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Factors Surgical Team Members Perceive Influence Choices of Wearing or not Wearing Personal Protective Equipment During Operative/Invasive Procedures

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FACTORS SURGICAL TEAM MEMBERS PERCEIVE INFLUENCE CHOICES OF WEARING OR NOT WEARING PERSONAL PROTECTIVE EQUIPMENT DURING OPERATIVE/INVASIVE PROCEDURES

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Richard G. Cuming

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To: Interim Dean Marie V. McDemmond
College of Education

This dissertation, written by Richard G. Cuming, and entitled Factors Surgical Team Members Perceive Influence Choices of Wearing or Not Wearing Personal Protective Equipment during Operative/Invasive Procedures, having been approved in respect to style and intellectual content, is referred to you for judgment.

We have read this dissertation and recommend that it be approved.

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Date of Defense: October 19, 2009

The dissertation of Richard G. Cuming is approved.

Interim Dean Marie V. McDemmond
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Florida International University, 2009

DEDICATION

I dedicate this dissertation to my mother, Liliane J. Cuming (1941-2004) and my grandmother, Phina M. Schumacher (1917-2007). Two women who won't see me graduate, but never doubted that I would.

Also to my father, K. Gordon Cuming who taught me at an early age that all things were possible with the right amount of persistence and dedication.

Finally to my life partner, John F. Lally. This work would never have been possible without your continual love and support – thank you for your patience, and your belief in me. I love you.

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Lastly, to the countless men and women who make up America's surgical teams. You place yourselves at risk for potential exposure to blood and body fluid contamination daily in the service of your fellow human being. Without you, this work would not have happened, thank you.

ABSTRACT OF THE DISSERTATION

FACTORS SURGICAL TEAM MEMBERS PERCEIVE INFLUENCE CHOICES OF WEARING OR NOT WEARING PERSONAL PROTECTIVE EUIPMENT DURING OPERATIVE/INVASIVE PROCEDURES

by

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Exposure to certain bloodborne pathogens can prematurely end a person's life. Healthcare workers (HCWs), especially those who are members of surgical teams, are at increased risk of exposure to these pathogens. The proper use of personal protective equipment (PPE) during operative/invasive procedures reduces that risk. Despite this, some HCWs fail to consistently use PPE as required by federal regulation, accrediting agencies, hospital policy, and professional association standards. The purpose of this mixed methods survey study was to (a) examine factors surgical team members perceive influence choices of wearing or not wearing PPE during operative/invasive procedures and (b) determine what would influence consistent use of PPE by surgical team members.

Using an ex post facto, non-experimental design, the memberships of five professional associations whose members comprise surgical teams were invited to complete a mixed methods survey study. The primary research question for the study was: What differences (perceptual and demographic) exist between surgical team members that influence their choices of wearing or not wearing PPE during operative/invasive procedures?

Four principal differences were found between surgical team members. Functional (i.e., profession or role based) differences exist between the groups. Age and experience (i.e., time in profession) differences exist among members of the groups. Finally, being a nurse anesthetist influences the use of risk assessment to determine the level of PPE to use.

Four common themes emerged across all groups informing the two study purposes. Those themes were: availability, education, leadership, and performance.

Subsidiary research questions examined the influence of previous accidental exposure to blood or body fluids, federal regulations, hospital policy and procedure, leaders' attitudes, and patients' needs on the use of PPE. Each of these was found to strongly influence surgical team members and their use of PPE during operative/invasive procedures.

Implications based on the findings affect organizational policy, purchasing and distribution decisions, curriculum design and instruction, leader behavior, and finally partnership with PPE manufacturers. Surgical team members must balance their innate need to care for patients with their need to protect themselves. Results of this study will help team members, leaders, and educators achieve this balance.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF ACRONYMS

ACRONYM	MEANING
AANA.	American Association of Nurse Anesthetists
AASPA	American Association of Surgical Physician Assistants
ACS	American College of Surgeons
AORN	Association of periOperative Registered Nurses
ASA	American Society of Anesthesiologists
ASPAN	American Society of PeriAnesthesia Nurses
AST	Association of Surgical Technologists
CDC	Centers for Disease Control and Prevention
CSPS	Council on Surgical and Perioperative Safety
HBV	Hepatitis B Virus
HCV	Hepatitis C Virus
HCW	Healthcare Worker
HIV	Human Immunodeficiency Virus
OSHA	Occupational Safety and Health Administration
PEP	Post Exposure Prophylaxis
PPE	Personal Protective Equipment
SP	Standard Precautions
SPSS	Statistical Package for the Social Sciences
TRA	Theory of Reasoned Action
UP	Universal Precautions

CHAPTER I

INTRODUCTION

This mixed methods study explored factors surgical team members perceive influence choices of wearing or not wearing personal protective equipment (PPE) during operative/invasive procedures. This chapter presents the background to the problem, problem statement, and research questions. Significance of the study, delimitations, definition of terms, and organization of the study are also discussed.

Background to the Problem

Federal regulations, accrediting agencies, institutional policies, and national guidelines require the use of PPE during operative/invasive procedures (Association of periOperative Registered Nurses [AORN], 2005a; OSHA, 1991; The Joint Commission, 2008). However, surgical team members remain inconsistent in their use of PPE such as eye protection, reinforced surgical gowns, and double gloves which can protect both them and their patients from exposure to bloodborne pathogens (Cutter & Jordan, 2004). Surgical procedures, by their very nature, place the surgical team at risk of exposure to blood or body fluids (AORN, 2005b). The use of sharp instruments, suture needles, and the required speed of team members contribute to the potential for an unsafe work environment. Personal protective equipment, when used properly, can substantially reduce environmental risk.

Risk is inherent in all occupations to varying degrees but more so in those professions that interact intimately with the public such as fire fighters, law enforcement officers, health care workers, and emergency medical personnel. First responders to the attacks on New York's World Trade Center, who were exposed to the dust and smoke at ground zero, have sustained significant lung damage. Those on the scene shortly after the collapse were most severely affected. Despite the subsequent use of protective masks, damage had already been done and additional protection was not demonstrated (Osterweil, 2006; Spillane, 2006). For healthcare workers (HCWs), the risk of acquiring transmissible, incurable bloodborne disease is perhaps most frightening. The Center for Disease Control (CDC) has identified Human Immunodeficiency Virus (HIV), Hepatitis B (HBV), and Hepatitis C (HCV) as three bloodborne pathogens requiring surveillance (CDC, 1998).

Human Immunodeficiency Virus

Since the mid-1980s when HIV transmission was first reported in the literature, HCWs have been concerned with the potential risk this virus poses as an occupationally acquired illness. As of December 2001, 57 cases of HIV seroconversion have been documented among HCWs in the United States (CDC, 2002). The overall risk of HIV transmission from a hollow bore needle is 1 in 300 or 0.3%. For solid bore needles and other types of exposure, the risk is 1 in 1,000 or 0.09% (CDC, 1998). Fortunately, HCWs can routinely take actions that reduce the risk of exposure or, once exposed, to reduce the risk of disease transmission. The use of PPE reduces contact with infectious materials. Prompt washing of skin surfaces immediately after blood or body fluid exposure reduces the risk of disease transmission. The careful handling and disposing of sharp instruments during and after use are effective risk reduction practices (CDC, 2002).

Hepatitis B Virus

HBV is reported to be the most contagious of the bloodborne pathogens with risk of acquiring infection after a single exposure estimated at 40% (CDC, 2001). Like HIV and HCV, the risk of disease transmission is related to the amount of viral exposure and the length of the exposure. Unlike HIV and HCV, healthcare workers can be protected against HBV by a vaccination that is 95% effective in the prevention of HBV (CDC, 2001).

Hepatitis C Virus

The third major bloodborne pathogens of concern, HCV is not efficiently transmitted through occupational blood exposures. The average risk of HCV infection after exposure to a positive source is estimated to be 1.8% with a range of 0% to 7% (CDC, 2001). Although the effectiveness of post exposure prophylaxis (PEP) has been examined, its benefit remains unclear hence the CDC does not currently recommend PEP therapy. Limited research does suggest the early introduction of antiviral therapy might be useful following the diagnosis of acute infection (CDC, 2001).

Universal Precautions

Avoiding occupational blood exposure is the most effective method of preventing transmission of bloodborne disease in the healthcare setting (CDC, 2002). Universal precautions (UP), first introduced by the CDC in 1987, require the use of eye shields, gloves, masks, and/or gowns by HCWs when appropriate. In 1996 the CDC introduced new recommendations (standard precautions; SP) which combined UP and body substance isolation principles (CDC, 1996). Standard precautions are implemented primarily in hospital settings.

Whether following UP or SP, HCWs should treat all patients as though they are infected with HIV, HBV, or HCV (CDC, 1996). Implementing UP/SP reduces the risk of occupational exposure to bloodborne pathogens. However, these methods are only effective when followed. Despite the provision of PPE in the workplace and the knowledge that PPE reduces individual risk of exposure, some HCWs choose not to comply with regulations and recommendations related to exposure to pathogens (Cutter & Jordan, 2004).

Problem Statement

Exposure to certain bloodborne pathogens can prematurely end a person's life. HCWs, especially those working as members of surgical teams, are at an increased risk of exposure to these pathogens. Surgical procedures expose the blood and body fluids of the patient to the surgical team members and, at times, expose the blood and body fluid of the surgical team members to the patient (AORN, 2005a). These exposures place all involved at an increased risk of disease transmission. PPE can reduce the risk of exposure to blood and body fluid. Extra reinforced surgical gowns prevent blood and other fluids from passing through to the wearer's undergarments. Wearing two pairs of gloves instead of one dramatically reduces exposure of the HCW's skin to body fluids during glove failure. Finally, wearing eye protection reduces the risk of blood or other fluids being splashed into the team member's eyes. Despite these known risks and the availability of PPE, some HCWs fail to comply with recommendations and regulations intended to reduce their risk. Extra reinforced gowns are warmer when worn for extended periods; double gloving cramps the hand while reducing dexterity, and protective eyewear can fog or slide down the bridge of the nose – these things are all uncomfortable.

In its bloodborne pathogen standard of the Federal Register, the Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor describes employers' responsibility surrounding PPE. In articles 1910.1030 (d) 3 (i-iii), OSHA clearly places the responsibility for the provision of PPE, the use of PPE, and the accessibility of PPE squarely on the shoulders of the employer. Failure to enforce these requirements can result in monetary fines imposed by the federal government.

Previous studies have examined compliance with UP finding that compliance rates range from extremely high to extremely low (97% - 63%) depending on the item and certain individual demographic characteristics (Gershon et al., 1995). Exposure reporting has also been studied finding that while HCWs' intentions to report exposure to blood and body fluids was high (92%), actually reporting the incident was considerably lower (23%; Osborne, 2003). Finally methods to reduce exposure have been examined finding that targeted educational programs can influence the use of PPE and exposure reporting by HCWs in operating room environments (Holodnick & Barkauskas, 2000).

Most studies have found that significant differences exist between groups of surgical team members based on profession (Brown, 2002; Gershon et al., 1995; Makary et al., 2007; see Appendix A for role definitions of surgical team members) and that team position (power) may influence the use or nonuse of PPE (Cutter & Jordan, 2004). Before this study, the degree and rationale for nonuse of PPE remained unexamined (Cutter & Jordan, 2004) as did the factors that affect decision making by surgical teams to wear or not wear PPE. Finally, what specific actions by educators and managers would influence the consistent use of PPE by surgical team members was explored.

Purpose of the Study

Because reporting of exposures is inconsistent (Osborne, 2003) and health care organizations are unlikely to release data surrounding employee or patient exposure to bloodborne pathogens, this study surveyed related professional association members. The purpose of this mixed methods study was to (a) examine factors influencing surgical team members' choices of wearing or not wearing PPE during operative/invasive procedures and (b) determine what would influence consistent use of PPE within and between each group of respondents.

Research Questions

The primary research question for the study was: What differences (perceptual and demographic) exist between surgical team members (surgeons, anesthesiologists, nurse anesthetists, registered nurses, and surgical technologists) that influence their choices of wearing or not wearing PPE during operative/invasive procedures?

