorporation of high fidelity simulation into nursing education, the authors discussed the use of video recordings as a means of allowing nursing students opportunities to reflect on their performances and to assess their actions. Also, the video recordings allowed nursing faculty opportunities to assess groups of students (Childs & Sepples, 2006; Jeffries, 2005; Jeffries & Rizzolo, 2006). Students have reported feeling anxious and stressed during simulation scenarios (Dreifuerst, 2009; Elfrink, Nininger, Rohig, & Lee, 2009; Haidet, Tate, Divirgilio-Thomas, Kolanowski, & Happ, 2009). Their anxiety potentially inhibited their ability to process what was happening in the scenario and how they were responding to the event. During the debriefing sessions, watching video recordings of their performances in the scenarios helped students to identify what they missed, what they did correctly, and what the consequences were of their actions (Childs & Sepples, 2006; Dreifuerst, 2009; Elfrink et al., 2009).

However, students have commented that being video recorded was very stressful. Research has shown that the experience of being watched changes how people act. Researchers must

question to what extent the observed behaviors accurately represent the participants' true behaviors in real situations (Elfrink et al., 2009; Haidet et al., 2009). Anecdotally, nurse educators have reported that once students have become fully engaged in the clinical situation embedded in the simulation scenario, the students seemed to forget about the camera (Childs & Sepples, 2006).

Research using the qualitative methodology of ethology when analyzing video recordings of nursing practice situations in order to develop qualitative descriptions and grounded theory models of the concept of suffering have been reported in nursing literature (Morse & Bottorff, 1990; Morse et al., 2003). These researchers used FACS (Facial Action Coding System) techniques to guide their analyses of video recordings of individuals based on frame-by-frame review of transitional emotional states of suffering (Morse et al., 2003). These techniques, drawn from the field of psychology, proved to be effective tools for investigating complex human reactions. Morse et al. reported that their research project was the first observational study designed to link verbally expressed emotions with facial expressions within a particular context. The authors acknowledged that in the interview situations and the video recording processes, participants unsuccessfully attempted to suppress their emotions and to control their crying. These efforts to suppress their behaviors represented changes in the normal behaviors of the participants which could have potentially threaten the validity of findings (Haidet et al., 2009; Morse et al., 2003).

Morse et al. (2003) wrote that basic emotions produced patterned facial expressions which could be described as normative reactions and which could be easily recognized. This work was particularly applicable to the current study which investigated the facial expressions of nursing students associated with the basic human emotion of disgust in reaction to malodor. The disgust

emotion in reaction to malodor was a normative reaction (Ekman, 2011; Hager, 2003; Morse et al., 2003; Sayette et al., 2001). The research by Morse et al. added support to the appropriateness of using FACS methodology to describe and label the reactions of nursing students in video recordings of malodorous wound care.

The literature on the use of video recordings for research revealed both advantages and disadvantages of video recording participants. Researchers from the field of psychology noted the advantages of video recording were improvement in the reliability of observations because the researchers could view the data again and again just as it occurred the first time. Additionally, other observers could access the exact same event by reviewing the video recordings. The researchers affirmed the importance of controlling for observer bias by establishing inter-rater agreement on coding documentation of observations. Video recordings made establishing inter-rater agreement more precise because the raters could watch and code the same participants and events (Haidet et al., 2009; Yeshurun & Sobel, 2010). Another benefit was that video recordings allowed researchers to explore data from microanalytic and macroanalytic perspectives. Microanalysis is defined as the observation of minimally observable nonverbal behaviors, for example facial muscle movement; while macroanalysis is defined as the observation of gross motor movements, i.e. posturing and gesturing (Bull, 2002; Haidet et al., 2009). However, video recordings did present some disadvantages to the research process.

Haidet et al. (2009) reported some of the disadvantages of using video recordings for research. They noted that video recordings could be intrusive into the interactions being recorded thus causing participant reactivity to the presence of the video camera. Participant reactivity could potentially alter the participants' normal behaviors, thereby compromising the findings of the research (Haidet et al., 2009). Haidet et al. noted that video recorded data were limited by

observer bias which determined what was observed and what was not observed. Additionally, video recordings were not able to capture contextual elements of the event. This lack of context could potentially affect the observer's findings. Finally, there were often technical difficulties with camera placement and equipment failures during video recording (Downing, 2008; Haidet et al., 2009). Another challenge of observing video recorded data was the question of what to observe and document and how to analyze the observations.

Analysis of video recordings requires substantial resources. To explore a method for conserving research time and money, Murphy (2005) conducted a study to examine the effects of slicing video recordings into shorter segments for analysis of nonverbal behaviors of two psychology students interacting in a scenario. The purpose of Murphy's study was to compare the findings when short segments of video recorded data were analyzed versus the findings when the whole video recording was analyzed. The shorter segments were extracted from fifteen minute video recordings. The researchers established inter-rater reliability of the coding scheme which focused on six discrete nonverbal behaviors. Using analyses of several full fifteen minute video recordings, the researchers found that four of the six behaviors coded with a kappa coefficient greater than r .90. This level of inter-rater agreement represented a high level of reliability for the coding scheme based on the researchers' standard. The researchers used a random number generator to select which one minute segments of the fifteen minute video recordings would be analyzed for the slicing experiment. The findings of this research indicated that the thin slices (short segments) of the video recordings were predictive of the coding results (final scores) of the full fifteen minute coding process. The researcher stated that the findings suggested that slicing video recordings into short segments appeared to be an effective way to conserve valuable research resources without compromising the coding process (Murphy, 2005).

In support of the concept of slicing the video recordings into segments, Marques and McCall (2005) argued that when using inter-rater agreement in qualitative research, a primary goal of the researcher should be to expose the raters to segments of the data. They stated the rationales for segmenting data were to reduce the time required to train and orient raters and to accommodate the limited time raters have for observing and scoring data (Marques & McCall, 2005). The strategy of slicing video recordings into short segments for inter-rater scoring was employed in the current research study.

Summary

The literature review provided evidence about the physiology of odor detection and reactions of human beings to malodor. Psychology literature demonstrated how human reactions to malodor have been researched and identified measures of reactions to malodor through the application of FACS (Facial Action Coding System) methodology. The challenges of providing wound care to patients with malodorous chronic wounds were explored in nursing literature. The subjects of how nursing students have been traditionally instructed about wound care and how high fidelity simulation has been incorporated into wound care nursing education were described. Finally, evolution of the modern scientific methodology of observation was explored and the advantages and disadvantages of using video recordings in observation research were discussed. The literature review identified gaps in nursing knowledge about how nursing students reacted to malodor in wound care simulation.

Gaps in Nursing Knowledge

No description of nursing students' nonverbal reactions to malodor during wound care simulation was found in the literature. However, Roberson et al. (2008) noted anecdotally several

nonverbal behaviors in reaction to malodor during their simulation study. Nurse educators need practice-based research information about how nursing students react to malodor in simulation in order to evaluate students' performances in the simulation laboratory (Leeman & Sandelowski, 2012). With this information, nurse educators can identify which students are exhibiting reactions to malodor. Once the students' nonverbal reactions are identified, nurse educators can determine which reactions are inappropriate. When inappropriate nonverbal behaviors are exposed, the educators can develop additional instruction and support strategies for those students who need help modifying their nonverbal behaviors in order to meet professional standards and to adapt to the cultural norms of the nursing profession.

Most of the literature on malodorous wound care focused on the challenges faced by nurses in practice, rather than nursing students during instruction in wound care. There was a lack of nursing knowledge about how nursing students reacted to malodor in wound care simulation in the literature. The current study aimed to address this gap in nursing knowledge.

Chapter 3

The purpose of this research project was to describe how nursing students reacted to malodor in video recordings of wound care simulation. Research questions were developed and the research methodology which was most appropriate to answer the questions was selected.

Research Questions and Methodology

The study was an observational study using qualitative descriptive methodology to answer the following questions:

- How did nursing students react to malodor in video recordings of wound care simulation?
- What specific nonverbal behaviors were nursing students' reactions to malodor in video recordings of wound care simulation?

This research study involved events that were video recorded in the simulation laboratory. The simulation laboratory is a natural education environment where nursing students practice wound care skills to develop competency. An important feature of this qualitative research study was the fact that nursing students had experienced repeated engagement in wound care activities in the simulation laboratory. The Principal Investigator (PI) aimed to observe students' nonverbal reactions to malodor while they were participating in wound care simulation scenarios. These nursing education activities were part of the socialization process helping students internalize the values, attitudes, and skills of the nursing profession (Kitayama & Tompson, 2010; NLN, 2011; Roberson et al., 2008). Qualitative description, a generic form of qualitative methodology, was selected as the best methodology to allow the PI to produce a description and pattern summary of students' nonverbal behaviors in reaction to malodor (Sandelowski, 2011).

This qualitative inquiry operated on the basic ontological assumption that there were multiple realities mediated in the minds of the individual participants. The epistemological stance of the inquiry was that the researcher became a participant in the research process during observation and analysis of the video recordings. From an axiological perspective, the researcher regarded the research process as necessarily embedded with values and biases that had to be explicitly stated in order to enhance the credibility of the process. This qualitative methodology required inductive logic which drew meanings from the context of the study situation and allowed meanings to emerge from the data (Creswell, 2007). Since little was known about nursing students' reactions to malodor during wound care simulations, allowing concepts to emerge from the data was the primary strategy used to develop a description of how students reacted to malodor. Selecting the sample of video recordings for analysis was an important first step.

Sampling Strategy: Identification and Selection

The sources of students' nonverbal behaviors in reaction to malodor in simulation were the existing 25 video recordings from an earlier wound simulation study (Roberson et al., 2008). The video recordings were designated as "cases" of simulation experience (Creswell, 2007; Sandelowski, 2011). The sampling method was purposeful as the researcher reviewed and coded all the video recordings (*N*25) to identify fifteen video recordings (cases) which met these inclusion criteria:

- participant's facial expressions were observable
- participant's nonverbal behaviors were observable
- participant's voice quality was audible.

Fifteen cases were selected for coding and represented a sample of 60% (15/25) of the population of 25 video recordings. The strategy of selecting a sample of the total video

recordings available allowed the PI to eliminate video recordings which did not meet the inclusion criteria. A small sample size is a common feature of qualitative research. Yet, each of the *n*15 video recordings contained hundreds of data bits (nonverbal behaviors) and thousands of video frames for analysis (Murphy, 2005; Polit & Beck, 2008; Sandelowski, 2011).

The 49 baccalaureate nursing students, volunteers from a population of 137 students, were the participants in the earlier research (Roberson et al., 2008). The participants had just completed routine wound care evaluation simulations a few days prior to the research project. The participants were asked to choose a partner and to sign-up on a master list if they were willing to be involved in wound care simulation research. When a student did not have a partner for the simulation scenario, a faculty member filled-in as the assistant to that student during the simulation. At the briefing session prior to entering the simulation laboratory, the researchers explained to the student volunteers the purpose of the study, the fact that their participation was voluntary, and that their participation would not affect their grades for the course. Additionally, the researchers explained the risks and the potential benefits of participating in the study. Each student signed an open consent form and an agreement to have the simulation performance video recorded. Since the researchers in the current study had no access to the students in the video recordings, the open consent forms from the earlier project were used. The research proposal for this project was approved by the University and Medical Center Institutional Review Board (UMCIRB) prior to the start of the study.