The subsidiary research questions concerned these groups' perceptions about:

1. How does previous accidental exposure to blood or body fluids influence surgical team members regarding the use of PPE?
2. How do federal (OSHA) regulations influence surgical team members regarding the use of PPE?
3. How do hospital policies and procedures influence surgical team members regarding the use of PPE?
4. How do hospital leaders' attitudes encourage or discourage the use of PPE by members of surgical teams?
5. What is the influence of patients' needs on the use of PPE by surgical team members?

Theoretical Frameworks

The three theoretical frameworks supporting this study will be briefly discussed here. They are, Azjen and Fishbein's (1980) theory of reasoned action, Rosenstock's (1966) health belief model, and Kolb's (1984) experiential learning theory.

Theory of Reasoned Action

Azjen and Fishbein's Theory of Reasoned Action (TRA) proposes that personal attitudes influence a person's intent to engage in different behaviors (Azjen & Fishbein, 1980). The TRA views people as rational beings utilizing information at their disposal to judge, evaluate, and decide action. Therefore, the intent towards choosing a given behavior is a function of an individual's attitude towards the behavior. An individual's attitude towards an object is related to his or her beliefs about the object rather than to any general belief (Fishbein & Ajzen, 1975).

As a theory interested in predicting human behavior the TRA informed the present study and will facilitate the development of effective interventions (education, policy, leader behavior, etc.) resulting in improved voluntary compliance with the use of PPE. Using the TRA, studies have examined HCWs and their attitudes towards patients with various diagnoses, such as HIV/AIDS and cancer or with body piercings (Pereira, 2004; Stuppy, Armstrong, & Casals-Ariet, 1998).

Health Belief Model

The health belief model is one of the most widely used frameworks for understanding health related behavior. Originally developed by a group of psychologists in the 1950s the model attempts to explain and predict health behaviors by focusing on the attitudes and beliefs of individuals (Rosenstock, 1966). The model is based on the understanding that a person will engage in a health-related action if the person: (a) believes he or she can avoid a negative health condition (i.e., exposure to bloodborne pathogens), (b) has a positive expectation that he or she will avoid a negative health condition by taking a recommended action (i.e., wearing PPE to avoid exposure), and (c) believes that he or she can successfully take a recommended health action (Becker, 1974).

The model suggests that behavior is largely influenced by the value a person places on a health related goal and his or her belief that the goal is achievable through a specific action. Four original constructs formed the underpinnings of the model: (a) perceived susceptibility or a person's belief surrounding his or her risk of actually getting the condition, (b) perceived severity or a person's belief of the seriousness of the condition along with its potential consequences, (c) perceived barriers or a person's belief of influences that facilitate or discourage adoption of the promoted behavior and, (d) perceived benefits or a person's belief of the positive consequences of adopting the behavior (Becker, 1974).

Experiential Learning Theory

In Kolb's (1984) experiential learning theory, knowledge is believed to be formed through the transformation of lived experiences into already established frameworks resulting in new behaviors and actions. The theory presents distinct learning preferences (styles) as well as a four-stage learning cycle. Thus the theory offers a method to understand both an individual's learning style while providing an explanation of an experiential learning cycle that applies to us all. Kolb's (1984) experiential learning theory guides educators, trainers, and managers of surgical teams to develop programmatic instruction that will increase their use of PPE.

Delimitations

This study focused on members of surgical teams use or nonuse of PPE during operative/invasive procedures. Results are limited to these specific groups. Further research would be necessary before conclusions could be extrapolated to different groups of workers such as other HCWs and emergency response personnel.

Definition of Terms

For the purpose of this study the following terms are defined:

Bloodborne pathogen is an infection spread from contact with the blood or body fluid of an infected person to the blood or body fluid of another person (CDC, 1998).

Healthcare worker is any person whose activities involve contact with patients or with blood or other body fluids from patients in a health-care, laboratory, or public-safety setting (CDC, 2001).

Hepatitis B virus (HBV) is the virus that causes hepatitis B (CDC, 2001).

Hepatitis C virus (HCV) is the virus that causes hepatitis C (CDC, 2001).

Human immunodeficiency virus (HIV) is the virus that causes acquired immunodeficiency syndrome (AIDS; CDC, 1996).

Operative/invasive procedures is the surgical entry into tissues, cavities, or organs or repair of major traumatic injuries (AORN, 2008a).

Personal protective equipment (PPE) is protective equipment such as masks, gloves, gowns, goggles, and face shields designed to protect the wearer from injury (AORN, 2008a).

Respondent's awareness of federal regulations (OSHA/Joint Commission) and hospital policies and procedures regarding the use of PPE will be self reported by each respondent (see Appendix B, question 7) in order to assist in data interpretation.

Respondent's perceptions of the importance of leader's attitudes, hospital policy and procedure, and federal regulations regarding the use of PPE will be self reported by each respondent (see Appendix B, questions 16, 17, and 18) in order to assist in data interpretation.

Surgical team is defined as the group of professional healthcare workers gathered together for the purpose of performing an operative or invasive procedure and includes surgeons, anesthesiologists, nurse anesthetists, registered nurses, and surgical technologists (AORN, 2008b).

Universal precautions are recommended guidelines published by the CDC designed to prevent the transmission of HIV, HBV, and other bloodborne pathogens when providing first aid or healthcare (CDC, 1996).

Significance of the Study

This study extends the previous work of Cutter and Jordan (2004) who examined compliance with universal precautions and exposure reporting in the United Kingdom. Information gained from this study adds to the empirical body of knowledge concerning surgical teams and their decision making regarding the use or nonuse of PPE.

Incorporating the health belief model (Rosenstock, 1966) as one of the theoretical frameworks guiding this study, health behaviors of health care workers were examined. While the model has been widely used to examine health behaviors of health care consumers, it has not been used to look at actions of surgical team members. Findings from this study add to the theoretical body of knowledge related to the health belief model.

Finally, not wearing PPE during operative/invasive procedures places members of surgical teams and their patients at increased risk for exposure to bloodborne pathogens. This study contributes to the research on surgical teams by providing information about what factors influence these decisions. Information about factors influencing these decisions informs managers and educators who can then develop successful training and practice policies that improve voluntary compliance.

Summary

Chapter 1 discussed the background to the problem and the purpose of the mixed methods study. This chapter described the study’s rationale and presented the primary research question and the subsidiary research questions, the theoretical frameworks of the study, delimitations, and the definition of key terms. Significance of the research was also discussed.

Chapter 2 presents the literature review and chapter 3 reviews the study method. Chapter 4 presents the qualitative analysis and Chapter 5 presents the quantitative analysis. The last chapter discusss the results of the study including the implications of the research for surgical team members, limitations of the research, and recommendations for further research.

CHAPTER II

LITERATURE REVIEW

This chapter provides the background leading to the development of PPE requirements by regulatory agencies and hospitals and a review of conceptual and empirical literature pertinent to the use or nonuse of PPE by surgical team members during operative/invasive procedures. The literature review is divided into four parts: (a) theoretical frameworks which informed the study; (b) background to requiring the use of PPE; (c) reporting of exposure to blood and body fluids; and (d) compliance with use of PPE.

Theoretical Frameworks

Surgical teams can choose to use or not use PPE during operative or invasive procedures. As has been discussed previously, many team members, for reasons yet unknown, choose not to use PPE even though by using them the spread of bloodborne pathogens can be prevented. In this section the theory of reasoned action will be presented (Azjen & Fishbein, 1980). This will be followed by a discussion of the health belief model (Rosenstock, 1966) and experiential learning theory (Kolb, 1984).

All three of these theories informed the present study and were useful in analyzing the results and suggesting opportunities for future research. The TRA posits that personal attitudes influence behavior, the health belief model holds that people will take action if there is sufficient risk, and experiential learning theory suggests that new knowledge is formed through the transformation of lived experiences. These models support the research questions and will later guide the development of interventions intended to improve voluntary compliance with the use of PPE.

Theory of Reasoned Action

The Theory of Reasoned Action is rooted in the belief that people are rational organisms and make decisions regarding behavior based on a systematic review of information available rather than succumbing to overwhelming desires or engaging in thoughtless acts. The tenet of the theory is that people consider the consequences of their actions before they decide to behave or not behave in a certain fashion. Thus, action is a result of thoughtful reasoning (Azjen & Fishbein, 1980).

Behavior is viewed as voluntary, and, as such, the principle determinant of behavior is a person’s intention to perform (or not perform) a certain action. Intentions are comprised of two constructs, one personal and the other social. The personal construct is the individual’s attitude toward the behavior. Attitude is either a negative or positive judgment towards a certain action. Attitude is a reflection of whether a person is in favor of or against behaving in a particular manner. In other words, attitude is the judgment that an action is either good or bad and is shaped by beliefs about the consequences of the behavior. The social construct of intention is the subjective norm and is determined by a person’s understanding of social pressures to perform or not perform an action. Subjective norm is highly influenced by the importance of others as viewed by the individual. People will intend to behave in a particular manner when that action is associated with a positive attitude and when they believe that others important to them think they should behave in that way. Given this, an individual’s beliefs ultimately determine behavior through the influence of attitudes and intentions (Azjen & Fishbein, 1980).

Application To This Study

This study examined the use or non use of PPE by members of surgical teams during operative/invasive procedures. Concepts of the TRA define the individual's own beliefs and also the individual's perceived beliefs of others important to them towards using or not using PPE. Therefore, the combination of personal beliefs and group beliefs (important others) lead to action based on which set of beliefs are more valued.

Application To Risk Behaviors

The following discussion describes studies that demonstrate how the TRA has been used to study people's decision-making about engaging in risky behaviors. Factors influencing undergraduates' engagement in unprotected sex were studied in a mixed-methods sequential design testing the TRA (Protogerou, 2007). Results showed that a fatalistic time perspective had the weakest relationship with intended unprotected sex followed by relationship status, attitudes, and finally past non-condom use having the strongest relationship. The effectiveness of using mixed-methodologies was validated in this study.

The TRA was used to investigate factors that influence HIV testing decisions among sexually active heterosexual college students (King, 2006). Despite knowledge of what constituted risky sexual behavior, students continued to engage in many behaviors that potentially exposed them to HIV infection and these behaviors did not result in an increased likelihood of being tested for HIV. Findings suggested that HIV testing behavior was significantly related to HIV testing belief, college norm, family/friend/sexual partner norm, and perceived behavior control. The general findings of this study were that the TRA was useful and valuable as an HIV testing intervention framework.

Application To Healthcare

The TRA was used in a three study dissertation, examining interpersonal, intra-personal, and organizational factors that either enhance or impede the organ donation process in a multi-hospital system (Josiah, 2006). The first study evaluated relationships between critical care professionals' attitudes towards organ donation and the organ donor process. This study confirmed a statistically significant relationship between personal attitudes about organ donation and how the organ donation process was managed. The second study used the TRA to assess HCW's intentions to participate in the organ donor process. The TRA suggested positive, significant relationships between intention and attitudes and subjective norms. The third and final study retrospectively examined perceptions and experiences of critical care nurses involved in the organ donor process. Nurses identified coping strategies used to ensure a successful organ donation process, and they validated the importance of interpersonal relationships and communication to successful organ donation (Josiah, 2006).

In a test of the TRA as applied to nurses caring for ventilator-dependent patients in Hong Kong, nurses' subjective norms and attitudes were found to be significantly related to their behavioral intention toward this specific patient population (Chow, 2005). These two constructs (subjective norm and attitude) accounted for 32% of the variance in nurses' behavioral intentions toward ventilator-dependent patients. Implications for nursing education, nursing practice and nursing research were provided. Nursing education may be influenced by this study in the context of curriculum design and education delivery emphasizing the potentially emotionally satisfying aspects of caring for this particular population. Nursing practice could be enhanced by providing increased opportunities for non-Intensive Care Unit nurses to care for ventilator dependent patients, thus improving their skill and comfort with this group of patients. Second, the possibility of establishing ventilator units in the hospital and placing all ventilator dependent patients in this specialty unit rather than dispersed throughout the hospital was discussed. Finally, the researchers stated that future research should further investigate nursing care of ventilator dependent patients.

Using the TRA as a framework, a descriptive study investigated the attitudes of nurses and nursing students toward patients with body piercings (Pereira, 2004). Nurses in the operating room, intensive care unit, and emergency department were surveyed along with student nurses in a baccalaureate nursing program. No significant differences were found between the two groups (nurses and student nurses) based on age, gender, nursing specialty, educational level, work environment, or number of patients seen with body piercings. Attitudes towards patients with many piercings (i.e., more than seven) were less favorable in both groups than were attitudes towards patients with fewer piercings (i.e., less than three).

A survey to evaluate the reporting habits of attending surgeons following bloodborne pathogen exposure was conducted at a Yale-New Haven Hospital (Brown, 2002). The survey included scales to measure the relationship between knowledge, attitudes, beliefs, and subjective norms and the exposure reporting behavior of respondents. Bloodborne pathogen exposure was underreported by 95% with the majority of respondents overestimating the prevalence of bloodborne pathogen infection among the patient population and underestimating the risk of transmission of bloodborne pathogens. A significant barrier to exposure reporting was the length of time necessary to complete the report (Brown, 2002).

Application Outside of Healthcare

The TRA has application in disciplines other than healthcare. As an example, in one study of college athletes, gambling behaviors were investigated (Thrasher, 2006). Relationships among subjective norms, gambling attitudes, gambling motivations, locus of control, and gambling intentions on gambling behavior were studied. Results of this study found that there were differences in gambling attitudes between men and women, attitudes and subjective norms predicted gambling intentions, and motivations and locus of control affected the relationship between gambling attitudes and gambling intentions (Thrasher, 2006).

Health Belief Model

In the early 1950s a group of social psychologists working for the U.S. Public Health Service were studying why people wanted X-ray examinations for tuberculosis. This research led to the development of the original health belief model (Rosenstock, 1966). The model was later revised to include the possibility of the presence of asymptomatic disease rather than only susceptibility to disease (Becker, 1974). In its present form, the model is a value expectancy theory. Value expectancy addresses the perception of personal susceptibility to and severity of an illness, and the ability of the individual to minimize or negate the threat of the illness through some action. The health belief model suggests that people will take certain actions to prevent or control illness if they believe they are susceptible to it and if the illness is considered severe. They will also be more likely to act if they believe that taking action will be beneficial and the barriers to the action are less than the cost of the action itself (Becker, 1974).

The health belief model has been used as the theoretical framework in many studies such as needlestick safety (Turnbeaugh, 1997), compliance with safe needle devices (Grant, 2000), and breast cancer screening behaviors (Yarbrough & Branden, 2001). In the early 1990's the health belief model was the most frequently applied model in health behavior and health education programs (Turnbeaugh, 1997).

The model postulates that behavior depends largely on the value a person places on some goal and his or her belief that an action will achieve that goal. In health-related behavior, this is viewed as a person's estimate of the threat of a particular illness and the likelihood that action will reduce or eliminate the threat. The model is comprised of four original constructs: (a) perceived susceptibility or a person's belief surrounding their risk of actually getting the condition, (b) perceived severity or a person's belief of the seriousness of the condition along with its potential consequences, (c) perceived barriers or a person's belief of influences that facilitate or discourage adoption of the promoted behavior and, (d) perceived benefits or a person's belief of the positive consequences of adopting the behavior (Becker, 1974). Later, two final constructs were added to the model: (e) perceived efficacy or a person's belief in their ability to successfully implement the desired behavior, and (f) cues to action or the external influences promoting the desired behavior (Glanz, Rimer, & Lewis, 2002).

Combining elements of value expectancy theory and social cognitive theory from within a nursing framework resulted in the health promotion model (Pender, Murdaugh,

& Parsons, 2006). Behavior motivated by the desire to increase well being is considered health promotion while behavior motivated by a desire to avoid illness, is considered disease prevention. Nurses, as the single largest group of healthcare providers, are optimally positioned to influence the health promotion behaviors of others (Pender, Murdaugh, & Parsons, 2006). Originally published in the early 1980s, the model examined factors influencing health behaviors from both a behavioral science and nursing perspective. Seven cognitive-perceptual factors were identified that explained and predicted behaviors. These factors were modified by five modifying factors. The cognitive-perceptual factors were: (a) importance of health, (b) perceived control of health, (c) definition of health, (d) perceived health status, (e) perceived self-efficacy, (f) perceived benefits, and (g) perceived barriers. The five modifying factors were: (a) demographic and biologic characteristics, (b) interpersonal influences, (c) situational influences, and (d) behavioral factors. The model describes the nature of interaction between people and their physical and interpersonal environments as they seek health. In the late 1990s, the model was revised to include three additional variables: (a) activity-related affect, (b) commitment to a plan of action, and (c) immediate competing demands and preferences (Pender, Murdaugh, & Parsons, 2006; see Figure 1).

Experiential Learning Theory

Learning is a continuous process whereby new knowledge is formed through the transformation of lived experiences into already established cognitive frameworks resulting in new actions and behaviors (Kolb, 1984). Having its intellectual roots in the work of Dewey, Freire, Lewin, Piaget, and James, the theory is called experiential to highlight the important role played by personal experiences in the learning process (Baker, Jensen, & Kolb, 2002).

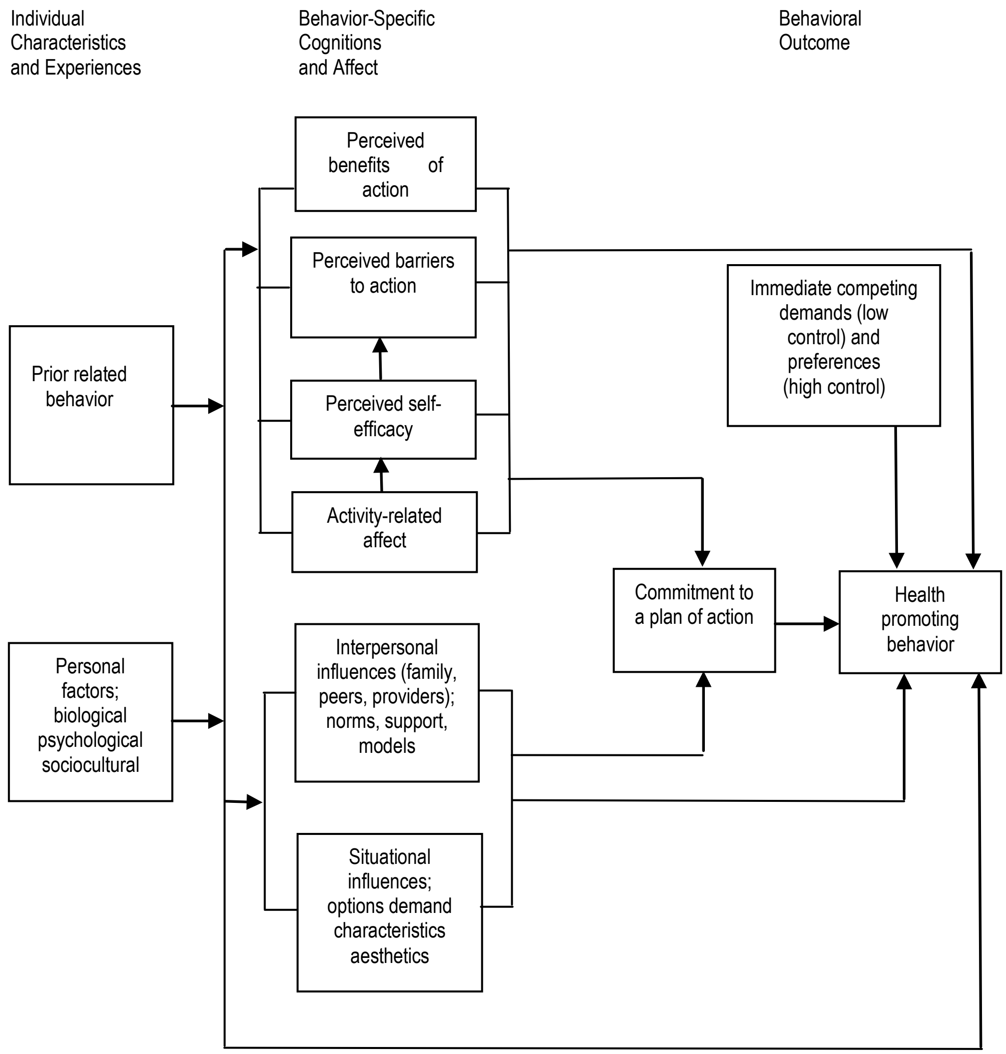

Figure 1. Health Promotion Model (revised).

Note. From *Health Promotion in Nursing Practice*, 5th ed., (p. 50), by N. J. Pender, C. L. Murdaugh, and M. A. Parsons, 2006, Upper Saddle River, NJ: Pearson Education, Inc.

In the model, experiences are grasped either through apprehension (concrete experience) or through comprehension (abstract conceptualization). Once the experience has occurred, it must be transformed if learning is to occur. Experiences are transformed either through intension (reflective observation) or through extension (active experimentation; Kolb, 1984). Thus, people learn in different ways and change the way they learn depending on the situation (Baker, Jensen, & Kolb, 2002). Educational experiences developed within the context of experiential learning theory focus on the learner while creating learning opportunities that resonate with the various learning styles.

Learning Styles

An individual's preferred way of learning is referred to as their learning style, yet this style is not something that people learn (Brazen & Roth, 1995). Learning styles are different for each learner. They are learner focused and represent the process-oriented piece of learning as opposed to the educator focused product-oriented piece of learning. In this model there are four different learning styles: accommodating, diverging, converging, and assimilating (Kolb, 1984). The accommodating learner learns best through apprehension (i.e., experience) and transforms the experience best by extension (i.e., active experimentation). Diverging learners also learn best through apprehension but transform the experience best through intension (i.e., reflecting on it). Converging learners learn best through comprehension (i.e., abstract ideas separated from the experience) and transform the experience through extension. Assimilating learners also learn best through comprehension and transform the experience through intension (Sewchuk, 2005).

Learning Cycle

The learning cycle is comprised of four elements: concrete experience, observation and reflection, the formation of abstract concepts, and testing in new situations (Kolb, 1984). In the model, the learner can begin in the cycle at any one of the four points as the model is cyclical. In general the learning process begins with the learner carrying out a particular action and seeing the results in the situation (i.e., concrete experience). Next, the effects in this particular instance are understood and processed so that if the same action was undertaken under similar circumstances the learner could anticipate the outcome (i.e., observation and reflection). Thus the third step in the cycle is to understand the general principle that is being applied (i.e., formation of abstract concepts) and finally to test that principle under different circumstances (i.e., testing in new situations).

Educators who understand this model are well equipped to guide learners through the experiential learning process (Sewchuk, 2005). The model has been applied to settings within surgical service environments to plan, coordinate, and implement perioperative nursing education program (Brazen & Roth, 1995; Rosentreter & Talboy, 2003; Sewchuk, 2005). It has also been used to initiate a medical equipment recovery program to help third world countries (Canales & French, 2003). Use of the experiential learning theory in structured settings allows educators to capitalize on learners' natural styles, facilitating the learning experience.

Background to Requiring the Use of Personal Protective Equipment

In the late 1960s, America's attention was focused on the Vietnam War, the assassination of Robert F. Kennedy and Martin Luther King, and the safety of the U.S.

workplace. Fourteen thousand workers were dying from work-related injuries each year, and disabling injuries sustained in the workplace rose 20% from the previous decade (OSHA, n.d. a). In the U.S. Senate, New Jersey Senator Harrison A. Williams, Jr. (Democrat) called for government intervention to improve the safety of America's workplaces. Meanwhile, in the House of Representatives, William A. Steiger (Republican) advocated for the passage of a bill to protect America's workers. The urgent need for this legislation was supported by bipartisan cooperation. Thus, in December 1970, the Williams-Steiger Act was signed into law by President Richard M. Nixon. This Act is more commonly known as The Occupational Safety and Health Act of 1970 (OSH Act; OSHA, n.d. a).

Legal Authority

The purpose of the OSH Act is "to assure so far as possible every working man and woman in the nation safe and healthful working conditions and to preserve our human resources" (29 U.S.C. 651 (b)). To achieve this, the Secretary of Labor was authorized by Congress to adopt existing consensus and federal standards within two years of the Act's enactment, promulgate standards via notice and comment rulemaking, and require employers to comply with OSHA standards (29 U.S.C. 654 (b), 1970). OSHA's mission is to develop and implement standards that prevent occupational injury, illness, and death (OSHA, n.d. b). The establishment and enforcement of standards through inspections and the levying of monetary fines is how OSHA has been able to improve the safety of the American workplace.