Data Collection Procedures

The research project was conducted in three phases:

- Phase 1: Developing the coding scheme and identifying sample video recordings

- Phase 2: Validating the coding scheme and establishing inter-rater agreement for the coding scheme
- Phase 3: Identifying themes and patterns of nursing students' reactions to malodor in simulation.

The three phases of the study will serve as headings for a description of the methods.

Phase 1: Developing the Coding Scheme and Identifying Sample Video Recordings

The literature documents twelve distinct nonverbal behaviors observed in reaction to malodor (Ekman & Friesen, 1978; Roberson, et al., 2008; Sayette, et al., 2001; Soussignan & Schall, 1996; Vrana, 1993). Based upon these nonverbal behaviors, codes and specific definitions were developed (Appendix F). The behavior list became the a priori coding scheme used by the PI for initial analysis of the video recordings. Pictures illustrating the twelve behaviors are presented in Figure 3.

Sample Selection

The video recordings for this study were produced in an earlier research project (Roberson et al., 2008). In that study, researchers recorded videos of nursing students working together in pairs during simulation scenarios which depicted the treatment of malodorous wounds. Twenty-five video recordings were produced.

Review of the 25 video recordings resulted in 15 video recordings meeting the inclusion criteria. The PI reviewed the full length (approximately 20 minutes) for each of the 15 video recordings applying the a priori coding scheme and making memos about other nonverbal behaviors which nursing students seemed to be exhibiting in reaction to malodor. The PI

compiled a list of additional nonverbal behavior reactions which had emerged from the data. The PI returned to the literature to develop codes, descriptions, and limitations for the eight additional nonverbal behaviors (Appendix G). These behaviors were incorporated into the coding scheme

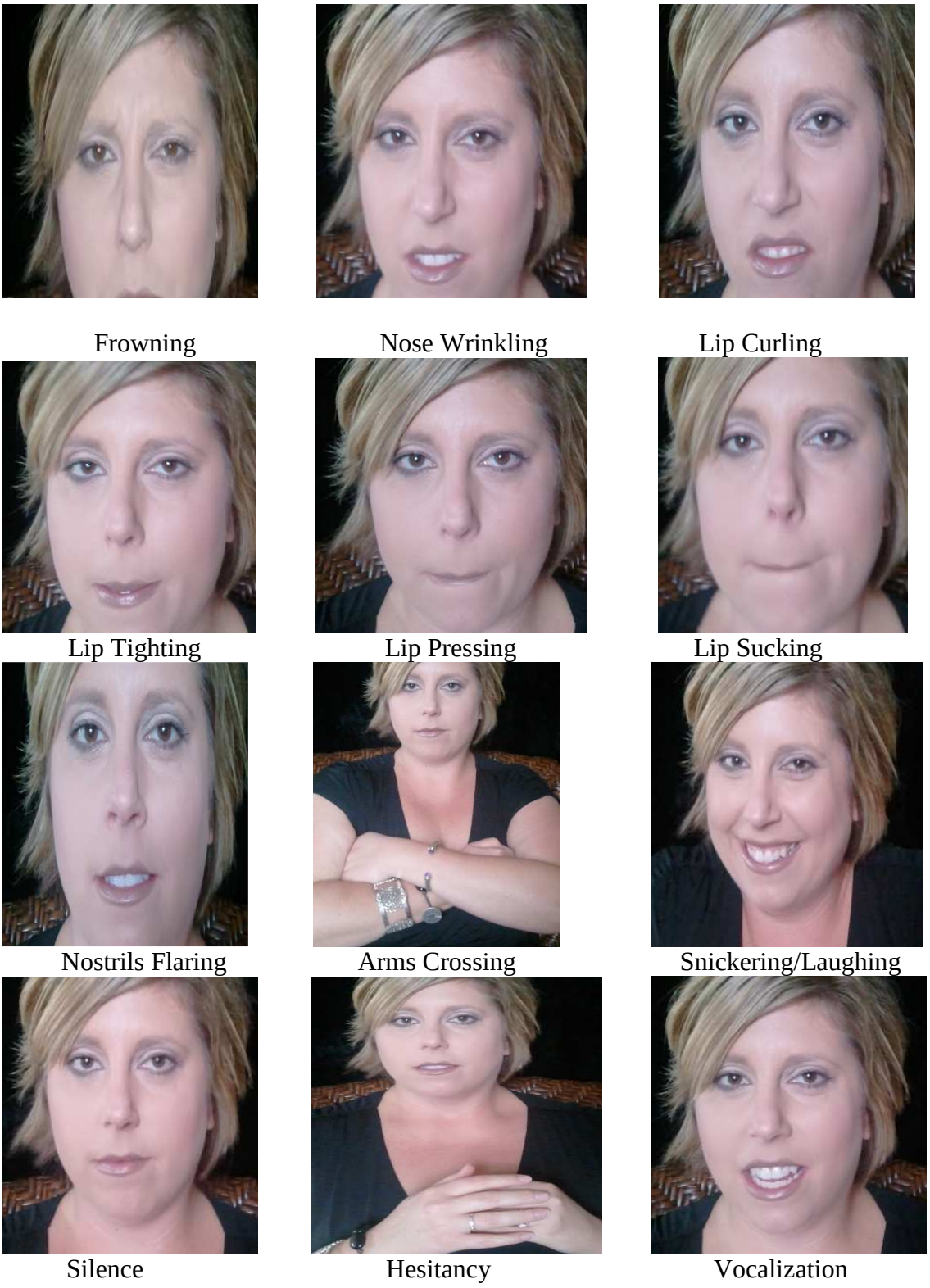

Figure 3 Documented Nonverbal Behavior Reactions to Malodor
(posed images of nonverbal behavior reactions generated in July 2012 by Baker)

to produce a revised twenty item a priori coding scheme. Because the video recordings captured simulation scenarios involving two students, a simulated human patient, and a faculty facilitator, new behaviors were generated within the social context of the scenarios. Pictures illustrating the additional nonverbal behaviors which emerged from the data in Phase 1 are presented in Figure 4.

Next a sample of video recordings was selected. A purposeful selection process reduced the total number of videos to12 video recordings. These 12 video recordings (20 minutes in duration) were spliced to produce 15 video clips (1-2 minutes in duration) encompassing 48 video segments (5-20 seconds in duration). The 15 videos clips were uploaded into NVivo software. In the final process of Phase 1, 48 video segments were reviewed and coded by the PI.

Each video recording was designated as a case and was given a unique identifier, for example, video number one was V1. Within the video recordings, there were participants: the nurse educator (NE) and students who performed either the role of primary nurse or the role of assistant. There were three nurse educators participating in the simulation study. The nurse educators (NE) were assigned an identification number from one to three (1-3) and the number was referenced to the nurse educator's name in the research code notebook. The student participants were identified by their roles. For example, the student participant who changed the patient's dressing (primary nurse) was designated by the number 1 [Student 1(S1)] and the student participant who assisted by positioning the patient (assistant) was designated by the number 2 [Student 2 (S2)]. Each segment of each video clip was numbered with a lower case s and an Arabic number, i.e. V3s2. An example of a complete code would be V1s1S1, video

Peer Eye Contact

Head Back

Smile/Grin

Swallow

Touch Face

Close Eyes

Facilitator Eye Contact

Head Forward

Figure 4 Additional Nonverbal Behavior Reactions to Malodor)
(posed images of discovered nonverbal behavior reactions generated in July 2012 by Baker)

number one, segment one, student participant number one who changed the dressing. A code notebook was developed for all the video recordings during the initial review process.

In this project, NVivo software, a computer program which facilitates analysis of qualitative data, offered several benefits to the research process. The program supported the researcher's

efforts to record, code, search, and condense the data. Perhaps the greatest benefit of NVivo was the provision of an explicit audit trail which demonstrated the rigor of the research process (NVivo Tutorial, 2011). Smyth (2006) stated that use of NVivo software indicated a robust methodology which would enhance the trustworthiness of a study.

Phase 1 of the research project was completed when the PI had applied the coding scheme to analyze the 15 video clips showing nursing students' reactions to malodor.

Phase 2: Validating the Coding Scheme and Establishing Inter-rater Agreement

Phase 2 of the research project involved two observers/raters, members of the dissertation committee, who agreed to review the video segments, apply the coding scheme to create scoring data on specific nonverbal reactions to malodor exhibited by the student participants, and to critique the usability of the coding scheme. They were selected to be observers/raters based of their expertise and their having not participated in the earlier research which generated the video recordings. The PI used observer/rater feedback to revise the coding scheme as indicated.

Inter-rater agreement was an important strategy to control for observer bias. When the researcher is the primary research instrument, bias can threaten the credibility of research findings (Creswell, 2007). The research team agreed that the standard agreement level of 80% would enhance the credibility of the coding scheme (Creswell, 2007).

In the first round of scoring in Phase 2, the two observers/raters coded the video segments using the a priori coding scheme developed by the PI in Phase 1. One observer/rater was an expert in qualitative methodology, and the other was an expert in behavioral observation. The PI designed a brief orientation protocol to introduce the coding scheme, to focus the observers/raters on the review process, to orient them to NVivo software navigation, and to practice coding a sample video segment.

The PI met with the two observers/raters individually to upload the video clips onto their computers and to orient them to the review process. The observers/raters reviewed the video recordings frame-by-frame and scored their observations on the coding screens in NVivo. When the experts completed coding the video segments, the researcher downloaded their scores from their computers and entered their data into NVivo software on the PI's computer for analysis.

After the first round of scoring, the experts reported that having twenty different nonverbal behaviors to monitor was very difficult to do. They stated that the numerically based coding scheme was confusing and difficult to remember and apply to the video segments. Also, they felt that they needed more direction about how to observe the video clips. The observers/raters recommended reducing the number of codes and using words to describe the nonverbal behavior codes instead of numbers.

The committee members and the PI met to develop a plan of action to address the feedback from the observers/raters. A decision was made to limit the coding scheme to the nonverbal behaviors identified in the Facial Action Coding System (FACS); thereby, excluding posture and gross motor behaviors which were part of the original coding scheme. This strategy reduced the number of nonverbal behaviors that raters had to monitor from twenty to thirteen codes. The codes were changed from numbers to words that described each specific nonverbal behavior. The codes were organized in a list moving from the top of the participant's head to the participant's mouth (Appendix H). Additionally, the orientation protocol for the observers/raters was revised to be very prescriptive about how to observe the participants in each video segment (Appendix J). Pictures of each nonverbal behavior code accompanied the coding scheme guideline (Appendix I). Finally, the PI adjusted the start/stop timelines for the video segments to more specifically target participants' nonverbal behaviors. To test the coding

revisions prior to taking the new scheme to the observers/raters, the PI applied the revisions to analysis of the video clips to produce a new set of coding data.

After the revisions were tested, the PI met individually with the two observers/raters to prepare the video clips for coding in NVivo. They were reoriented to NVivo navigation and introduced to the new orientation protocol which included the word-based coding scheme with pictures. When the observers/raters completed scoring the video segments, they emailed transcripts of their codes to the researcher.

The PI uploaded the scoring data from the observers/raters into NVivo software for analysis. The inter-rater scores were not compared to the PI's coding for the purpose of inter-rater agreement because the PI had developed the coding scheme, had seen all the video recordings, and had reviewed the video recordings multiple times. In the literature, researchers postulated that there may be substantial differences between a researcher's coding scores and the scores of raters who had only limited exposure to selected video clips (Marques & McCall, 2005).