OSHA and Healthcare

Healthcare facilities can be dangerous places and include hospitals, out-patient surgery centers, dental offices, nursing homes, and clinics. Each facility is regulated through OSHA standards for general industry. The general duty clause of the OSH Act requires the employer to "furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or likely to cause death or serious physical harm to his employees" (29 U.S.C. 654 Sec. 5(a)(1), 1970). There are a number of safety and health concerns associated with healthcare facilities. These include exposure to biological or respiratory contaminants, ergonomic and repetitive task hazards, chemicals and drugs, waste anesthetic gases, x-ray and laser, radioactive materials, and exposure to bloodborne pathogens (OSHA, n.d. c).

Healthcare facilities employ many other groups of workers besides medical personnel. They include electricians, plumbers, housekeepers, and building and ground maintenance crews. Each group has unique workplace safety hazards represented by the seven OSHA standards most frequently cited in healthcare facilities. In order, they are bloodborne pathogens, hazard communication, control of hazardous energy, wiring methods, general requirements (personal protective equipment), general requirements (electrical), and respiratory protection (OSHA, n.d. c).

Employers are obliged by law to protect their workers from occupational hazards (Cuming, Rocco, & McEachern, 2008). Through the use of engineering and work practice controls, employers are required to reduce and eliminate employee risk. Engineering controls involve physically changing the work environment to eliminate exposure to potential hazards. Work practice controls eliminate exposure to potential hazards by changing the way employees do their work. If unable to achieve adequate risk reduction through these methods, the employer is required to establish and implement a PPE program (OSHA, 2003).

A PPE program establishes procedures for selecting, providing, and using PPE by employees when they are engaged in activities where potential risk for exposure to hazards cannot be avoided through other controls (OSHA, 2003). An assessment of the workplace is conducted to determine if hazards exist or are likely to exist. If a hazard is detected, PPE use is required. Once the proper PPE has been selected, each employee must be properly trained. At a minimum, PPE training addresses type of equipment and its necessary use, how to properly put on, take off, wear, adjust, and dispose of PPE; limitations of PPE; and proper care and maintenance of PPE. During training, each employee must demonstrate an understanding of the training and the ability to properly use the PPE. Immediate retraining is indicated if the employee cannot understand or demonstrate the required skill. Employers are to maintain written certification of training completion for each affected employee (OSHA, 2003).

Bloodborne Pathogens

HCWs regularly work with and around bloodborne pathogens. Fortunately, there are actions HCWs can routinely take to reduce the risk of exposure or, once exposed, to reduce the risk of disease transmission. Prior to 1987, HCWs wore gloves only when desired as a measure of cleanliness. HCWs were not required to use PPE as a measure of personal safety until the CDC introduced Universal Precautions in 1987 (CDC, 1996).

In 1991, OSHA issued its Bloodborne Pathogens Standard (29 CFR 1910.1030) to help protect workers from occupational exposure to blood and other potentially infectious material. The regulation requires employers to develop a written exposure control plan designed to reduce or eliminate employee exposure. The plan must address engineering and work practice controls to eliminate risk, a PPE program when exposure risk cannot be eliminated, and decontamination and removal procedures for regulated waste. In addition, annual training of employees, a vaccination program against Hepatitis B for at risk employees, evaluation of and follow-up with employees post exposure, and record keeping procedures must be described in the plan. In response to the Needlestick Safety and Prevention Act passed in October 2000, OSHA revised the Bloodborne Pathogens standard in 2001. In addition to previous requirements, employers are obligated to select safer needle devices for use in the workplace and annually review advances in technology that might reduce risk or injury. They are also required to involve non-management personnel in safe device selection and maintain a log of injuries resulting from contaminated needles or blades (Taylor, 2006).

Universal Precautions and PPE are only effective when used properly. Legally mandating the use of PPE through standards has not resulted in improved compliance (Akduman et al., 1999; Cutter & Jordan, 2004; Gershon et al., 1995; Nelsing, Nielsen, & Nielsen, 1997; Taylor, 2006).

OSHA, in its bloodborne pathogens standard (1991), goes one step further than the CDC. It not only recommends use of PPE but requires employers to provide PPE for employees and places responsibility for employee compliance in the use of PPE on the employer. This responsibility includes training all employees in the proper use of PPE prior to being assigned duties which may result in potential exposure and annual retraining (Gile, 2001). In addition, the standard requires employers to clean, launder, and dispose of PPE at no cost to the employee. Finally, the employer is required to repair or replace PPE to maintain its effectiveness (1910.1030 (d)(3)(i-v)). According to the OSHA standard, employers are accountable for the behaviors of their employees. If employees are found to be noncompliant with the use of PPE during inspection, employers are subject to citations and fines. In addition to the risk of exposure to occupationally acquired infectious disease for the failure to properly use PPE, employees are subject to disciplinary actions, reduction in workers' compensation claims, and loss of future employment opportunities (Taylor, 2006).

While employers are held accountable for the actions of their employees, they are not responsible for non-employee care providers (e.g., temporary agency workers, independent physicians, and students; Gile, 2001). The bloodborne pathogens standard applies to all full-time, part-time, temporary, and per diem employees of an organization. Although agency workers are covered by the standard, the responsibility for ensuring compliance rests with the agency employer, not the healthcare facility where the agency worker is assigned. While not legally required to provide PPE for non-employee workers, organizations have an ethical obligation to provide the same protection to non-employee care providers working at the facility as they do for employees.

Reporting of Exposure to Blood and Body Fluids

While exposure to blood and body fluids is a frequent occurrence in any operating room, fewer than 30% of all injuries are reported appropriately (Taylor, 2006). Not reporting injuries prevents accurate data analysis, hinders the development of public policy, precludes the initiation of counseling and prophylactic treatment if warranted, and prevents the establishment of legal prerequisites for workers' compensation (Makary et al., 2007).

Education can improve reporting of exposure to blood and body fluids (Holodnick & Barkauskas, 2000). The surgical services department at a university teaching hospital in the United States studied the effect of an education program on exposure reporting. Following a targeted educational intervention, the development of a streamlined exposure reporting kit and an awareness campaign that included exposure reporting information printed on the back of employee badges, surgical team members' reporting of blood and body fluid exposure increased. Prior to the intervention, reporting rates were 10.15 per 1,000 cases and rose to 14.10 per 1,000. In addition, the employee health office reported an over reporting of no risk exposures.

A descriptive correlational study was conducted to assess the level of compliance with reporting of blood/body fluid exposure among perioperative nurses in Australia and to isolate factors affecting reporting compliance (Osborne, 2003). Respondents in that study reported a high mean compliance rate with the intention to report blood/body fluid exposure (92%) but a very low rate of actual reporting (23%). Low reporting rates could lead public policy makers to underestimate the magnitude of the problem, resulting in less attention directed towards improving the situation. Barriers to reporting were cited by respondents as an inconvenient process, too much paperwork, and the long amount of time required to complete the necessary documentation. The author recommended that reporting systems be streamlined and surgical team members be encouraged to report all blood/body fluid exposures (Osborne, 2003).

A survey study was conducted to determine the incidence of needle-stick injuries, reporting patterns, and barriers to reporting by surgeons in training (Makary et al., 2007). By the time they reached their final year of surgical residency, 99% of respondents had sustained a needle-stick injury with 53% of those needle-sticks involving a high risk patient. Seventy-two percent (72%) of respondents reported the needle-stick occurred in the operating room. When describing the most recent injuries, 51% were not reported and 16% of those exposures involved a high risk patient. Injuries involving patients not considered high risk were less likely to be reported than those involving known high risk patients. Many respondents (42%) cited lack of time as the reason for not reporting the injury. To provide surgical residents a safer training environment, improved prevention strategies are needed along with improved reporting strategies (Makary et al., 2007).

Compliance with Use of Personal Protective Equipment

To investigate compliance with universal precautions and to isolate correlates of compliance, a confidential questionnaire was sent to 1,716 hospital-based HCWs from three different hospitals in geographically distinct areas. The hospital in the Midwestern United States had a low prevalence rate of bloodborne infection, the southwestern hospital had a moderate rate, and the mid-Atlantic hospital had a high rate. Compliance rates varied based on the item. Compliance rates were extremely high for glove use and disposal of sharps and low for others such as use of eye protection and protective clothing. Six correlates of compliance were isolated: (a) perceived organizational commitment to safety, (b) perceived conflict of interest between worker's need to provide care to patients and their need to protect themselves, (c) risk-taking personality, (d) perceived risk, (e) HIV transmission knowledge, and (f) universal precaution training.

Overall compliance rates were higher for Mid-Atlantic respondents than for those from the Midwest or Southwest. The results of that study allow for the development of targeted, specific HCW training to improve compliance with the use of PPE (Gershon et al., 1995).

Non-compliance with the use of PPE during operative or invasive procedures is not a phenomenon limited to North American healthcare facilities. A recent survey study of one National Health Service trust in the United Kingdom found that only 1.5% of respondents implemented standard precautions universally for all patients regardless of the presence or absence of a bloodborne illness (Cutter & Jordan, 2004). More than half of respondents admitted to considering factors such as nationality, sexual orientation, or lifestyle when determining the appropriate level of PPE. Three quarters of respondents (74%) reported having been accidentally exposed to blood or body fluids during the previous decade; however, the report rate of accidental exposures was determined to be low, with one third (32%) of respondents not reporting previous exposure. Finally, scrub nurses and midwives were more likely to report exposures than surgeons.

A nationwide questionnaire was sent to 9,384 hospital employed physicians in Denmark to determine compliance with PPE, reasons for noncompliance, and the associated exposures to blood and body fluids (Nelsing, Nielsen, & Nielsen, 1997). Results demonstrated an overall poor use of PPE with only 35% of respondents complying with proper use of PPE. Gloves were most commonly used (63%) and protective eyewear was least commonly utilized (11.5%). Reasons listed by respondents for not using PPE were: (a) it interferes with working skills, (b) not available, (c) wear glasses, and (d) forget. Respondents also provided details surrounding exposures to blood and/or body fluids with blood splashes in the eye being the most common among surgeons and pathologists. Blood on the hands was most frequently reported by other physicians. The authors estimated 84% to 98% of these exposures could have been prevented had the physician been wearing PPE (gloves and eye protection). Nationwide, these researchers found unacceptably low compliance with PPE and recommended increased education, ease of access to PPE, and improved design of barriers to reduce the risk and improve compliance (Nelsing et al., 1997).

Compliance with the use of PPE during operative procedures was studied to gain a deeper understanding of the mechanisms of blood contact experienced by surgical personnel (Akduman et al., 1999). Surgical procedures in four subspecialties were observed (cardiothoracic, orthopedic, gynecologic, and general surgery) by trained observers to document the use of PPE by surgical team members. In addition, behaviors of team members were recorded as were blood/body fluid exposures. Use of PPE by surgical team members in this study was described as suboptimal. Protective eyewear was worn only 44% of the time and 24% of participants wore no protective eyewear at all. Use of protective eyewear was highest for scrub nurses, residents, and medical students (60%), and lowest for attending surgeons (27%) and anesthesia providers (22%). The practice of double gloving was recorded only 28% of the time, and the announcement of sharps passage occurred during only 9% of observed surgeries. During the study period, 17 blood and body fluid exposures occurred, resulting in a 22% exposure rate. Generational differences may influence the use of PPE, medical students were more likely to wear goggles and residents were more likely to double glove (Akduman et al., 1999).

Based on the hypothesis that targeted education could reduce the occurrence of percutaneous injuries in the OR, nurses at one academic medical center in the Eastern United States developed and implemented an educational campaign aimed at all members of their surgical teams (Holodnick & Barkauskas, 2000). The educational intervention consisted of an awareness campaign that included lecture, video, local rates of injury; and to facilitate exposure reporting, the development and implementation of a streamlined body substance exposure kit. In addition, the researchers implemented an awareness campaign wherein information sheets and graphs (exposures per surgical service, personnel injured, causes of injury, and items implicated in the injury) were posted at each scrub sink. Surgical team members were required to scrub their hands prior to surgery for 5 minutes at these sinks, giving people sufficient opportunity to review the information. Information posted at the scrub sinks was changed every 2 weeks. Two posters were developed, one reminding personnel to properly wear PPE and the other reminding personnel that blood and body fluids are potentially hazardous. These posters were placed at the scrub sinks near soap dispensers. Exposure rates decreased following the educational intervention, and there was a noticeable increase in the use of PPE based on inventory levels (Holodnick & Barkauskas, 2000).

Summary

The proper and consistent use of PPE during operative/invasive procedures by members of surgical teams reduces the risk of acquiring bloodborne disease. Despite the provision of PPE in the workplace and the knowledge that PPE reduces individual risk of exposure, some surgical team members choose not to comply with regulations and recommendations related to exposure to pathogens (Gershon et al., 1995). This chapter provided the background leading to the development of PPE requirements by regulatory agencies and hospitals and a review of conceptual and empirical literature pertinent to the use or nonuse of PPE by surgical team members during operative/invasive procedures. Chapter 3 describes the research design used to study factors influencing surgical team members' choices of wearing or not wearing PPE during operative/invasive procedures. Chapter 4 presents the qualitative analysis, Chapter 5 presents the quantitative analysis, and chapter 6 discusses the results of the study including the implications of the research for surgical team members, limitations of the research, and recommendations for further research.

CHAPTER III

METHODS

This chapter opens with the purpose of the study and the research questions repeated verbatim from chapter 1. Next, the research design is discussed, including a description of the population, sample, and procedures for data collection and data analysis. Finally, the limitations of the study will be described, followed by a brief summary.

Purpose of the Study

Because reporting of exposures is inconsistent (Osborne, 2003) and health care organizations are unlikely to release data surrounding employee or patient exposure to bloodborne pathogens, this study surveyed related professional association members. The purpose of this mixed methods survey study was to (a) examine factors influencing surgical team members' choices of wearing or not wearing PPE during operative/invasive procedures, and (b) determine what would influence consistent use of PPE within and between each group of respondents.

Research Questions

The primary research question for the study was: What differences (perceptual and demographic) exist between surgical team members (surgeons, anesthesiologists, nurse anesthetists, registered nurses, and surgical technologists) that influence their choices of wearing or not wearing PPE during operative/invasive procedures?

The subsidiary research questions concerned these groups' perceptions about:

1. How does previous accidental exposure to blood or body fluids influence surgical team members regarding the use of PPE?

2. How do federal (OSHA) regulations influence surgical team members regarding the use of PPE?
3. How do hospital policies and procedures influence surgical team members regarding the use of PPE?
4. How do hospital leaders' attitudes encourage or discourage the use of PPE by members of surgical teams?
5. What is the influence of patients' needs on the use of PPE by surgical team members?

This mixed methods study utilized a parallel mixed data analysis approach. The survey instrument included questions that are both closed and open-ended. First I will describe the research design and later the quantitative and qualitative data analysis plan used.

Ex Post Facto Research Design

The research design used in this study was ex post facto (correlational). Ex post facto studies investigate relationships between variables. They do not determine cause and effect (Burns & Grove, 2004). In ex post facto designs, inferences about how variables relate to one another are made without direct intervention by the researcher (Kerlinger & Lee, 2000). Because this study sought to understand what factors influenced surgical team members' choices of wearing or not wearing PPE, an ex post facto design was appropriate.

There are three major weaknesses in studies using ex post facto designs: (a) the researcher is unable to manipulate independent variables, (b) the researcher is unable to randomize participants, and (c) the researcher may improperly interpret results (Kerlinger

& Lee, 2000). All three weaknesses relate to the internal validity of the design method. Internal validity is the ability to say that the effect on a dependent variable was a result of the independent variable (Newman, Newman, Brown, & McNeely, 2006). Because there is no control in this design to ensure that any results are due to an independent variable, causation cannot be inferred.

Conversely, ex post facto designs possess a relatively high degree of external validity. External validity deals with the extent to which study results may be generalized beyond the sample used in the study (Burns & Grove, 2004). It is the relative absence of experimental controls in this design method that allows for broad generalization of results (Newman et al., 2006). This high degree of external validity is further enhanced in this study by the large sample size of the population of interest.

Population and Response Rate

Members of professional organizations whose membership comprises surgical teams were surveyed. The professional organizations included in this study were the American College of Surgeons (ACS), American Society of Anesthesiologists (ASA), American Association of Nurse Anesthetists (AANA), the Association of periOperative Registered Nurses (AORN), and the Association of Surgical Technologists (AST). All totaled, these organizations have more than 200,000 members. The ACS has more than 70,000 members; the ASA has more than 41,000 members; the AANA has more than 35,000 members; the AORN has more than 40,000 members; the AST has more than 21,000 members. Membership in these professional organizations is voluntary. Therefore, some surgeons, anesthesiologists, nurse anesthetists, registered nurses and surgical technologists are members of surgical teams but not members of their professional organizations. It is unlikely that a member of any one of these organizations is simultaneously a member of any of the others. For the purpose of this study, members of these five organizations comprised the population of interest.

Because it was important to analyze groups separately (within group) and compared to one another (between groups), the response rate was determined for each of the five professional organizations independently. As population size increases, the percentage of the population needed to obtain a representative group decreases (Gay, Mills, & Airasian, 2006). In populations larger than 15,000 members a sample of 271 will provide sufficient statistical power (90% confidence interval, population proportion of $P = .5$, and a level of accuracy of $d = .05$; Newman & McNeil, 1998). Therefore, each of the five subgroups in this study required a minimum sample of 271 completed responses. Respondents were asked to identify themselves as surgeons, anesthesiologists, nurse anesthetists, registered nurses, or surgical technologists. Respondents were divided into these five classifications to compare and contrast responses between and within groups.

Procedures

This mixed methods study sought information about surgical team members' choices about wearing or not wearing PPE during operative/invasive procedures as well as demographic information (e.g., organizational information, profession, number of years of experience, level of education, gender, and age). This section will describe the survey instrument, survey instrument construction, development, and administration.

A non-experimental ex post facto, correlational design was used, allowing for the collection of data that can be self-reported. Ex post facto studies are used when researchers want to gather information about a particular topic of interest without manipulating variables (Burns & Grove, 2004). A mixed-method instrument was used (i.e., collecting both quantitative and qualitative data; Tashakkori & Teddlie, 2003). The addition of open-ended questions to a quantitative questionnaire helps the researcher analyze responses in an approach that is sensitive to context (Greene & Caracelli, 1997).

Survey Instrument Construction

The survey instrument that was administered in this study (see Appendix B) was adapted from a previous survey (see Appendix C) conducted in Great Britain (Cutter & Jordan, 2004). The purpose of the original study was to investigate blood and body fluid exposure reporting compliance and adherence to UP by surgeons, nurses, and midwives employed by one UK National Health Service trust. The survey instrument administered in this study (see Appendix B) was substantially modified from the original (see Appendix C). Four questions were added to capture specific demographic data (see Appendix B, questions 1, 2, 3, and 6). One question was added to determine respondents' self-reported awareness of federal regulations and hospital policy and procedure related to the use of PPE (see Appendix B, question 7). Three questions were added to allow respondents the opportunity to provide response in free text (see Appendix B, questions 9, 19, & 20). Five questions were added to support the specific research questions of this study which are substantially different than the original study (see Appendix B, questions 10 [primary research question], 15 [research question 5], 16 [research question 4], 17 [research question 3], and 18 [research question 2]). Two questions were modified to either reflect North American vernacular or include all study participant groups (see Appendix B, questions 4 and 8). One question in the original survey (see Appendix C, question 8) was separated into two questions for clarity and the nature of response was changed from ordinal data to categorical (see Appendix B, question 11) and continuous (see Appendix B, question 12) data. One question was expanded from the original survey (see Appendix C, question 9) to support the primary research question and explore the use or nonuse of PPE at the time of previous exposure to bloodborne pathogens (see Appendix B, question 13). In two questions the nature of data collected was modified to enhance analysis. Ordinal data were converted to continuous data (see Appendix B, question 11) and categorical data were converted to a Likert-type scale (see Appendix B, question 14). Finally, six questions from the original survey were deleted altogether as they related to the original study objectives (compliance with reporting of blood and body fluid exposure and familiarity with UP) but did not support the research questions in this study (see Appendix C, questions 3, 4, 6, 10, 11, and 12).

Final Instrument Composition

A survey instrument (see Appendix B) consisting of a combination of open-ended and different types of closed-ended questions was administered. Open-ended questions were used to generate more detailed responses and provided respondents the opportunity of answering in their own words (Greene & Caracelli, 1997). Closed-ended questions consisted of Likert-type scale items, ordinal items, numerical items, and categorical items. In the first few questions, respondents were asked to provide basic demographic data (age, gender, geographic location, profession, experience in years, and professional association membership; see Appendix B, questions 1, 2, 3, 4, 5, and 6). Next, respondents were asked to indicate on a Likert-type scale their degree of agreement to two statements regarding their awareness of both federal regulations (OSHA/Joint Commission) and hospital policy and procedure about the use of PPE (see Appendix B, question 7). The first closed-ended ordinal question was a multiple item question wherein respondents selected those exposure precautions they employ based on differing patient conditions such as bloodborne infection status (see Appendix B, question 8). This question was followed by providing the respondent the opportunity to elaborate in a free-text fashion. In the following questions respondents indicated rationale for not always using PPE (if applicable; see Appendix B, question 9), opinions as to what barriers needed to be overcome to consistently use PPE (see Appendix B, question 10) and lastly the respondents' blood and body fluid exposure (i.e., injury) history (see Appendix B, questions 11, 12, and 13). In a closed-ended Likert-type scale question ranging from strong influence to no influence respondents indicated to what degree certain factors influence their use of PPE such as, previous injury, education and training, OSHA regulations, etc. (see Appendix B, question 14). This question was also followed by an opportunity for the respondent to add a free text comment. Finally, in a combination of closed and open-ended questions respondents indicated to what degree patient care needs conflict with their use of PPE, respondents' history of exposure to blood and body fluids via injury, to what degree hospital leaders' attitudes encourage or discourage the use of PPE, and to what degree federal regulations or regulatory agency requirements encourage or discourage the use of PPE (see Appendix B, questions 15, 16, 17, and 18).

The following steps were taken to modify/adapt the instrument based on Fink's (2003a) methodology.

Initial Pilot Test

Pilot testing occurred in two distinct phases. First, six peers reviewed the survey instrument to assess questions for clarity and appropriateness. Results of the first pilot test helped guide survey revisions. For instance four questions were reordered to improve clarity and flow (see Appendix B, questions 4, 5, 11, and 13). Participant instructions were refined to help guide respondents when responding to the multiple item questions (see Appendix B, questions 8 & 14). Finally, the last multiple item question was changed from a yes/no response to a Likert-type scale (see Appendix B, question 14).

Secondary Pilot Test

Next, a convenience sample of 10 people, possessing similar characteristics to those who were surveyed, completed the survey and provided feedback (Fink, 2003a). Validity and reliability of the survey were assessed by this convenience sample. A minimum of 80% of reviewers agreed that the items identified as answering each research question did indeed measure that question (Validity; see Table 1). Reliability of the survey was measured when the same convenience sample was asked to complete the survey a second time, one week later. This test-retest method of measuring reliability (Burns & Grove, 2004) yielded a correlation of .82 on quantitative question items over the one week period.

Qualitative feedback from this convenience sample helped to further refine the survey. For instance, two questions were changed from collecting ordinal data to collecting continuous data (see Appendix B, questions 5, and 12). Two questions were reworded to further improve clarity (see Appendix B, questions 8 & 14). One question was reworded to avoid leading respondents to a particular response (see Appendix B,

Table 1

Research Questions and Corresponding Survey Items

Research Question	Survey Item	Expert Judge[a]
What differences exist between surgical team members that influence their choices of wearing or not wearing PPE during operative/invasive procedures?	See Questions 8 and 14.	90%
How does previous accidental exposure to blood or body fluids influence surgical team members regarding the use of PPE?	See Questions 11, 12, 13, and 14.	100%
How do federal (OSHA) regulations influence surgical team members regarding the use of PPE?	See Questions 14 and 18.	90%
How do hospital policies and procedures influence surgical team members regarding the use of PPE?	See Questions 14 and 17.	100%
How do hospital leaders' attitudes encourage or discourage the use of PPE by members of surgical teams?	See Questions 14 and 16.	90%
What is the influence of patients' needs on the use of PPE by surgical team members?	See Questions 14 and 15.	90%

[a] Percent of agreement of 10 judges that survey items measure specified research questions.

question 9) and finally, four questions were changed from collecting categorical data to Likert-type data (see Appendix B, questions 15, 16, 17, and 18). The final version of the survey instrument contained 20 items. Table 1 relates each research question with the corresponding item on the survey used to answer the question.