In the final round of scoring the data, one of the observers/raters suggested that the nonverbal behaviors from the thirteen item coding scheme be collapsed into a summary coding scheme involving four codes: head/brow, eyes, nose, and mouth reactions. This suggestion was based on the experiences of the observers/raters with difficulty discriminating subtle facial movements. For example, both observers/raters would notice movement involving a student participant's mouth, but they would code it as a different nonverbal reaction. Mouth movements in FACS methodology have demonstrated lower inter-rater agreement values than other facial movements. The researchers stated that there appeared to be variation in raters' interpretation of mouth movements (Sayette et al., 2001).

The PI used coding data from the thirteen items FACS based coding scheme and collapsed the nonverbal behaviors under the four summary categories. Once the raters' data and the researcher's data were loaded into NVivo, data analysis began.

Data Analysis

The strategy of qualitative content analysis was the primary systematic approach to analysis of the video recordings used in the study. Qualitative content analysis involves breaking down the data into smaller units for analysis. The smaller units were identified by the content they represented and were coded, for example, changes in facial expressions in reaction to malodor, i.e. nose wrinkling (Ekman & Friesen, 1978; Polit & Beck, 2008).

The process of open coding was the first level of analysis which involved basically describing the nonverbal behaviors and patterns of reactions to malodor observed in the video recordings. The PI employed constant comparison, an analysis procedure in which the researcher continuously compared newly collected video observation data to data that were collected earlier. The purpose of the constant comparison technique was to refine the coding concepts or to develop categories of concepts (Polit & Beck, 2008). After the PI entered the raters' transcript scores into the NVivo software, inter-rater agreement was calculated for overall performance of the coding scheme and the use of the coding scheme with each video segment.

Inter-rater agreement was calculated by counting the number of agreed upon codes documented by each rater in each video segment and placing the total number of agreement codes in the numerator. The total number of codes documented, both agree and disagree codes, were placed in the denominator. The value obtained by dividing the numerator by the denominator was multiplied by 100 to produce a percentile value. The level of inter-rater agreement was calculated for aggregate data for each coding scheme.

In Phase 3 of the research project, the results of the study were explored to identify themes and patterns of nursing students' reactions to malodor in simulation. The nonverbal behaviors and patterns of reactions which emerged from analyses of the data were refined and developed into a rich description of nursing students' reactions to malodor. The PI was careful to adhere to quality standards of qualitative inquiry.

Credibility

In qualitative research, the concept of credibility corresponds to the quantitative research concept of internal validity. The PI established the credibility of the findings of this study by demonstrating rigor in representing the facts, events, actions, and meanings embedded in the data, i.e. students' nonverbal behaviors (Creswell, 2007; Polit & Beck, 2008). Credibility signifies how closely the findings approximated the concepts found in the raw data. In this research project, the PI maintained an audit trail in a hard copy journal and in the NVivo software program to document how the findings were generated. The coding data from three different raters (the PI and two observers/raters) documented students' nonverbal behaviors observed in the video recordings. These processes supported the credibility of the findings and showed how the findings were embedded in the data.

Trustworthiness

Trustworthiness is an important concept in qualitative research. Trustworthiness is the degree of confidence that the researcher has that the data accurately represents the phenomena of interest which in this study were students' nonverbal behaviors in reaction to malodor (Polit & Beck, 2008). A basic assumption of this research project was that the nonverbal behaviors exhibited by nursing students participating in the malodorous wound care simulations

represented their normal, natural reactions to malodor (Bull, 2002; Ekman, 2011; Hager, 2003; Soussignan & Schall, 1996).

Trustworthiness relies on multiple strategies to validate the findings of the study. For example, the PI engaged in multiple reviews of the video recordings, made memos in her journal and in NVivo, took notes during reviews of the video recordings, and participated in peer debriefing with other scholars on the dissertation committee. Additionally, the PI used the strategy of inter-rater agreement between the observations of two raters (Creswell, 2007). These strategies supported the rigor of the process to establish the trustworthiness of the findings.

Audit Trail

The audit trail was designed to contribute to the credibility of the research by illuminating the research process and demonstrating the rigor of the process (Creswell, 2007). The PI kept two journals: a process journal or research log book that documented events and activities involved in the research project and a reflective journal to track the researcher's thoughts about the work as the study evolved. One advantage of using NVivo software was the trail of evidence showing the explicit process employed to develop the coding scheme and coding patterns from the data. The coding notebook which documented information about all 25 video recordings highlighted how the purposeful sample was selected. Each video clip with its memos and coding notations explicitly documented the coding and slicing processes. The use of multiple data sources (notes, memos, video clips, inter-rater coding sheets) enhanced the credibility of the study and documented the origin of each finding (Creswell, 2007).

The digital video disc (DVD) that contained all the video recordings, copies of the questionnaires from the earlier research project, the coding notebook, and the researcher's journals were kept in a locked drawer in the home office of the PI to ensure security and

confidentiality of the data. The video recordings were uploaded from the DVD into NVivo where the information was password protected and where there were security strategies to protect the data from unauthorized access (NVivo Tutorial, 2011). The participants in the video recordings were referenced by their code names, for example V2NE1 (video number 2 and nurse educator number 1) or V3S2 (video number 3 and student who was the assistant in the scenario), to ensure the anonymity and confidentiality of the participants. The NVivo software folders containing the video clips and analyses will be maintained for at least five years on the researcher's computer. The hard copy data will be maintained for a period of five years in a locked drawer in the home office of the PI (Creswell, 2007).

Reflexivity

Another quality enhancement strategy used by the researcher was reflexivity. Reflexivity is a critical process of self-reflection which allows the researcher to recognize biases and preconceptions about the phenomena of interest (Polit & Beck, 2008). The researcher engaged in reflexivity throughout the coding and analysis processes to ensure the accuracy of the coding scheme and to ensure that the findings represented the true nonverbal behaviors of nursing students in reaction to malodor. The researcher kept a journal of her thoughts and reactions to the research process and to the nonverbal behaviors of the nursing students in the video recordings. Using the strategy of inter-rater agreement on the coding of the video segments, the PI controlled for observer bias which might have remained unconscious to her.

The researcher isolated her personal biases and continued to monitor her thinking for evidence of bias throughout the analysis phase. One concern was the researcher's negative bias for certain student behaviors in the video recordings, for example snickering when the malodor was encountered. The researcher has many years of direct care experience with patients and

adheres to the nursing profession's core values of caring and integrity. She expects students to exhibit caring behaviors indicating respect for the integrity of patients' suffering with malodorous chronic wounds. The researcher felt bias against students exhibiting non-caring behaviors in the simulation scenarios. The researcher acknowledged her negative biases but focused on remaining objective during observation of the video clips.

Additionally, as a nurse educator, the researcher valued the role of the educator as a guardian of the profession when evaluating the performances of nursing students. When students behaved in non-caring ways, the researcher felt bias against those students' becoming members of the nursing profession. The researcher continued to acknowledge these biases to reduce value judgments and to focus on the observable nonverbal behaviors of nursing students in reaction to malodor. The researcher's goal was to view the students' reactions as neutral events.

Peer Debriefing

The next strategy employed by the researcher to enhance the quality of the study was peer debriefing. Peer debriefing is the practice of meeting with colleagues and scholars to review, explore, and monitor aspects of the research process. This strategy enhances the trustworthiness of the findings by controlling for researcher bias or procedural deficits in the research design (Polit & Beck, 2008). The dissertation chairpersons and the dissertation committee members asked questions and collaborated with the researcher during the research process to ensure rigor and the integrity of the research project. The important function of peer debriefing was demonstrated in how the research team addressed the results of observer/rater feedback on the usability of the coding schemes. The researcher and the research team set the standard of 80% inter-rater agreement using the coding scheme to enhance the dependability of the research findings.

Dependability

The qualitative criterion of dependability is the equivalent to the quantitative research concept of reliability (Polit & Beck, 2008). Dependability means that the research process has been well documented and that the logic of the conclusions producing the findings could be traced via the audit trail. The audit trail demonstrated how the findings were grounded in and emerged from the data.

Confirmability

Another quality criterion for qualitative research is confirmability. Confirmability approximates the quantitative research standard of objectivity (Polit & Beck, 2008). Confirmability of research findings is demonstrated by the neutrality of the data which can substantiate and locate the researcher's interpretations within the raw data (Creswell, 2007). The audit trail with field notes documented the research activities and thinking processes of the PI to provide evidence to support the confirmability of the findings. The strategy of inter-rater agreement confirmed the validity of the coding scheme which the raters observed embedded in the data.

Triangulation

Triangulation helped to support the confirmability of the research findings. Triangulation is the use of multiple sources of information about the phenomena being studied, i.e. the nonverbal behaviors of nursing students in reaction to malodor (Polit & Beck, 2008). The researcher used 15 video clips which included 42 video segments depicting nursing students engaged in malodorous wound care simulations. Each of the video recordings was analyzed frame-by-frame representing thousands of frames of data for analysis. Coding of nonverbal behaviors observed

in each frame and creating nodes in NVivo were done to document each student's reactions. Additionally, the PI used note taking, memoing, and cross-referencing of data from the video recordings to describe nonverbal behaviors in reaction to malodor.

Transferability

The quality criterion of transferability is analogous to the quantitative research concept of generalizability. The transferability of the study findings refers to how well the findings transfer to other settings or other groups (Polit & Beck, 2008). For example, the baccalaureate nursing students from a southeastern university nursing program participated in the research project which produced the video recordings (Roberson et al., 2008). The participants exhibited certain nonverbal behaviors in reaction to malodor in wound care simulation. Whether student nurses from other programs would exhibit similar nonverbal behaviors remains uncertain. The extent to which another group would mirror the nonverbal behaviors of the student participants in this study would indicate the degree of transferability of the research findings. Future research is needed to determine if the identified nonverbal behaviors would be transferable. However, the fact that reactions to malodor have been well documented in the literature as universal human biological responses (Ekman & Friesen, 1978) should provide strong support for the potential transferability of the findings from the study.

Researcher's Background and Expertise

The PI has more than thirty-five years of experience as a registered nurse and several years experience as a nurse educator. Through the process of reflexivity, the personal biases which might have contributed to observer biases of the researcher have been explicitly stated in an earlier section of this paper.

During her master's education, the PI was a graduate teaching assistant in the concepts integration laboratory in an undergraduate baccalaureate nursing program of the university. In this role, the researcher assisted in creating realistic clinical environments within the simulation laboratory. The researcher performed the role of nurse educator facilitator within simulation scenarios and participated in assessments of nursing students' performances within the simulations. In her current education practice, the PI continues to be actively engaged in instruction in the simulation laboratory. These career experiences add credibility to the PI as a qualified investigator of educational practices in high fidelity simulation laboratories.

The PI has listed some explicit assumptions which were foundational to the conduct of the study:

- An individual's nonverbal behaviors communicate cognitive, affective, and social information about the individual's emotional state (Bull, 2008).
- Observation is a research technique which produces knowledge about the phenomena being observed (Daston & Lunbeck, 2011).
- Observation of nonverbal behaviors allows the observer to make inferences about the cognitive, affective, and social experiences of the observed individuals (Daston & Lunbeck, 2011).
- Reaction to malodor involves a unique set of nonverbal behaviors, for example facial movements and postures (Bull, 2008; Soussignan & Schall, 1996).
- Nursing students must develop professionalism and internalize the core values of the nursing profession during their nursing education (Kitayama & Tompson, 2010; NLN, 2011).