Survey Instrument Administration

Guided by Dillman's (2000) tailored design method of administering surveys, preplanned actions were performed in order to improve response rate. These included sending potential respondents e-mail reminders at 15 day intervals which has been shown to generate as much as 23 to 48 % of total survey responses and soliciting survey data from respondents who are interested in the topic (i.e., issue salience; Fink 2003a; Sheehan & McMillan, 2001). The researcher's contact information was provided in case the respondents experienced technical difficulties completing the on-line survey or preferred to complete the survey as a pencil and paper exercise. Table 2 provides a graphic display of the timing and steps that were taken to obtain maximum possible response rates.

The council on surgical and perioperative safety (CSPS) is a group comprised of seven professional organizations formed in February of 2004 to promote a culture of patient safety and a caring perioperative workplace environment (CSPS team web site, n.d.). Because the particular purposes of this study were in line with the mission of the CSPS, the membership of the five professional organizations of interest were accessed via the CSPS governing body (L. Groah, Executive Director/CEO, Association of periOperative Registered Nurses, personal communication, May 3, 2008). The two

Table 2

Timeline of Activities to Boost Response Rates

Time	Action
Initial survey administration	Survey e-mail sent
Fifteen days later	Reminder e-mail sent
Thirty days later & repeated each 15 days until minimum response received	Reminder e-mail sent

member groups of the CSPS which were not included in this study are the American Society of PeriAnesthesia Nurses (ASPAN) and the American Association of Surgical Physician Assistants (AASPA). ASPAN was not included in this study as their membership does not practice in environments where operative or invasive procedures are performed. AASPA was not included in this study as their membership is significantly smaller than each of the other groups, only 7,000, possibly limiting between group comparisons.

This survey was administered using SurveyMonkey®, a commercially available survey tool. SurveyMonkey® prevents multiple responses to the survey from the same respondent. All forms and web links were provided by the researcher to the designated representative from each of the organizations except for the AORN. AORN provided the member mail list directly to the researcher who e-mailed the members through SurveyMonkey®. The remaining organizations then e-mailed the survey solicitation and web links to their membership or posted it in their electronic newsletter (see Appendix D). This method maintained the privacy of the individual association members and at the same time provided additional validity to the study as it was endorsed by the professional organization.

Originally it was the researcher's intention to e-mail the survey solicitation letter and web link to each individual member of the five organizations. None of the organizations permitted such broad access and two of the organizations would not agree to send a specific e-mail concerning the study to its members at all. Rather, the AORN provided the researcher the e-mail addresses of 5,000 randomly selected members. The ASA e-mailed the survey solicitation and web link directly to 5,000 randomly selected members and the AANA e-mailed the survey solicitation and web link to 10,000 randomly selected members. Both the ACS and AST placed the survey solicitation announcement and web link in their electronic member newsletter which was sent to all members with an e-mail address on file. Except for the ACS, these approaches yielded satisfactory response from each organization's members. In a final attempt to obtain maximum possible responses from the surgeon group, the researcher attended a meeting of the department of surgery at the University of Miami (February 12, 2009) where an additional 17 completed surveys were obtained. Table 3 details the organization's solicitation method, the dates of each solicitation, and total number of surveys received.

Data Analysis

Both qualitative and quantitative data analysis procedures were used and are described in this section. Parallel mixed data analysis was used to examine the data, allowing for a deeper understanding of the relationships among variables (Tashakkori & Teddlie, 2003). Open-ended responses were analyzed using content analysis while closed ended responses were statistically examined.

Table 3

Respondent Solicitation and Methods

Organization	Solicitation Method	Initial Contact	Reminder Contact	Reminder Contact	Total Surveys
AANA	Web link in e-mail from organization	01/16/2009	N/A	N/A	437
ACS	Web link in member newsletter	01/15/2009	01/30/2009	02/06/2009	235
AORN	Web link in e-mail from SurveyMonkey®	01/19/2009	02/02/2009	N/A	342
ASA	Web link in e-mail from organization	02/02/2009	N/A	N/A	366
AST	Web link in member newsletter	01/23/2009	N/A	N/A	486

Qualitative Data Analysis

Open-ended survey responses were analyzed initially using content analysis (Boyatzis, 1998). The content analysis technique sorts words into categories based on their congruence with the theoretical frameworks (Burns & Grove, 2004). By counting the occurrence of important words a systematic approach to measure the intensity, order, or frequency of words, phrases, or sentences is established. Content analysis is either manifest or latent (Boyatzis, 1998). Manifest content analysis is counting the exact word or phrase of interest while latent content analysis is more interpretive, examining underlying aspects of certain phenomenon (Boyatzis, 1998). Content analysis was performed by dividing text into specific units of meaning (Burns & Grove, 2004). These units of meaning were clustered around elements of the TRA. Content analysis was used for each participant sample individually (surgeon, anesthesiologist, nurse anesthetist, registered nurse, and surgical technologist). To accomplish this, each group's responses to open-ended questions were read and common elements were identified and counted for each group sample separately.

In this same fashion, latent content analysis was performed across each sample to determine similarities and differences between the groups. This was achieved by comparing each sample one at a time to the surgeon sample as a focal point. In this fashion, the surgeon sample was first compared to the anesthesiologist sample, then compared to the nurse anesthetist sample, the registered nurse sample and finally, the surgical technologist sample (see Table 4).

Table 4

Matrix for Content Analysis of each Sample to all Other Samples

Principle Group	Comparative Groups			
ACS	ASA	AANA	AORN	AST
ASA	AANA	AORN	AST	
AANA	AORN	AST		
AORN	AST			

Quantitative Data Analysis

The entire survey instrument was coded, assigning numerical labels to nominal and ordinal scale data to allow for data entry. All quantitative data were entered into a Statistical Package for the Social Sciences (SPSS) database (version 16.0) and were examined for relationships among variables such as years of experience, gender, profession, and frequency of use or nonuse of PPE. Characteristics of the groups were analyzed using descriptive statistics that included percentage, frequency, mean, and standard deviation (see Appendix B, questions 1, 2, 3, 4, 5, and 6). For instance, description of participants' profession is reported in frequency counts and percentages.

Data from the Likert-type scale items are reported in percentage, frequency, mean, and standard deviation (see Appendix B, questions 7, 8, 14, 15, 16, 17, and 18). Additionally, principal component analysis was performed on these Likert-type scale items in order to examine interrelationships among the large numbers of variables (Kerlinger & Lee, 2000; Newman et al., 2006; Rummel, 1970; Stevens, 2002; Tabachnick & Fidell, 2007). Principal component analysis can be used for two distinct purposes: (a) to search for possible relationships among a group of variables or, (b) to test specific hypotheses about particular constructs. In this study principal component analysis was used to seek out possible relationships among variables. It is important to note that the production of a factor through principal component analysis in and of itself is not necessarily meaningful (Newman et al., 2006). A factor is only meaningful if it can be interpreted. Factor rotation enhances interpretation (Kerlinger & Lee, 2000; Newman et al., 2006; Rummel, 1970; Stevens, 2002; Tabachnick & Fidell, 2007). The varimax method of orthogonal rotation is a commonly used technique which was used in this study. The method produces either high or near zero factor loading, making the factor easier to interpret.

Multiple linear regression models were used to isolate variables that predicted the occurrence of other variables. Variables were isolated by purposefully and systematically controlling the effects of other variables. The advantage of building regression models lies in their ability to determine that isolated correlations have a higher probability than occurring just by chance (McNeil, Newman, & Kelly, 1996). Models were run which looked at sets of independent demographic variables believed to predict the dependent variable. Then, different independent variables of interest were examined to see if they accounted for unique variance in predicting these dependent variables while controlling for demographic influences (McNeil, Newman, & Kelly, 1996). For instance, models were constructed that examined the effect of age on the use or nonuse of double gloves while controlling for variables such as profession, gender, years of experience, and geographic location. Then a model was constructed that examined the effect of gender on the use or nonuse of double gloves while controlling for age, etc. Multiple linear regression is more flexible than traditional analysis of variance, allowing for testing of relationships between continuous variables, between categorical variables, or between continuous and categorical variables (McNeil, Newman, & Kelly, 1996). To be consistent with prior social science research, in all cases the level of significance was set at $p < .05$.

Data Management

The returned surveys were saved on a jump drive and kept in a locked filing cabinet in my home office. All surveys will be kept for 3 years from the completion of the study after which time the data will be erased.

About the Author

Born and raised in Montreal, Canada I graduated from a 3 year community college nursing program in 1984. I subsequently obtained a Bachelor's degree (University of Ottawa) and a Master's degree (University of Miami) both in Nursing. Currently, I am a student in the College of Education at Florida International University pursuing a Doctor of Education (Ed.D.) degree. Immediately after graduating from nursing school, I began to practice nursing in a specialty area and have remained in specialty nursing environments throughout my career.

While concentrating in only two clinical areas, I have had many roles during my career including staff nurse, supervisor, head nurse, clinical nurse specialist, adjunct professor, associate director, director of nursing, and chief nursing officer. All of these roles have helped shape the person I am today. In addition, I have been board-certified at one time or another in critical care, operating room nursing, recovery room nursing, and advanced nursing administration. Currently, I hold two board certifications: operating room nursing and advanced nursing administration. I have been active on the national scene as well, serving one term as a member of the Board of Directors of the Association of periOperative Registered Nurses (AORN).

I believe that hospital systems exist so that patients may be the recipients of nursing care, that nurses hold the healthcare system together, and that nursing is an altruistic profession, fundamentally interested in the benefit of others.

Limitations

The limitations of this study include its reliance on respondents to accurately self-report behavior surrounding the use of PPE. Respondents may have answered survey questions according to how they believe they should behave rather than how they actually do behave. In addition, despite the anonymity of the survey, respondents may have feared repercussions for admitting non-use of PPE. The different methods used to recruit subjects (individual e-mail versus survey solicitation in an electronic newsletter) is a potential limitation. Not having obtained the minimum completed survey response of 271 from the surgeon group may limit generalization of results to other surgeons. Finally, as there are members of surgical teams who are not members of their association, generalization of the results may be limited.

Summary

Using an ex post facto research design, this study examined factors influencing surgical team members' choices of wearing or not wearing PPE during operative/invasive procedures. The members of five professional associations (ACS, ASA, AANA, AST, and AORN) were surveyed using a survey questionnaire consisting of closed-ended and open-ended questions. Data was analyzed both qualitatively and quantitatively to investigate the factors involved in using or not using PPE.

CHAPTER IV

QUALITATIVE ANALYSIS

This chapter presents the qualitative analysis. There are eleven sections to the chapter. The first section describes the sample followed by a section describing the latent and manifest content analysis method. The next seven sections present the results for each of the open-ended survey questions. The next section presents the themes that were common across questions followed by a summary.

Description of the Sample

A total of 1, 878 respondents participated in the survey. Of those, 57.7% were female (*N* = 1,077) and 42.3% (*N* = 789) were male. The participants represented four geographic regions. Twenty percent (*N* = 382) were from the Northeast; 28% (*N* = 531) from the Midwest; 33.4% from the South (*N* = 623); and 17.64% (*N* = 329) from the West. All participants were asked to report their profession. The professions represented included: (a) anesthesiologists (19.61%, *N* = 366), (b) nurse anesthetists (23.42%, *N* = 437), (c) registered nurses (18.33%, *N* = 342), (d) surgeons (12.59%, *N* = 235), and (e) surgical technologists (26.05%, *N* = 486; See Table 5).

The average age of the participants of this research was 48.29 years and the average length of time respondents had been in their profession was 18.96 years. Anesthesiologists had an average age of 50 years with 19 years experience in the profession. Nurse Anesthetists had an average age of 48 years with 17 years of experience in the profession. Registered Nurses comprised the oldest and most experienced respondent group with an average age of 54 years and 30 years of experience. Surgeons had an average age of 50 years with 20 years of experience.

Finally, surgical technologists represented the youngest and least experienced group with an average age of 43 years and 12 years of experience. Even this youngest and least experienced group of respondents had practiced their profession for a considerable amount of time (See Table 6).

Table 5

Demographic Data

Variables	Frequencies	Percent	Valid Percent	Cumulative Percent
Geographic Location				
Northeast	382	20.34	20.48	20.48
Midwest	531	28.27	28.47	48.95
South	623	33.17	33.40	82.36
West	329	17.52	17.64	100.00
Profession				
Anesthesiologist	366	19.49	19.61	19.61
Nurse Anesthetist	437	23.27	23.42	43.03
Registered Nurse	342	18.21	18.33	61.36
Surgeon	235	12.51	12.59	73.95
Surgical Technologist	486	25.88	26.05	100.00
Gender				
Anesthesiologist				
Men	284	77.60	78.00	78.00
Women	80	21.90	22.00	100.00
Nurse Anesthetist				
Men	212	48.50	48.50	48.50
Women	225	51.50	51.50	100.00
Registered Nurse				
Men	26	7.60	7.60	7.60
Women	316	92.40	92.40	100.00
Surgeon				
Men	186	79.10	79.80	79.80
Women	47	20.00	20.20	100.00
Surgical Technologist				
Men	78	16.00	16.10	16.10
Women	405	83.30	83.90	100.00

Table 6

Age and Time in Profession

Variables	*N*	*M*	*SD*
Age			
Anesthesiologist	362	49.60	9.26
Nurse Anesthetist	436	47.94	10.03
Registered Nurse	336	54.29	7.36
Surgeon	233	49.71	10.54
Surgical Technologist	485	42.68	10.45
Time in Profession			
Anesthesiologist	365	19.49	9.44
Nurse Anesthetist	437	16.84	11.84
Registered Nurse	339	30.29	9.19
Surgeon	232	20.34	10.54
Surgical Technologist	481	11.79	10.96

Content Analysis

Content analysis was performed to analyze responses to the seven open-ended questions posed in the survey. First manifest content analysis was used to capture important phenomena in the responses (Boyatzis, 1998). This was done by counting the number of times exact words or phrases of interest were mentioned. Data were originally examined within each respondent group and then across each group to determine similarities and differences between the groups. Latent content analysis, more interpretive than manifest, was then conducted to identify themes occurring within and across respondent groups (Boyatzis, 1998). Each group was analyzed separately and individually. Common themes that emerged in each group were then identified and compared across groups.

Percentage of respondents who chose to answer open-ended questions showed little variability across respondent groups and ranged from 41% to 51%. Among anesthesiologists who completed the questionnaire, 51% responded to one or more open-ended question. Nurse anesthetists were similar to their physician colleagues, with 49% responding to one or more open-ended question. Forty-one percent (41%) of the registered nurses who participated completed one or more open-ended question while 52% of surgeon respondents chose to do so. Finally, 47% of surgical technologists who responded completed one or more open-ended question. These high response rates suggest that the topic of PPE is important to these respondents.

The next seven sections will present the qualitative data and content analysis for each of the open-ended questions.

Provide the Reason(s) for No, Limited, or Occasional Use of Personal Protective Equipment During Operative/Invasive Procedures.

This first open-ended question asked respondents to discuss their perceptions of why they may not wear complete PPE during operative/invasive procedures. The table below sorts responses by frequency (counts) and by respondent groups. Following the table, responses are discussed by group and sample, verbatim responses are provided.

Table 7

Reason(s) for No, Limited, or Occasional Use of PPE

Reason	Surgical Team Member				
	Anesthesiologist	CRNA	Registered Nurse	Surgeon	Surgical Technologist
Comfort/Function	56	38	16	50	33
Availability	18	11	5	12	14
Habit	5	10	4	5	5
Perceived Low Risk	6	6	17	6	
Time Pressure	7	7	5		3
Surgeon Resistance to Neutral Zone[a]					7

[a] an area where sharps are placed by the technologist and picked up by the surgeon.

Anesthesiologists

The most common response by anesthesiologists to this question concerned their physical comfort while wearing PPE as well as the increased difficulty of performing anesthesia related tasks while wearing PPE. One respondent noted, “I wear glasses and PPE is awkward on my face, creating a glare that impairs my vision.” Another said, “Lose tactile sensation for IV starts in small children. Disposable gloves ill fitting and uncomfortable. Glasses with eye shields distort vision.” These respondents commented frequently that gloves interfere with their work (i.e., starting and securing invasive lines) and eye shields inhibit their vision. The second most common response by anesthesiologists concerned the lack of easy availability of PPE in their setting. Other responses by this group were related to the time pressures associated with contemporary operating room settings, perceived low risk, and habit. One respondent commented, “Risk of eye contamination during anesthesiology related procedures is extremely small.” Another noted, “Not trained that way – hard to break habits learned during training.”

Nurse Anesthetists

Nurse Anesthetists responded to this question much the same as their anesthesiologist colleagues. Comfort/function was the most common reason for their non-use of PPE and comments were also similar to the anesthesiologist group. The next most frequent response to this question cited lack of availability of PPE as the reason for nonuse followed by habit, time pressure, and perceived low risk.

Registered Nurses

The most common reason that registered nurse respondents did not wear PPE was the view that when circulating, there was minimal risk thus protective eyewear was not worn. “When circulating on cases when I’m confident there will be no splashes or spills, I’ll usually omit eye protection.” The next most common reason for not wearing PPE during operative/invasive procedures by registered nurses was issues related to comfort/function. Similar to both anesthesiologists and nurse anesthetists, comments from registered nurses centered around three principal areas: face shields glare and/or fog, double gloves affect tactile sensation, and reinforced surgical gowns are too warm. “If I wear goggles or a face shield, they fog up.” “Reinforced gowns are too warm, do not want to sweat over the patient or fog up eye wear, then you can’t see.” “The only area I balk at is double gloving as I have not been able to find a comfortable combination that does not limit my dexterity while scrubbing ‘delicate’ cases.” The last three responses from this group were availability, time pressure, and habit.

Surgeons

The most common reason cited by surgeons for not wearing PPE involved issues of comfort/function. Statements relating to face shields fogging, double gloves limiting dexterity or sensation, and reinforced gowns being too warm were repeated by this group of respondents. “I used to wear glasses which provided some eye protection. Face shields are cumbersome and fog up, impeding vision. Double gloving makes my hands numb.” “Gloves don’t fit properly when double gloved. Eye shields fog and have flaws in them that interfere with vision. Waterproof gowns are too hot and cause fluid to run onto ankles, socks, and shoes.”

> Sharps are needed. Many of the "safety" measures like needle covers get in the way of certain procedures. Safe handling of sharps, such as in a tray, is far more helpful. Many safety shield blades are nice for skin but are useless when a blade is needed deep in a body cavity. Double gloving is cumbersome, limits dexterity, and fingers can fall asleep - I only do it for patients at high risk. Sometimes, doing what you are most familiar and comfortable with is the safest option.

Availability of PPE was the second most frequent reason cited by surgeon respondents for not consistently using PPE during operative/invasive procedures, followed by perceived low risk, and habit. Comments included, “Lack of accessibility”, “Only a low risk of infection/exposure”, and “bad habit”.

Surgical Technologists

As cited by other groups, comfort/function was the most common reason for nonuse of PPE during operative/invasive procedures by surgical technologists. “Double gloving disables my dexterity and sensitivity. I actually feel safer when only wearing one pair of gloves as I can feel what I need." "Full face visors fog or cause a glare, decreasing visibility and increasing risk of sharp injury." "Comfort, reinforced gowns can burn you up especially if emergency heat is used during the case. Also if you are in a case that is 12+ hours it is just too uncomfortable." The second most commonly cited reason that surgical technologist respondents did not use PPE was lack of availability, followed by surgeon resistance to using a neutral zone (an area where sharps are placed by the technologist and picked up by the surgeon), habit, and finally, time pressure. This group of respondents spoke about surgeons' reluctance to use a hands free method for passing sharps: "Surgeons don't want to pick up or replace sharps themselves, they don't want to look away from the surgical field." "When I try to use an emesis basin to pass sharps, the surgeons tell me to get rid of it."

Across Group Analysis

In looking at similarities and differences across each group with respect to this question, each group listed comfort and function of PPE, availability of PPE, and habit as a reason for no, limited, or occasional use of PPE during operative/invasive procedures. These three themes are either specifically related to product performance, external environment, or original training and experience. As such, each of these would reasonably cross all respondent groups. All groups except for surgical technologists listed perceived low risk. Surgical technologists, perhaps by the very nature of their work are at most risk of exposure to blood/body fluids during operative/invasive procedures. Anesthesia providers and circulating nurses perceive a low risk of blood and body fluid splash while the surgeon is generally in control of the contaminated sharps. All groups but the surgeons listed time pressure. Operating rooms are time sensitive, frequently measuring performance through indicators such as first case on time start accuracy and room turn around time between procedures. Time is money. Surgeons are the only group of respondents in this study who have the freedom/power to take their patients (i.e., their business) to other facilities that might be faster. It makes sense that all groups except for the surgeons' would feel this time pressure. Finally, only the surgical technologists listed surgeons' resistance to neutral zone. This too is logical since surgical technologists are the only group in this study who are responsible for handing and retrieving sharp objects to/from surgeons.

What Barriers Must be Overcome to Consistently use Personal Protective Equipment During Operative/Invasive Procedures.

This second open-ended question asked respondents to document their perceptions of barriers to using PPE consistently during operative/invasive procedures. The table below sorts responses by frequency (counts) and by respondent groups. Following the table, responses are discussed by group and some sample, verbatim examples are provided.

Table 8

Barriers to Overcome to Consistently Use PPE

Barriers	Surgical Team Member				
	Anesthesiologist	CRNA	Registered Nurse	Surgeon	Surgical Technologist
Availability	47	48	22	25	16
Improve Product	41	51	27	21	47
Leadership	11	8	14	5	20
Education	9	18	27	7	20
Change Habit	15	10		6	2
Time Pressure	14		6		

Anesthesiologists

The most common response to this question from anesthesiologists was to improve the availability of PPE followed by improving the PPE itself. One respondent noted, “Ready availability, convenience, time saving, non-fogging eyewear, and most importantly, preservation of natural tactile senses.” Another commented, “The quality of the barrier must not interfere with performing the task at hand. They must be easily and immediately available, and they must be comfortable. If not, they won’t be used.” The remaining barriers that must be overcome if PPE is to be worn consistently, according to this group of respondents, were leadership, education, habit, and time pressures. One respondent commented, “This needs strict enforcement of hospital policies, incentive and punishment for using or not using it.” Another noted the importance of both education and leadership by noting, “Educate staff frequently about infectious diseases and implement policies and procedures with consequences.” Habit was noted to influence the use of PPE. One respondent said, “Will need to change the culture/habit of those taking care of patients so that it becomes strange not to use protection.” Finally, time pressure was noted to negatively impact the use of PPE. “Eliminate the time pressure. As long as there is a time push, other things like PPE, will be compromised.”

Nurse Anesthetists

While responses to this question were similar to their anesthesiologist colleagues, this group of respondents identified improving the quality of PPE as most important, followed by improving the availability. One respondent said that PPE would have to be, “more comfortable, non-fogging, non-constrictive, easy to don and change” if care providers were ever to consistently use them during procedures. Another suggested that, "making sure that PPE are available and right there in the room or in pre-op areas, I believe if they were in each room right at hand, most people would wear them" was the most effective way to ensure consistent use. The three remaining barriers to overcome so that PPE can be consistently used were leadership, education, and habit.

Registered Nurses

Like nurse anesthetists, the most common barrier identified to the consistent use of PPE by registered nurses was the quality of the product, followed by PPE availability. One respondent perhaps identified the root of the product performance issue when she stated, "Provide gloves that allow me to feel and eye protection that allows me to see." Accessibility was identified as a barrier when PPE is not immediately available where it will be used. One respondent said, "Eye protection and other PPE must be readily available, where I'm going to use it, not down the hall! They must be easy to use and readily available." Leadership, education, and time pressure were the final three barriers identified by this group of respondents. One respondent suggested that, "Wearing PPE starts at the top. The chief of surgery or nurse managers must mandate their use and then follow up with noncompliant staff." As for the barrier of education one respondent said, "I think everyone needs training about why it is important. Education, enforcement of policies, provide evidence-based data and leadership accountability." Perhaps more than any other single response, one respondent summarized the various themes most succinctly.