- Nurse educators are responsible for socializing nursing students to the core values, professional norms, and cultural display rules of the nursing profession (Kitayama & Tompson, 2010; NLN, 2011).
- High-fidelity malodorous wound care simulation is an appropriate and effective teaching/learning strategy to foster nursing students' socialization to the nursing profession and to foster students' development of professionalism (Jeffries, 2005; Roberson et al., 2008).
- Nursing students have a duty to their patients to exhibit professionalism in clinical practice (NLN, 2011; Reutter et al., 1997).
- Nurse educators need to know how nursing students reacted to malodor during wound care simulation video recordings in order to identify which students exhibited nonverbal behaviors which did not meet professional standards (Reutter et al., 1997; Roberson et al., 2008).

These assumptions guided the researcher's investigation into how nursing students reacted to malodor in wound care simulations.

Summary

In this chapter, the research questions, the research methodology, the study design, the study procedures, and quality criteria related to conducting qualitative inquiry were discussed. Qualitative descriptive approach was determined to be the appropriate research strategy for this observational study. The aim of the study was to generate descriptions of nursing students' reactions to malodor in simulation. The PI outlined a research plan which addressed the quality criteria that supported the integrity of the research findings. The researcher explicitly stated her qualifications and her personal biases which she acknowledged to ensure the integrity of the

findings. Additionally, the assumptions upon which the research was based were explicitly stated.

Chapter 4

Introduction

Using qualitative methodology, the researcher sought to identify specific nonverbal behaviors in reaction to malodor when nursing students were presented with wound care simulations. Prior video recordings of student nurses caring for mock wounds (Roberson et al., 2008) were used in the current study in order to identify these nonverbal behaviors. The study was conducted in three phases. Each phase serves as a subheading to present the results of the study.

Phase 1 Results

Developing a Coding Scheme and Identifying Sample Video Recordings

The processes for developing the a priori coding scheme and selecting the sample video recordings were presented in detail in the methods section of the paper. In summary, Phase 1 of the research project produced the coding scheme which included a list of twenty literature derived and additional nonverbal behaviors identified as nursing students' reactions to malodor in simulation. Phase 1 provided the final sample of video recordings for review and coding by observers/raters in Phase 2 of the project.

Phase 2 Results

Validating the Coding Scheme and Establishing Inter-rater Agreement

Phase 2 of the project focused on validating the coding scheme and establishing inter-rater agreement. The research team set the goal of 80% for inter-rater agreement (Creswell, 2007; Marques & McCall, 2005). The observers/raters agreed to review the video segments, to apply the coding scheme to score observed behaviors, and to critique the usability of the coding

scheme. During the research process, three different coding schemes were developed based on feedback from the raters: a four item summary coding scheme (Appendix L), a thirteen item scheme based on the Facial Action Coding System, and a twenty item coding scheme.

The level of analysis for the participants' nonverbal reactions to malodor was occurrence/nonoccurrence. Each observer/rater reviewed the video segments and documented or scored the occurrence of nonverbal behavior reactions based on the coding scheme. When the observers/raters did not document (score) an occurrence, a nonoccurrence for that particular nonverbal behavior was recorded. The level of measurement was the nominal level for categorical variables where 1 = occurrence and 0 = nonoccurrence. Disagreement data were recorded when one rater documented an occurrence and the other rater did not document an occurrence for a specific behavior exhibited by a particular participant (Student 1 or Student 2). After the first round of scoring by the raters, the PI recorded the coding scores for each rater in the Statistical Package for the Social Sciences (SPSS, version 19) statistical software program. At this time, Video 2, Video 3, and Video 11 were deleted from analysis because of discrepancies in their timelines and missing scoring data. The total number of video recordings scored by the two raters for analysis purposes included twelve video clips containing 42 video segments. Each of the video segments was scored four times. Two observers/raters scored each behavior code in the coding scheme for each of the two student participants in the video segments. After isolating the number of agreement codes versus the number of disagreement codes, the PI calculated inter-rater agreement percentiles for each of the coding schemes.

There were a total of 166 observations scored by the two observers/raters in each data set. Inter-rater agreement percentile for the four item summary coding scheme was 63% agreement, which did not meet the goal of 80% set by the research team. The statistical explanation for the

low agreement percentile was the fact that each score counted 25% of the possible scores. Therefore, each disagreement score pulled down the agreement percentage. The findings from the four item coding scheme are presented in Table 1. Nonverbal reactions to malodor involving the participants' mouths occurred in 52.4% of the video segments (87 occurrences). The second most frequent set of reactions to malodor were eye movement reactions which occurred in 48.2% of the video segments (80 occurrences).

Table 1 Observations of Four Item Coding Scheme (n166)

Observed Behavior	Frequency of Occurrence	Percent of Total Observations
Head/Bow Reactions	35	21.1
Eye Reactions	80	48.2
Nose Reactions	35	21.2
Mouth Reactions	87	52.4

Note: Frequency of Occurrence = number of scores from 2 raters for 42 video segments
Percent of Total Observations = occurrence #/ n166

Inter-rater agreement for the thirteen item FACS based coding scheme was 82% which satisfied the inter-rater goal of 80%. The high level of inter-rater agreement indicates that the observers/raters were consistently applying the coding scheme to their observations (Creswell, 2007). The scoring results of the thirteen item FACS based coding scheme are presented in Table 2. Peer eye contact which occurred in 33.1 % of the video recordings (55 occurrences), and lip pressing reactions (42 occurrences; 25.3%) were the most frequently scored reactions. These findings of the two observers/raters validated the coding scheme as embedded in the data and as emerging from the data.

Table 2 Observations of Thirteen Item Facial Action Coding System Scheme (n166)

Observed Behavior	Frequency of Occurrence	Percent of Total Observations
Peer Eye Contact	55	33.1
Lip Pressing	42	25.3
Lip Tightening	34	20.5
Nostrils Flaring	32	19.3
Smiling/Grinning	32	19.3
Head Back/Chin Tilt	29	17.5
Facilitator Eye Contact	23	13.9
Swallow	15	9.0
Lip Sucking	11	6.6
Frowning	6	3.0
Nose Wrinkling	3	1.8
Closing Eyes	2	1.2
Lip Curling	0	0.0

Note: Frequency of Occurrence = number of scores from 2 raters for 42 video segments
Percent of Total Observations = occurrence #/ n166

The twenty item coding scheme, though difficult to apply to the videos as reported by the observers/raters, produced an inter-rater agreement score of 82%. Inter-rater agreement values for the thirteen item FACS based coding scheme and the twenty item coding scheme varied by a

decimal fraction but both equaled 82%. The head forward toward the wound behavior occurred 41 times in 24.7% of the video segments. Head forward toward the source of malodor emerged from the data as a nonverbal behavior by nursing students that was not documented in the literature. Head back or chin tilt away from the odor source (21 occurrences: 12.7%) was a nonverbal reaction to malodor documented in the literature and also exhibited by nursing students in the videos (Ekman & Friesen, 1978; Sayette et al., 2001; Soussignan & Schall, 1996). Occasionally, students would seem to instinctively head back/chin tilt (21 occurrences: 12.7%) away from the malodor but then seem to compensate by exhibiting head forward toward the wound to assess the wound. Nursing literature has documented the willingness of nurses "to do what has to be done" in order to care for the patient with a malodorous wound. This "striving to endure" was interpreted to be an element of caring behavior in nursing (Lindahl et al., 2008). In the video recordings, student participants exhibited socialization to the caring culture of the nursing profession by moving their heads forward toward the malodor source in order to inspect the wounds, despite the unpleasant experience of malodor.

Smiling or grinning at a peer participant occurred 37 times in 22.3% of the video segments. This finding is consistent with results reported in the literature. Researchers explored the impact of social presence on children's reactions to malodor to note that smiling/grinning occurred in reaction to malodor when an adult was in the room with the child during the exposure but not when the child was alone in the room (Soussignan & Schall, 1996). The phenomenon of smiling during negative emotional states (disgust in reaction to malodor) is theoretically interpreted as masking smiles which are exhibited when an individual is attempting emotional concealment. The researchers documented that children smiled longer in reaction to malodor than to pleasant odors (Ekman & Friesen, 1978; Ekman, 2011; Soussignan & Schall, 1996). In the current study,

student nurse participants may have been attempting to conceal their negative emotional reactions of disgust to malodor within the social context of providing wound care in simulation scenarios. The smiling/grinning occurred when they unexpectedly encountered the malodor during dressing changes. The social context of interaction with another student and the simulated human patient may have enhanced the smiling/grinning behaviors (Soussignan & Schall, 1996). Scoring data for the twenty item coding scheme are presented in Table 3.

In summary, Phase 2 of the study established inter-rater agreement for the twenty item coding scheme and the thirteen item FACS based coding scheme at 82%. The four item summary coding scheme exhibited inter-rater agreement at 63%. The scoring of the two independent observers/raters validated all twenty nonverbal behavior reactions to malodor as being embedded in the raw data and as emerging from the data.

Table 3 Observations of Twenty Item Coding Scheme (n166)

Observed Behavior	Frequency of Occurrence	Percent of Total Observations
Head toward Wound	41	24.7
Smiling/Grinning	37	22.3
Silence	32	19.3
Lip Pressing	30	18.1
Peer Eye Contact	29	17.5
Nostrils Flaring	23	13.9
Vocalization	22	13.3
Head Back/Chin Tilt	21	12.7
Laughing/Snickering	18	10.8
Nose Wrinkling	13	7.8
Hesitancy	9	5.4
Lip Curling	7	4.2
Facilitator Eye Contact	6	3.6
Swallowing	6	3.6
Touching Face	4	2.4
Closing Eyes	4	2.4
Lip Tightening	3	1.8
Arms Crossed	3	1.8
Lip sucking	3	1.8
Frowning	2	1.2

Note: Frequency of Occurrence = number of scores from 2 raters for 42 video segments
Percent of Total Observations = occurrence #/ n166

Phase 3 Results

Identifying Themes and Patterns of Reactions to Malodor in Simulation

In the literature, themes in qualitative data analysis are defined as issues within each case that appear to share commonality and that seem to cluster around a set of ideas (Creswell, 2007). Three themes of student participants' nonverbal behaviors seemed to emerge from the data during analysis: Noticing, Confirming, and Focusing. In this report each of the themes serves as a subheading.

Noticing

The first theme of nonverbal behavior reactions was "Noticing". These nonverbal reactions to malodor were associated with spontaneous frowning when the malodor was first detected. In video ten, segment one, student one (V10s1S1) was observed flaring her nostrils, wrinkling her nose, and a quickly curling of her upper lip. In other video recordings, student participants moved their heads back and tilted their chins up moving away from the odor source or touched their noses as if to block the malodor. Except for touching the face, all of these nonverbal behaviors have been documented in the literature as expressions of the negative emotion of disgust following exposure to a noxious stimulus (Ekman & Friesen, 1978; Sayette et al., 2001; Soussignan & Schall, 1996; Vrana, 1993). Perhaps the absence of face touching in the literature is a function of this movement not being part of FACS methodology which has been used most frequently to study universal facial expressions (Ekman & Friesen, 1978; Sayette et al., 2001; Soussignan & Schall, 1996). Occasionally, other participants would stop talking (silence) and hesitate to continue removing the dressing when they detected the malodor (Roberson, Neil, & Bryant, 2008).

Confirming

The second theme observed was a set of behaviors suggesting that student participants were attempting to communicate with each other about the malodor. These behaviors seemed to be efforts to confirm the presence of malodor. In video six, segment two, both student participants one and two (V6s2S1S2) made peer eye contact, smiled then laughed when they detected the malodor. In video four, segment 3, student 1 (V4s3S1) made a vocalization (Huh!) in response to the malodor. Other participants were observed blinking or closing their eyes during peer eye contact or crossing their arms briefly before proceeding to change the dressings.

Additionally, in video fifteen, segment one, student participant two (V15s1S2) turned her head to make eye contact with the nurse educator facilitating the scenario when she encountered malodor. She seemed to be questioning the presence of this novel stimulus.

Smiling/grinning reactions to malodor observed in the video recordings were documented in the literature. Researchers using electromyography reported that both disgust and joy reactions produced high level activity in the upper lip (levator labii). The researchers proposed that this facial muscle may be sensitive to the emotional processes found in disgust and joy or that there may have been an issue with electrode placement (Soussignan & Schall, 1996). The findings of the current study support the association between disgust reactions and smiling behaviors within a social context because student participants exhibited smiling/grinning when exposed to malodor in simulation.

Focusing

The third theme identified during analysis of nonverbal behavior reactions was Focusing. In video one, segment six, students one and two (V1s6S1S2) exhibited lip tightening, lip pressing, and lip sucking behaviors during sustained contact with malodor. The observers/raters in the current study stated that they struggled to discriminate among these subtle facial changes. The raters' observations supported findings by Sayette et al. (2001) who reported that lip tightening and lip pressing behaviors exhibited lower inter-rater agreement scores in FACS methodology. Those researchers suggested that the lower scores were related to differences in rater interpretation of these facial movements. Student participants appeared to be using the mouth movements as coping mechanisms during sustained exposure to malodor during dressing changes.

In addition to these mouth movements, a few of the student participants were observed swallowing as if to control their gag impulses, a challenge for nurses documented in the literature (Siegel, 2008). Participants would move their heads forward toward the malodor to inspect and clean the wound during the dressing changes. Lindahl et al. (2008) reported, in their qualitative study of nurses caring for patients with malodorous wounds, the subtheme of "striving to endure". This theme described nurses' willingness not to abandon the patient with a malodorous wound but to find the courage to stay physically close to the malodor and contamination of the wound. Student participants exhibited this willingness to endure and provide wound care to the patient in simulation. These professional behaviors exhibited by students suggested that in the context of high fidelity simulation the students had internalized the core nursing value of caring (& Tompson, 2010).

Creswell (2007) has defined patterns of qualitative findings as a correspondence between two or more categories or variables which serves to reduce the total number of categories or variables. In the current study, the nonverbal reactions to malodor by student participants in simulation appeared to diverge into two patterns: Physical Reaction Patterns and Psychosocial Reaction Patterns.

Certain nonverbal behaviors exhibited by the participants appeared to be involuntary physical reactions to the malodor. The most frequently exhibited physical reactions were participants' pressing their lips together (30 occurrences: 18.1%) and flaring their nostrils (23 occurrences: 13.9%). These reactions seemed to be automatic, reflexive, and unconscious as the participants detected the malodor. The participants were observed tightening their top lips (3 occurrences: 1.8%), apparently to control their nostrils flaring. This reaction may have limited malodor molecules from entering their noses (Yeshurun & Sobel, 2010). Sometimes, participants would wrinkle the bridge of their noses (13 occurrences: 7.8%), tilt their heads back away from the malodor source (21 occurrences: 12.7 %), suck their lips tight between their teeth (3 occurrences: 1.8%)), and swallow (6 occurrences: 3.6%) in reaction to malodor. These reactions are FACS based behaviors and have been documented in the literature as disgust reactions when a participant was exposed to malodor (Ekman & Friesen, 1978; Sayette et al., 2001; Soussignan & Schall, 1996). Other nonverbal reactions by participants appeared to be motivated by psychosocial factors.

The psychosocial nonverbal behaviors seemed to be forms of nonverbal communication as participants detected and adapted to the malodor of the simulated wounds. The most frequently observed psychosocial reactions to malodor were peer eye contact between the participants (29 occurrences: 17.5%) when they encountered the unexpected malodor during the dressing changes

and smiling or grinning at each other (37 occurrences: 22.3%). Several of the participants turned their heads to make eye contact with the nurse educator facilitating the scenarios (6 occurrences: 3.6%) when they noticed the malodor. The students had previously experienced repeated engagements with dressing changes in the simulation laboratory, but malodor was a novel stimulus in the video recorded scenarios. Rarely, the participants would close or blink their eyes (4 occurrences: 2.4%) during eye contact with the other participant or the facilitator. Members of the research team hypothesize that closing the eyes, crossing the arms, silence, hesitancy, and head forward behaviors have the potential to be physical reactions during exposure to malodor when the participant is alone. However, future research will be needed to test this theory. In the current study, these behaviors were observed in the context of social interaction with another student, a simulated human patient, and/or a nurse educator facilitator. These physical and psychosocial nonverbal behaviors formed patterns of nursing students' reactions to malodor in simulation (Table 4).

Table 4 Patterns of Nonverbal Reactions to Malodor in Simulation

Physical Reactions to Malodor	Psychosocial Reactions to Malodor
Frowning (E)	Peer Eye Contact (B)
Nostrils Flaring (E)	Facilitator Eye Contact (B)
Nose Wrinkling (E)	Smiling/Grinning (R)
Lip Curling (E)	Laughing/Snickering (R)
Lip Tightening (E)	Silence* (R)
Lip Pressing (E)	Hesitancy* (R)
Lip Sucking (E)	Vocalization (B)
Swallowing (E)	Closing Eyes* (B)
Touching Face (B)	Arms Crossing* (R)
Head Back (E)	Head Toward Wound* (B)

* These behaviors could potentially be exhibited as physical reactions when the participant is alone during odor exposure. However, they were observed within a social context in the video recordings.
Sources: (E) = Ekman, (B) = Baker, (R) = Roberson. Table generated by Baker September 2012

Summary

During Phase 3 of the research project, content analysis of participants' nonverbal reactions to malodor revealed three themes of reactions: Noticing, Confirming, and Focusing. Additionally, two patterns of behaviors emerged during analysis: physical reaction patterns and psychosocial reaction patterns. Two of the coding schemes exhibited 82% inter-rater agreement.

Chapter 5

Introduction

In this chapter, a discussion of the research findings is presented. The research project described how nursing students reacted nonverbally to malodor in wound care simulation scenarios. A twenty item coding scheme identifying and defining nonverbal behaviors in reaction to malodor exposure was developed. Based on this coding scheme, two observers/raters scored specific nonverbal behaviors which they identified as participants' reactions to the unexpected stimulus of malodor in simulation. The two independent raters validated the coding scheme as embedded in the raw data and established inter-rater agreement at 82%.

Three themes of nonverbal reactions were observed in the video recordings: Noticing, Confirming, and Focusing. Additionally, two patterns of behaviors were identified: physical reaction patterns and psychosocial reaction patterns. Using the strategy of peer debriefing, the two members of the research team who served as observers/raters reviewed the themes and patterns isolated by the PI and agreed that these findings were consistent with the participants' reactions observed in the video recordings.

A discussion of the findings from the research is organized under the following subheadings: Contributions of the Research, Theoretical Implications, Implications for Practice, Implications for Future Research, Limitations of the Research, and Conclusions.

Contributions of the Research

Nonverbal behaviors exhibited by nursing student participants in reaction to malodor in simulation validated the Facial Action Coding System (FACS) as descriptive of the negative emotional state of disgust in response to malodor (Ekman & Friesen, 1978; Sayette et al., 2001; Soussignan & Schall, 1996; Vrana, 1993). The current study supported the findings in earlier

research exploring how children reacted to malodor. In the study by Soussigan & Schall (1996), children's disgust reactions demonstrated a close association between smiling behaviors and exposure to a noxious stimulus when exposure occurred within a social context. Smiling/grinning reactions exhibited by varying age groups, the children and student nurse participants, support the universality of human facial reactions to malodor (Ekman & Friesen, 1978; Soussignan & Schall, 1996; Vrana, 1993; Yeshurun & Sobel, 2010)

Additionally, the nonverbal behaviors reported anecdotally by Roberson et al. (2008) were documented by the two independent observers/raters in the current study as embedded in the raw data. These behaviors were smiling, laughing, hesitancy, silence, and crossing of the arms.

The findings of the current study provide behavioral descriptions of phenomenological themes and subthemes developed in the literature from interviews with nurses who provided wound care to patients with malodorous wounds (Lindahl et al., 2008). The student participants exhibited adaptive behaviors (moving the head toward the malodor source to assess and clean the wound, lip tightening, lip pressing, lip sucking, and swallowing) as they "strove to endure" in order to provide wound care to the simulated patient. The students remained close to the malodorous wound and cleaned the "contaminated drainage" from the simulated wound. The focused behaviors of the student participants were examples of caring behaviors which are essential to the nursing profession (Lindahl et al., 2008).

The findings from the current study support the results reported in nursing literature regarding the normative responses of patterned facial cues which signal changes in the emotional states of participants in research (Morse et al., 2003). Those researchers were studying facial cues to the emotional state of suffering when they isolated patterned facial cues which appeared to be normative responses to the experience of suffering. In the current study, student participants

exhibited patterned facial cues (i.e. frowning, nose wrinkling, lip curling, nostrils flaring) in reaction to malodor exposure. Based on findings in the literature, the participants' reactions were normative human reactions of disgust following exposure to malodor.

Nursing literature included strategies to enhance the quality of data collected using video recordings for observational research. The authors reported that extracting video segments which occurred after several minutes of video recording reduced the problem of participant reactivity to the presence of the camera. The video segments used in the current study were extracted from the portions of the video recordings which occurred after the students had introduced themselves, positioned the patients, and begun the dressing changing procedures. This time delay allowed the participants to become desensitized to the video recording process and to focus on their tasks (Haidet et al., 2009). This strategy mediated participant reactivity to the camera.

Another recommendation for improving video data collection was the suggestion to use short, dense video segments when the observers/raters were scoring human interaction and communication behaviors (Haidet et al., 2009). In the current research, video segments ranged from 5-20 seconds in duration which allowed the observers/raters to focus on participants' subtle changes in facial structures and code them using the coding scheme. The authors stated that observers/raters needed definitive operational definitions for each code to consistently apply the coding scheme (Haidet et al., 2009). The PI developed a rubric identifying each nonverbal behavior reaction in the coding scheme, stating explicitly a description of the behavior, a definition of the behavior, and inclusion/exclusion criteria. During orientation of the observers/raters, pictures of each nonverbal reaction were provided and the observers/raters mimicked each of the behavior reactions to "get a feel for the behavior" prior to the coding

process. Inter-rater agreement values of 82% indicate that the observers/raters consistently applied the coding scheme to code the participants' reactions.

Theoretical Implications

The Neurocultural Interaction Model (Kitayama and Tompson, 2010) explained the process of change in brain connectivity as student nurse participants learned nursing wound care skills. In order to learn the practical knowledge of the profession [Level 2 of Kitayama and Tompson Model (2010)], the participants in the research had attended a lecture and read textbook assignments about wound care. To become familiar with the scripted behavioral routines called practices in nursing, participants had exposure to clinical laboratory practice and evaluation working in groups in the clinical laboratory (Huff, 2011; Roberson et al., 2008). Level 2 of the model focused students' attention on the values and skills which they were to internalize. Prior to the research project which generated the video recordings, the students experienced repeated engagement in dressing changes for wound care. These repeated engagements included cultural expectations related to professional dress, communication, and scripted behaviors (Kitayama & Tompson, 2010; NLN, 2011).

The findings of the research project added support of the Neurocultural Interaction Model as a theoretical framework for cultural adaptation in nursing education. Kitayama and Tompson (2010) stated that brain connectivity is a function of active and willful engagement in scripted behavioral routines. Therefore, through educational practices, nursing students internalized the values, skills, and knowledge of the culture of nursing.

This study documented students' exhibiting behaviors which represented caring for a patient, despite their spontaneous disgust reactions to malodor. Students demonstrated "willingness to endure" exposure to the noxious stimulus of malodor in order to provide wound care to the

simulated human patient (Lindahl et al., 2008). The students exhibited socialization to the nursing profession by internalizing the core value of caring during their simulation performances (Kitayama & Tompson, 2010).

Implications for Practice

The findings of the study support the use of high fidelity simulation instruction which challenges students with the realism of malodor in wound care (Jeffries & Rizzolo, 2006; Roberson et al., 2008). When faced with the noxious stimulus of malodor within the context of high fidelity simulation, the student participants exhibited caring behaviors identified in the literature as how nurses in practice care for patients with malodorous wounds (Kitayama & Tompson, 2010; Lindahl et al., 2008). The participants overcame their natural, spontaneous disgust reactions in order to provide care to their patients (Ekman & Friesen, 1978; Lindahl et al., 2008; Sayette et al., 2001; Soussignan & Schall, 1996). The participants "acted like nurses" when they encountered realistic simulations in wound care.

Another implication for nursing education practice is the potential use of the description of how nursing students reacted to malodor in simulation to help educators design information or evaluation rubrics for use in teaching wound care (Madsen & Reid-Searl, 2007). Perhaps when nursing students are developing teaching projects for patient caregivers, information about how a caregiver reacts to malodor may be useful in preparing family members for the challenge of malodor during dressing changes (Madsen & Reid-Searl, 2007). Segments of the video recordings could be used as teaching resources for nurse educators to allow students to watch and critique the nonverbal reactions of the student participants in the videos.

Limitations of the Research

One limitation of the study was poor camera placement which prevented the capture of full frontal facial expressions of the participants. The observers/raters reported that they were unable to achieve good visualization of some of the participants' facial expressions. A second limitation was inadequate observation protocol for the coding process. The observers/raters stated that they needed a more standardized orientation about how to observe and score the videos using NVivo software. During the study, some revisions, based on rater feedback, were made to the rater orientation protocol during refinement of the three coding schemes. However, these challenges and revisions may have affected the raters' scoring, thereby influencing the findings of the study.

A limitation of the study was the voluntary nature of student participation. There were low risks for participants and little direct benefit for the participants. The PI and the two raters noticed how playful the participants appeared during the simulation scenarios. Based on experience with students in simulations which were being graded, this playful attitude was atypical. Most often students working in simulation scenarios during evaluation are quite anxious and stressed as they attempt to perform appropriately. The absence of risks and benefits may have affected how the students reacted to malodor in the simulations and skewed the results of the study.

Additionally, the findings from a sample of baccalaureate nursing students from a southeastern university may not transfer to students from other types of nursing programs in other locations (Polit & Beck, 2008). However, the literature suggested that the disgust reaction to malodor appears to be a universal facial reaction found in humans, from neonates through adulthood, thereby, lending credibility to the findings of this study (Ekman & Friesen, 1978; Soussignan & Schall, 1996).

Implications for Future Research

In future research, a replication of the study to improve the quality of the video recordings may be helpful. Improvement in visualization may enhance the scoring process and provide new information about students' nonverbal reactions to malodor. Using a different approach, a study design which places the malodorous wound on the patient's leg would add the variable of eye contact with the patient during the wound care scenario. Researchers could explore how eye contact with the patient impacts student participants' nonverbal reactions to malodor.

Further research on each of the twenty nonverbal behavior reactions in relation to nursing professionalism may improve assessment and evaluation of students' skill performances in the clinical laboratory. In addition, research will be needed to determine how the twenty nonverbal behavior reactions relate to students' performances during malodorous wound care in the clinical practice setting.

There were several nonverbal reactions to malodor which were observed within the social context of simulation and which were identified as psychosocial behavior reactions. However, the behaviors of silence, hesitancy, closing the eyes, crossing the arms, and moving the head toward the wound may be physical behavior reactions when a participant is exposed to malodor in isolation. Future research is needed to determine the effect of social presence on these specific behavior reactions.

Conclusion

This observational, qualitative descriptive study using video recordings of nursing students engaged in high fidelity wound care simulations generated a rich description of how nursing students reacted to the olfactory realism of malodor. The findings of the study supported the Neurocultural Interaction Model as a framework for explaining the socialization process in

nursing education. The findings have the potential to inform nursing education practice and to suggest areas for future research.

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Appendix A

EAST CAROLINA UNIVERSITY
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Notification of Initial Approval: Expedited

From:	Biomedical IRB
To:	Gloria Baker
CC:	Janice Neil
Date:	1/11/2012
Re:	UMCIRB 11-001118 How Nursing Students React to Malodorous Wound Care Simulation

I am pleased to inform you that your Expedited Application was approved. Approval of the study and any consent form(s) is for the period of 1/10/2012 to 1/9/2013. The research study is eligible for review under expedited category #6. The Chairperson (or designee) deemed this study no more than minimal risk.

Changes to this approved research may not be initiated without UMCIRB review except when necessary to eliminate an apparent immediate hazard to the participant. All unanticipated problems involving risks to participants and others must be promptly reported to the UMCIRB. The investigator must submit a continuing review/closure application to the UMCIRB prior to the date of study expiration. The Investigator must adhere to all reporting requirements for this study.
The approval includes the following items:

Name	Description
A Priori Coding Scheme | History	Data Collection Sheet
Approval to Use Dataset | History	Dataset Use Approval/Permission
Baker Proposal: How Nursing React to Malodorous Wound Care Simulation | History	Study Protocol or Grant Application

The Chairperson (or designee) does not have a potential for conflict of interest on this study.

IRB00000705 East Carolina U IRB #1 (Biomedical) IORG0000418
IRB00003781 East Carolina U IRB #2 (Behavioral/SS) IORG0000418 IRB00004973
East Carolina U IRB #4 (Behavioral/SS Summer) IORG0000418

Appendix B

RE: Is data set available for my dissertation?

Neil, Janice [NEILJ@ecu.edu]
Sent: Wednesday, September 01, 2010 1:06 PM
To: Baker, Gloria
Cc: Pokorny, Marie Elizabeth

Gloria
The team has given permission for you to use the data. I will find out how to get a copy. They would ask that in any publication that comes out of it that they are acknowledged somewhere in the paper.
JN

From: Baker, Gloria [mailto:BAKERG03@students.ecu.edu]
Sent: Tuesday, August 31, 2010 1:10 PM
To: Neil, Janice
Cc: Pokorny, Marie Elizabeth
Subject: Is data set available for my dissertation?

Good Afternoon, Dr. Neil, I hope you are having a nice day! I was wondering if you had contacted the other investigators in your Stinky Wound Study to see if I can have access to the video recordings for my dissertation. I have been reading and searching for information on video analysis in qualitative research and some other possible approaches to the data. Please, let me know if the data set is definitely available. Have a nice Labor Day weekend (I hope that hurricane Earl leaves us alone!). Thanks, Gloria Baker

Appendix C

Research Request Form – Photo Permissions

CONTACT INFORMATION
Researcher
Name: **Gloria Waters Baker**
Phone Number: **252-209-6271**
Email Address: **BAKERG03@students.ecu.edu**
Institution: **East Carolina University**
Position/year: **Doctoral Candidate/2012**

Faculty Member, Supervisor or Sponsor for this project
Name: **Dr. Janice Neil**
Phone Number:**252-744-6407**
Email Address:**NEILJ@ecu.edu**
Institution: **East Carolina University**
Position: **Associate Professor**

PROJECT DETAILS
Project title: **Nursing Students' Reactions to Malodor in Wound Simulation**
Photo Sets(s) requested: **Unmasking the Face Photo Set**
Research project description (or paste Abstract here):

Background: Wound care is an essential competency which nursing students are expected to acquire during their nursing education. To foster students' competency, nurse educators employ the pedagogy of high fidelity simulation which provides the tools necessary to expose nursing students to various wound characteristics.
Problem: Little is known about how nursing students react to simulated wound characteristics. Malodor is a wound characteristic which can be particularly difficult for nursing students to manage in clinical practice. To facilitate students' developing skills in managing malodor, nurse educators were creative in designing realistic high fidelity simulations with the olfactory realism of malodor. However, nurse educators found that there was a gap in nursing knowledge about nursing students' reactions to malodor in simulation.
Aim of the Study: The aim of this research project was to describe how nursing students reacted to the introduction of malodor in video recordings of wound care in the simulation laboratory.
Methodology: The research project was an observational study using qualitative descriptive methodology to describe nursing students' nonverbal reactions to malodor during wound care in the simulation laboratory. A coding scheme of nonverbal behaviors in reaction to malodor was drawn the literature and refined based on observations of students' reactions to malodor during analysis of video recordings of wound care scenarios. The coding scheme was pilot tested and revised to limit codes to nonverbal behaviors classified in the Facial Action Coding System (FACS). The revised coding scheme was implemented by three observers to establish inter-rater agreement in describing students' nonverbal reactions to malodor in wound care simulations.

Findings: Nursing students' nonverbal reactions to malodor seemed to diverge into physical reactions and psychosocial reactions. The study findings produced a rich description of how nursing students reacted to the introduction of the olfactory realism of malodor in wound care simulation. This new nursing knowledge has the potential to inform nursing education practice using high fidelity simulation pedagogy. Additionally, knowledge of how students' react to malodor might augment wound care instruction. Future research is needed to determine the usefulness of the coding scheme for evaluating students and teaching malodorous wound care.

PUBLICATION DETAILS
Publication Date: **September 2012**
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Print Run/Number of Copies: **2**

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Appendix D

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Appendix E

Definition of Terms

- Culture is a multifaceted concept which encompasses attitudes, beliefs, and other social cognitions, social representations, and socially shared ideas (Kitayama & Tompson, 2010)
- Facial Action Coding System is a comprehensive, anatomically based technique for measuring minimally observable facial changes or action units produced by facial muscles as wrinkles, bulges, and pouches of skin (Ekman & Friesen, 1978; Morse et al., 2003; Sayette et al., 2001; Soussignan & Schall, 1996; Vrana, 1993)
- High Fidelity Simulation is the authentic replication of clinical settings using computerized human patients simulators (HPS) which can interact with students and produce physiological responses mimicking critical health events (Brannan et al., 2008; Howard, 2007; Nehring, W.M., Lashley, F.R., 2009)
- Macroanalysis is an observation concept referring to the observation of changes in postures, gestures, and voice quality (Bull, 2002a; Bull, 2008).
- Microanalysis is an observation concept referring to subtle changes in facial expressions (Bull, 2002a; Bull, 2008)
- Neurocultural Model postulated by Ekman (1972) stated that the biological potentiation to display particular facial expressions, through pre-wired neurologically, may be gradually brought under volitional control which may be governed by display rules based on cultural norms (Ekman & Friesen, 1978; Kitayama & Tompson, 2010).
- Neurocultural Interaction Model by Kitayama and Tompson (2010) proposed the processes involved in how biological adaptation is driven through repeated engagement in culturally-scripted behaviors based on cultural norms or display rules (Kitayama & Tompson, 2010).
- Nonverbal behaviors are significant, culturally mediated components of communication which involve facial expressions, touch, gestures, postures, and voice quality (Bull, 2002a; Bull, 2008; Martin et al., 2010).
- Observation is a method of data collection in which introspection and empathy are adequate tools to allow the observer to apprehend the inner experiences of the ones being observed (Daston & Lunbeck, 2011).
- Reaction is a change in behaviors in response to a stimulus (Merriam-Webster, 2011).
- Reaction to malodor includes the operational definition of upper lip raising (AU 10 = levator labii superioris) and nose wrinkling (AU 9 = alesque nasi region) as represented by the universal facial expressions in Ekman's Facial Action Coding System (FACS) (Bull, 2002b; Soussignan & Schall, 1996; Vrana, 1993).
- Socialization is a concept that refers to the process of learning a culture (Reutter et al., 1997).

Appendix F

A Priori Code Book of Documented Codes

Code Name	**Code ID**	**Description**	**Definition**	**Inclusion Criteria**	**Exclusion Criteria**
Code 1 Frowning	C1	Action Unit 4: Frowning is moving the eyebrows together, wrinkling the forehead, corners of the mouth down	AU4: Facial expression indicating sadness or disapproval and criticism	Change in facial appearance with the eyebrows drawing together, the forehead wrinkling, and the corners of the mouth moving downward in reaction to malodor	No change in facial appearance related to eyebrows, forehead, or mouth in reaction to malodor (Ekman & Friesen, 1978)
Code 2 Nose wrinkling	C2	Action Unit 9: wrinkling nosolabial furrows with nostrils flaring	AU9 of Facial Action Units from Ekman's Universal Human Emotions	Change in facial appearance of the nose as it wrinkles and the nares flares in reaction to malodor	No change in the appearance of the nose after exposure to malodor (Sayette, Cohn, Wertx, Perrott, Perrott, 2001)
Code 3 Lip raising	C3	Action Unit 10: raising the upper lip and inverting it slightly	AU10 of Facial Action Units from Ekman's Universal Human Emotions	Change in facial appearance of the mouth and upper lip as the lip raises and inverts slightly in reaction to malodor	No change in the appearance of the upper lip after exposure to malodor (Sayette, Cohn, Wertx, Perrott, Perrott, 2001)
Code 4 Upper lip tightening	C4	Action Unit 23: Flattening the upper lip against one's teeth	AU23:Lip tightener: Orbicularis Oris: pressing upper lip against one's teeth	Tightening upper lip against one's teeth	Upper lip is in neutral position (Ekman, 2004)
Code 5 Lips pressing tightly together	C5	Action Unit 24 Lips of mouth press tight together	AU24:Lip Pressor: Orbicularis Oris: Pressing both lips together tightly	Pressing lips together tightly against one's teeth	Lips are in a neutral position (Ekman, 2004)
Code 6 Lips sucking	C6	Action Unit 28: Lips are pressed together and sucked into mouth between one's teeth	AU28: Lip Suck: Orbicularis Oris: lips pressed tightly together and pulled in between	Lips pressed tightly together and pulled in between one's teeth	Lips are in a neutral position resting on top of one's teeth (Ekman, 2004)

			one's teeth		
Code 7 Nostrils Flaring	C7	Action Unit 38: Nostrils flare open	AU38: Nostril Dilator: Nasalis, Pars Alaris: Nostrils flare open	Nostrils flare open	Nostrils are in a neutral position (Ekman & Friesen, 1978)
Code 8 Arms across chest	C8	Crossing the arms over the body indicating a closed or defensive attitude	Gesture of nonverbal communication with the arms crossed over the chest indicating closure or defense	Change in posture with the arms moving across the chest and holding in that position in reaction to malodor	No change in posture with the arms away from the chest area in reaction to malodor (College of DuPage, 2011)
Code 9 Laughing or Snickering	C9	Laughing or snickering covertly	Laughing or snickering or giggling in a covert or partly suppressed manner	Laughing, snickering, or giggling covertly in reaction to malodor	No evidence of laughing, snickering, or giggling in reaction to malodor (Merriam-Webster, 2011)
Code 10 Silence	C10	Not speaking "Saying something by saying nothing". Avoiding a sensitive subject. Indicating doubt or indecision	Act of not speaking or conversing. Avoiding a sensitive subject. Indicating doubt or indecision	No speaking or conversing. Remaining quiet and not talking with patient during the dressing change in reaction to malodor	Speaking or conversing with the patient during the dressing change in the presence of malodor (Shelton & Shelton, 1992)
Code 11 Hesitancy	C11	Not moving, pausing, Not acting in the expected way	Not moving, Not proceeding with the dressing change	Not moving, Pausing, Not acting in the expected way during the dressing change as a reaction to malodor	Moving and acting in the expected way in the presence of malodor (Merriam-Webster, 2011)
Code 12 Vocalization	C12	To utter a sound, i.e. "whew", "yuck", "stinks"	To utter a sound in reaction to malodor	Uttering a sound or speaking in reaction to malodor	No sound emitted in reaction to malodor (Merriam-Webster, 2011)

Appendix G

Revised A Priori 20 Item Coding Scheme of Documented and Additional Codes

Code Name	**Code ID**	**Description**	**Definition**	**Inclusion Criteria**	**Exclusion Criteria**
Code 1 Frowning	C1	Action Unit 4: Frowning is moving the eyebrows together, wrinkling the forehead, corners of the mouth down	AU4: Facial expression indicating sadness or disapproval and criticism	Change in facial appearance with the eyebrows drawing together, the forehead wrinkling, and the corners of the mouth moving downward in reaction to malodor	No change in facial appearance related to eyebrows, forehead, or mouth in reaction to malodor (Ekman & Friesen, 1978)
Code 2 Nose wrinkling	C2	Action Unit 9: wrinkling nosolabial furrows with nostrils flaring	AU9 of Facial Action Units from Ekman's Universal Human Emotions	Change in facial appearance of the nose as it wrinkles and the nares flares in reaction to malodor	No change in the appearance of the nose after exposure to malodor (Sayette, Cohn, Wertx, Perrott, Perrott, 2001)
Code 3 Lip raising	C3	Action Unit 10: raising the upper lip and inverting it slightly	AU10 of Facial Action Units from Ekman's Universal Human Emotions	Change in facial appearance of the mouth and upper lip as the lip raises and inverts slightly in reaction to malodor	No change in the appearance of the upper lip after exposure to malodor (Sayette, Cohn, Wertx, Perrott, Perrott, 2001)
Code 4 Upper lip tightening	C4	Action Unit 23: Flattening the upper lip against one's teeth	AU23:Lip tightener: Orbicularis Oris: pressing upper lip against one's teeth	Tighten upper lip against one's teeth	Upper lip is in neutral position (Ekman, 2004)
Code 5 Lips pressing tightly together	C5	Action Unit 24: Lips of mouth press tight together	AU24:Lip Pressor: Orbicularis Oris: Pressing both lips together tightly	Pressing lips together tightly against one's teeth	Lips are in a neutral position (Ekman, 2004)
Code 6 Lips sucked in between teeth	C6	Action Unit 28: Lips are pressed together and sucked into mouth between one's teeth	AU28: Lip Suck: Orbicularis Oris: lips pressed tightly together and pulled	Lips pressed tightly together and pulled in between one's teeth	Lips are in a neutral position resting on top of one's teeth (Ekman, 2004)

			in between one's teeth		
Code 7 Nostrils dilator	C7	Action Unit 38: Nostrils flare open	AU38: Nostril Dilator: Nasalis, Pars Alaris: Nostrils flare open	Nostrils flare open	Nostrils are in a neutral position (Ekman & Friesen, 1978)
Code 8 Arms across chest	C8	Crossing the arms over the body indicating a closed or defensive attitude	Gesture of nonverbal communication with the arms crossed over the chest	Change in posture with the arms moving across the chest and holding in that position in reaction to malodor	No change in posture with the arms away from the chest area in reaction to malodor (College of DuPage, 2011)
Code 9 Laughing or Snickering	C9	Laughing or snickering covertly	Laughing or snickering or giggling in a covert or partly suppressed manner	Laughing, snickering, or giggling covertly in reaction to malodor	No evidence of laughing, snickering, or giggling in reaction to malodor (Merriam-Webster, 2011)
Code 10 Silence	C10	Not speaking "Saying something by saying nothing". Avoiding a sensitive subject. Indicating doubt or indecision	Act of not speaking or conversing. Avoiding a sensitive subject. Indicating doubt or indecision	No speaking or conversing. Remaining quiet and not talking with patient during the dressing change in reaction to malodor	Speaking or conversing with the patient during the dressing change in the presence of malodor (Shelton & Shelton, 1992)
Code 11 Hesitancy	C11	Not moving, pausing, Not acting in the expected way	Not moving, Not proceeding with the dressing change	Not moving, Pausing, Not acting in the expected way during the dressing change as a reaction to malodor	Moving and acting in the expected way in the presence of malodor (Merriam-Webster, 2011)
Code 12 Vocalization	C12	To utter a sound, i.e. "whew",	To utter a sound in reaction to	Uttering a sound or speaking in reaction to malodor	No sound emitted in reaction to malodor

		"yuck", "stinks"	malodor		(Merriam-Webster, 2011)
Code Additional 1 Eye contact between participants	CA1	Action Unit 69: Eyes positioned to look at other person	AU69: Eyes positioned to look at other person	Eyes positioned to meet and hold gaze between participants	No prolonged eye engagement between participants (Ekman & Friesen, 1978)
Code Additional 2 Head moves back	CA2	Head Movement Code 53: Participant tilts head back away from the odor source	Participant tilts head up & back away from the odor source	Participant head moves up & back and the chin tilts up away from the odor source	No backward movement of the head. Chin does not elevate away from the odor source (Ekman & Friesen, 1978)
Code Additional 3 Smiling Grinning	CA3	Action Units 6 & 12: Initiating and maintaining a smile or grin	AU6: Cheek raiser (orbbicularis Oculi (pars Orbitalis) AU12: Lip Corner Puller (zygomaticus major)	Lips part and corners of the mouth move out and up: teeth exposed	Lips and mouth in neutral position. Teeth covered by lips (Ekman & Friesen, 1978)
Code Additional 4 Swallowing	CA4	Gross Behavior Code 80: movement of face and throat as person gulps down saliva	GBC 80: movement of face and throat as person gulps down saliva	Mouth presses together, cheeks contract, throat moves up as person swallows saliva	No change in mouth, cheeks, or throat movement (Ekman & Friesen, 1978)
Code Additional 5 Touching face	CA5	Move hand or forearm to contact face	Move hand or forearm to contact face	Move hand or forearm to contact face, especially nose	No contact of hand or forearm with face (Baker, 2012)
Code Additional 6 Closing eyes	CA6	Action Unit 43: eyes close	AU43: relax levator palpebrae superioris	Eyelids come over eyes to cover them from view in reaction to malodor	Eyes remain open and focused (Ekman & Friesen, 1978)

Code Additional 7 Eye contact with facilitator	CA7	Action Unit 69: orient head toward facilitator and move eyes to engage facilitator	AU69: Orient head toward facilitator and move eyes to engage facilitator	Orient head toward facilitator and move eyes to engage facilitator	No orientation of head toward facilitator or eye contact maintained (Ekman & Friesen, 1978)
Code Additional 8 Move head toward odor	CA8	Moves torso toward wound, extends head toward wound	Moves torso toward wound & moves head toward wound, to see the wound	Moves torso toward wound and extends head toward wound, apparently to see the wound	Holds torso and head in a neutral position or away from the wound (Baker, 2012)

Appendix H

Revised Word-Based 13 Item Coding Scheme

Code Name	Code ID	Description	Definition	Inclusion Criteria	Exclusion Criteria
Code 1 (Additional) **Head back**	HB	Head Movement Code 53: Participant tilts head back away from the odor source	Participant tilts head up & back away from the odor source	Participant head moves up & back and the chin tilts up away from the odor source	No backward movement of the head. Chin does not elevate away from the malodor (Ekman & Friesen, 1978)
Code 2 (Literature) **Frowning**	F	Frown: moving the eyebrows together, wrinkling the forehead, corners of the mouth down	AU4: Facial expression indicating sadness or disapproval or criticism or confusion	Change in facial appearance with the eyebrows drawing together, the forehead wrinkling, and the corners of the mouth moving downward in reaction to malodor	No change in facial appearance related to eyebrows, forehead, or mouth in reaction to malodor (Ekman & Friesen, 1978)
Code 3 (Additional) **Peer eye**	PE	Action Unit 69: Eyes positioned to look at other person	AU69: Eyes positioned to look at other person	Eyes positioned to meet and hold gaze between participants in reaction to malodor	No prolonged eye engagement between participants (Ekman & Friesen, 1978)
Code 4 (Additional) **Facilitator eye**	FE	Action Unit 69: Orient head toward facilitator and eyes move to engage facilitator	AU69: Orient head toward facilitator and move eyes to engage facilitator	Orient head toward facilitator and move eyes to engage facilitator in reaction to malodor	No orientation toward facilitator or eye contact with facilitator with exposure to malodor (Ekman & Friesen, 1978)
Code 5 (Additional) **Closing eyes**	CE	Action Unit 43: eyes close	AU43: relax levator palpebrae superioris	Eyelids come over eyes to cover them from view in reaction to malodor	Eyes remain open and focused with exposure to malodor (Ekman & Friesen, 1978)
Code 6 (Literature) **Nostrils Flaring**	NS	Action Unit 38: Nostrils flare open	AU38: Nostril Dilator: Nasalis, Pars Alaris: Nostrils flare open	Nostrils flare open in reaction to malodor	Nostrils are in a neutral position with exposure to malodor (Ekman & Friesen, 1978)

Code 8 (Literature) **Lip curling**	LC	Action Unit 10: raising the upper lip and inverting it slightly	AU10 of Facial Action Units from Ekman's Universal Human Emotions	Change in facial appearance of the mouth and upper lip as the lip raises and inverts slightly in reaction to malodor	No change in the appearance of the upper lip after exposure to malodor (Sayette, Cohn, Wertx, Perrott, Perrott, 2001) (Ekman & Friesen, 1978)
Code 9 (Literature) **Lip tightening**	LT	Action Unit 23:Flattening the upper lip against one's teeth	AU23:Lip tightener: Orbicularis Oris: pressing upper lip against one's teeth	Tighten upper lip against one's teeth	Upper lip is in neutral position with exposure to malodor (Ekman & Friesen, 1978)
Code 10 (Literature) **Lip pressing**	LP	Action Unit 24: Lips of mouth press tight together	AU24:Lip Pressor: Orbicularis Oris: Pressing both lips together tightly	Pressing lips together tightly against one's teeth in reaction to malodor	Lips are in a neutral position with exposure to malodor (Ekman & Friesen, 1978)
Code 11 (Literature) **Lip sucking**	LS	Action Unit 28:Lips are pressed together and sucked into mouth between one's teeth	AU28: Lip Suck: Orbicularis Oris: lips pressed tightly together and pulled in between one's teeth	Lips pressed tightly together and pulled in between one's teeth in reaction to malodor	Lips are in a neutral position resting on top of one's teeth with exposure to malodor (Ekman & Friesen, 1978)
Code 12 (Additional) **Smiling/ Grinning**	S	Action Units 6 & 12: Initiating and maintaining a smile or grin	AU6: Cheek raiser (orbbicularis Oculi (pars Orbitalis) AU12: Lip Corner Puller (zygomaticus major)	Lips part and corners of the mouth move out and up: teeth exposed in reaction to malodor	Lips and mouth in neutral position. Teeth covered by lips with exposure to malodor (Ekman & Friesen, 1978)
Code 13 (Additional) **Swallowing**	SW	Gross Behavior Code 80: movement of face & throat as person gulps saliva	GBC 80: movement of face and throat as person gulps down saliva	Mouth presses together, cheeks contract, throat moves up as person swallows saliva in reaction to malodor	No change in mouth, cheeks, or throat movement with exposure to malodor (Ekman & Friesen, 1978)

Appendix I

Pilot Study 13 Item Coding Scheme Pictures

Head Back

Frowning

Peer Eye Contact

Facilitator Eye Contact

Closing Eyes

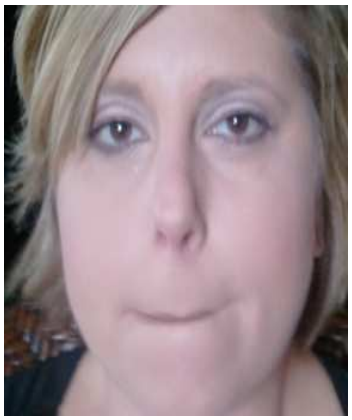
Nostrils Flaring

Nose Wrinkling

Lip Curling

Lip Tightening

Lip Pressing



Lip Sucking

Smiling/Grinning

Swallowing

Edited July 19, 2012

Appendix J

Orientation of Raters

- Upload video clips into NVivo Software
- Review the nonverbal behaviors' coding scheme, the pictures of the nonverbal behaviors, and the shorthand identification codes for the behaviors.
- Practice performing the nonverbal behaviors in the coding scheme
- Demonstrate opening NVivo software-opening a file-opening a source-turning on editing-selecting time parameters for each clip segment-coding each segment based on the coding scheme-saving your work-moving to the next source-etc.
- Practice navigating NVivo and coding a segment with the sample video
- **Remembe**r that you are looking for the participants' **reactions to malodor** versus their reactions to other elements of the scenarios. Concentrate on the participants' initial interactions with the wound, the drainage, the malodor, and the patient during the dressing change in order to isolate the participants' reactions to malodor. Be sure to refer to the pictures of the nonverbal behaviors in the coding scheme as needed during the coding process.
- **Video Review and Scoring Procedure**
- **Step 1**: Sensitization: The simulation scenarios involve 2 student participants interacting with a simulated patient. Student 1 (S1) is the participant changing the dressing. Student 2 (S2) is the participant assisting with the dressing change. Occasionally, only 1 participant in the viewing frame. The spliced video clips are less than 2 minutes long. Please watch a few of the clips one time without coding. When you observe the whole scene, you will begin to sensitize to what is happening in the videos, to the roles of the participants, and to the processes evolving within the scenarios. Keep in mind the research questions that you are trying to answer:
- **How did nursing students react to malodorous wound care simulation**?
- **What specific nonverbal behaviors indicated nursing students' reactions to malodorous wound care**?
- **Step 2**. Review and code the video clip segments **4 times**.
  1- Observe and score the participants' head and brow/forehead behaviors
  2- Observe and score the participants' eye behaviors
  3- Observe and score the participants' nose/nostril behaviors
  4- Observe and score the participants' lips/mouth behaviors
- After you have completed coding, email Gloria for an appointment to come and download your codes out of NVivo into a file. She will then transfer your data into NVivo on her computer for analysis. But you may choose to download the transcripts of your codes into a file outside of NVivo and email the file to Gloria when you have completed coding the video clips. (See the directions in your packet.) Select the option that works for you.
- Thank you for your time and expertise!!

Appendix K

Study Flow Chart

Nursing Students' Reactions to Malodor In Simulation Research Study Design

Phase 1

* Review the literature to develop a priori coding of nonverbal behaviors in reaction to malodor
* Review all N25 video recordings to identify which videos met the inclusion criteria
* Review n21 videos to identify which videos were positive and which videos were negative for nonverbal behaviors
* Review the n20 positive videos and code using the a priori coding scheme and noting other nonverbal behaviors
* Select the purposive sample of n15 videos
* Review notes on nonverbal behaviors in reaction to malodor to develop coding identification from initial analysis
* Review the literature to define and limit the new (discovered) codes for nonverbal behaviors in reaction to malodor
* Edit and prepare the coding scheme incorporating documented & discovered codes of nonverbal behaviors
* Review and select which videos will be spiced for uploading into NVivo software for analysis
* Splice video recordings into shorter clips for uploading into NVivo and load the videos
* Review and code the videos in NVivo using the coding scheme (a 3 step process)
* Select 58 video segments for review by the raters

Phase 2

* **Stage 1** Brief the raters on the coding scheme
* Explain the review process as a 3 step procedure
  + Step 1 Review the videos focusing on participant's facial expressions (microanalysis)
  + Step 2 Review the videos focusing on participant's posture, movements, voice (macroanalysis)
  + Step 3 Review the coding scheme then watch the videos and code any new behaviors noted
* Upload rater transcripts and calculate inter-rater agreement (IA)
* Research team conference on strategies to improve IA
* **Stage 2**
* Revise coding scheme to 13 item FACS codes & orientation of raters
* Orientation of raters to coding scheme and review protocol
* Compare and contrast the coding scores of the inter-raters
* Compare and contrast the coding scores of the inter-raters and the researcher's scores
* Establish level of IA by collapsing 13 codes into 4 categories(head/brow, eye, nose, mouth)

Phase 3

* Compare and contrast the rater codes
* Compare and contrast PI codes to rater codes
* Compare and contrast the performance of specific codes
* Identify patterns of participants' reactions

Appendix L
Four Item Coding Scheme Pictures

Head/Brow Reactions


Head Back/Chin Tilt


Frown

Eye Reactions


Peer Eye Contact


Facilitator Eye Contact


Closing Eyes

Nose Reactions


Nostrils Flaring


Nose Wrinkling

Mouth Reactions

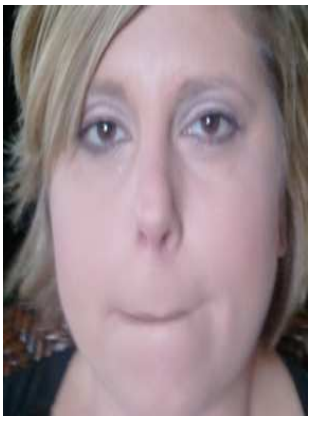
Lip Curl

Lip Tightening

Lip Pressing

Smiling/Grinning

Swallowing



Lip Sucking