> PPE must be readily available, disposable and comfortable. Usually good visibility for eye protection is a must, breathability or lightweight fabric for temperature control. This must all be enforced by the OR managers and charge staff, ensuring we have the time necessary to comply with these important safety practices. Team members who don't comply should

be dealt with immediately, point it out and demand conformity. After all, it's for everyone's safety.

Surgeons

Surgeon respondents identified similar barriers to the consistent use of PPE as did all other groups. Availability, improved product, the actions of leadership, education of the users, and the need to change the user's habit were all identified. Availability for this group had a slightly different nuance as the surgeon's concern was he/she did not want to have to wait for someone to get the PPE. This was exemplified by this respondent who stated, "The PPE must be convenient. I will not wait for a special gown or a second pair of gloves to come from central supply for example." Otherwise, all comments from this group were very similar to other groups.

> For physicians, I think it is a comfort issue or difficulty adjusting to new habits. For me, double gloving is not comfortable and interferes with my tactile feel of instruments and tissue, so I tend not to use two layers and face shields have a terrible glare so I go without eye protection. I need to be able to see what I'm doing. Using PPE needs to be very routine and easy so there are no time delays.

Surgical Technologists

The last group, surgical technologists like all other groups identified similar barriers and wrote similar comments regarding the consistent use of PPE. Overwhelmingly, this group mentioned product performance as the most common barrier. One respondent stated, "The biggest challenge is finding a mask that will prevent glasses from fogging and getting others to realize that they can operate with two pairs of gloves." The other performance problem frequently mentioned was the warmth of the reinforced surgical gowns, "For impervious gowns to become standard, it would be nice if they were not as hot. I work in pediatrics and the surgeons have to operate in 80+

degree temperatures when we are working on neonates." When discussing the need for education to break down barriers, this group spoke about the sense of invincibility often exhibited by their team members. One respondent represented the sentiment of the group.

> I think the barriers are the "it will never happen to me attitude" - education is the key. We all have to keep in mind that anything can happen at any time and most of the time it happens when you least expect it. Taking the time to don PPE before a procedure prevents regret that you didn't use it after the procedure. You must protect yourself.

Across Group Analysis

In looking at similarities and differences across each group with respect to this question, each group listed availability, improved product, leadership, and education as perceived barriers to overcome to consistently use PPE during operative/invasive procedures. Respondents expressed a need for PPE immediately available at the point of use rather than in a more remote location. Product performance was also discussed by all respondent groups. Protective eyewear fogs or distorts vision, two pairs of gloves limit tactile sensation and cramp the fingers, and reinforced gowns are too warm. All of these performance characteristics serve as a barrier to the products' use. According to comments from respondent groups, effective leadership would serve to remove barriers to the use of PPE. Leaders should articulate expectations of consistent PPE usage, reward those who perform as expected and discipline those who do not. Finally, the last barrier common to all groups was education. Respondents suggested that frequent education regarding bloodborne disease and prevention through the use of PPE would remove barriers to consistent PPE use. Surgical technologists took a slightly different approach to viewing education as a barrier. Respondents suggested that surgical team members as a group may be more prone to a belief that exposure to bloodborne pathogens is something that happens to other people. According to these respondents, this fallacy could be addressed through education along with education about pathogens and prevention of exposure through the proper and consistent use of PPE. All groups except for registered nurses identified habits as a barrier to the consistent use of PPE. This is likely due to the fact that most registered nurses function in the circulating role. In this role they would rarely be required to start IVs (where gloves would interfere with their dexterity), not wear surgical gowns (causing them to feel warm), and most circulators choose not to wear eye protection (eliminating the visual distortion or fogging experienced by their other team members). Given all of this, the registered nurse group would reasonably not view habits as a barrier to the consistent use of PPE. Finally, only two groups of respondents described time pressure as a barrier to the use of PPE, anesthesiologists and registered nurses. As previously described, operating rooms are time sensitive environments. Therefore it could be expected that in addition to anesthesiologists and registered nurses, nurse anesthetists and surgical technologists might also view time pressure as a barrier to the use of PPE.

Please Explain how Patient Care Needs Do or Do Not Conflict with the Use of PPE

This third open-ended question asked respondents to explain how they perceive patient care needs do or do not conflict with the use of PPE. The table below sorts responses by frequency (counts) and by respondent groups. Following the table, responses are discussed and some sample, verbatim examples are provided. Because the breath of responses is so limited, and response categories appear to have emerged specifically related to individual tasks of the care providers, responses from anesthesiologists and nurse anesthetists will be discussed together as will responses from registered nurses and surgical technologists.

Table 9

Patient Care Needs Conflicting with the Use of PPE

Patient Care Need	Surgical Team Member				
	Anesthesiologist	CRNA	Registered Nurse	Surgeon	Surgical Technologist
Emergency	23	35	31	16	22
Difficult IV	21	28			
Patient Need for Human Touch			6		3

Note. IV = Intravenous

Anesthesiologists and Nurse Anesthetists

When asked to explain how patient care needs do or do not conflict with the use of PPE both anesthesiologists and nurse anesthetists had similar responses. These groups identified emergency situations and while inserting difficult intravenous catheters as instances where PPE is difficult to use during patient care. One anesthesiologist respondent wrote, “only during extreme emergency when time is of the essence and equipment not immediately available would I not wear PPE. I will put on PPE as soon as possible though.” A nurse anesthetist responded, “If a patient starts vomiting or spitting sputum, the airway may be at risk and gloves or protective equipment may not be at hand. It comes down to me or the patient.” The second instance where patient care needs conflict with the use of PPE for these two groups is during the insertion of invasive lines. An anesthesiologist responded, “I still find it difficult to palpate a vein for IV starts through a glove." While another said, "Occasionally tactile sensation is improved without gloves; tearing tape is almost always hindered by gloves." This same sentiment was expressed by the nurse anesthetists. "Gloves (single or double) interfere with dexterity. During a difficult stick, I believe I can better start an IV if I cut out one finger or don't use gloves at all. Wrong, I know."

Registered Nurses and Surgical Technologists

Similar to the prior two groups, registered nurses and surgical technologists identified emergency situations as times when patient care needs may conflict with the use of PPE. One registered nurse respondent stated, "If a patient has a critical need and I don't have on PPE, I would tend to take care of the critical need rather than delay to place PPE." A surgical technologist respondent added, "Sometimes you can't always quickly grab a pair of gloves to assist. You have to just do what you gotta do." Unlike any other group however, these groups also identified the patient need for human touch as a time when PPE use may conflict with patient care. A registered nurse stated, "Patients often are nervous and want to hold your hand during anesthesia induction. They don't want to feel latex!" while another said, "If there is no possibility of encountering fluids, I don't always wear gloves. Human touch with gloves is not human touch." This sentiment was echoed by surgical technologist respondents. One example comes from the surgical technologist who said, "If it is before intubation and you are there and can hold the patient's hand for comfort you should not wear gloves. It is at these moments that the human touch is the ultimate in comfort."

Surgeons

Surgeon respondents only identified one instance when asked to explain how patient care needs do or do not conflict with the use of PPE, emergency situations. One respondent said, “When a patient codes, the minute it takes to completely gown and glove is a minute wasted in resuscitation.”

Across Group Analysis

All respondent groups identified patient emergencies as instances where care needs may conflict with the use of PPE. Care providers indicated that if necessary, they would provide needed care, potentially placing themselves at risk for contact with pathogens, rather than delay care in order to don PPE. Anesthesiologists and nurse anesthetists were the only two groups who identified difficult IV or invasive line insertions as instances where PPE can interfere with patient care. The insertion of intravenous and other invasive lines is generally the sole domain of anesthesia providers. It is reasonable that these two groups would identify this potential conflict. Finally, registered nurses and surgical technologists were the only two groups that identified the patient need for human touch as a potential conflict to the use of PPE. Surgical and invasive procedures are anxiety provoking experiences for most people. The operating room nurse has often been portrayed as the last person the patient sees as they fall to sleep and the first person they see when they awaken. This is a role perioperative nurses have embraced. In some settings, it appears that surgical technologists have also adopted the practice. Skin-to-skin contact, human connectedness during emotional times provides a reassuring presence and can be viewed as primary nursing intervention.

Please Explain how Leaders' Attitudes Influence the Use of PPE

This fourth open-ended question asked respondents to explain how they perceive leaders' attitudes influence the use of PPE. The table below sorts responses by frequency (counts) and by respondent groups. Following the table, responses are discussed and some sample, verbatim examples are provided. Because responses are so similar, all groups will be discussed together rather than individually.

Table 10

Leaders' Attitudes and the Use of PPE

Anesthesiologist	CRNA	Registered Nurse	Surgeon	Surgical Technologist
		Weak Influence		
11	22	14	4	24
		Strong Influence		
5	11	27	7	34

Responses to this question, regardless of the respondent group fell into two categories. Leaders' attitudes in respondents' workplaces were noted to either weakly or not at all influence the use of PPE or strongly influence its use. One anesthesiologist responded, " The leaders in my hospital talk about the importance of PPE but their conduct does not support that." A nurse anesthetist responded, " The party line says use them, but many of my superiors are deficient in their use of PPE." While another nurse anesthetist observed,

> The leadership encourages the use of PPE but does not always practice in that manner. There are great inconsistencies between the practice of the Chairman, Chief CRNA, and many anesthesiologists. However, their practice does not have a great impact on my practice – I would still protect myself in the same manner.

Registered nurse respondents shared similar sentiments. “My manager/Director doesn't seem to care if we use PPE especially eye protection. My own risk assessment strongly influences my choice to use/not use PPE, but leaders doing the right thing remind everyone of the correct behavior.” Few surgeon respondents chose to respond to this open-ended question. One who did observed the following, “No one is talking about it. It is strictly up to me when it comes to the use of PPE.” Finally a surgical technologist responded, “All supplies are available and the day you start working there you are told where they are and how to use them. But they don’t make you use them.” Another noted, “The higher ups don’t seem to take this seriously. They teach one thing but they themselves do the opposite…very frustrating.”

Responses indicating that leaders’ attitudes strongly influenced the use of PPE were also found across all groups. An anesthesiologist respondent noted, “Our department is regularly reminded to comply with the rules” and a nurse anesthetist responded, “my supervisor has gone out of their way to incorporate the needleless systems, along with comfortable and plentiful PPE.” Registered nurses also provided comments indicating how leadership can influence the use of PPE. One respondent said, “Good leadership and leadership example helps reinforce me taking the time to use PPE properly.” A surgeon respondent observed, “The hospital has a strong policy and supervision of compliance.” Surgical technologists mirrored these observations. One respondent commented, “If the leader constantly encourages use then it influences me to use it." While another noted, "Everyday first thing at the morning meeting she stresses wearing protection, not wearing protection will grant you a warning."

Leaders' attitudes are perceived to influence the use or nonuse of PPE by surgical team members. PPE use is negatively influenced when leaders are either silent on the issue or when they themselves set a poor example. Leaders should be aware that an attitude of do as I say, not as I do is immediately noticed by surgical team members. PPE use is positively influenced when leaders encourage and enforce the use of PPE and role model the expected behavior. Leaders who walk the walk and talk the talk are effective in setting a standard accepted by members of surgical teams.

Please Explain how Hospital Policy and Procedure Influence the Use of PPE

This fifth open-ended question asked respondents to explain their perception of how hospital policy and procedure influence the use of PPE. The table below sorts responses by frequency (counts) and by respondent groups. Following the table, responses are discussed and sample verbatim examples are provided. Because responses are so similar, all groups will be discussed together rather than individually.

Table 11

Hospital Policy and Procedure and the Use of PPE

Anesthesiologist	CRNA	Registered Nurse	Surgeon	Surgical Technologist
Policy Not Enforced				
4		7	18	3
Policies Exist to be Followed				
	11			31
No Effect				
	11			19

When asked to explain how hospital policy and procedure influences the use of PPE, respondents generally acknowledged the existence of a policy but comments focused on whether or not the policy was enforced by members of management staff. A policy can only have influence over a phenomenon if following the policy is rewarded and not following the policy has negative consequences. All respondent groups except for nurse anesthetists noted that the policy regarding the use of PPE at their facility was not enforced by leadership. One surgeon respondent noted, "The policy is there but rarely reinforced. The wearing of eye protection is the most ignored. People will put double gloves on but not wear a face shield – go figure." A registered nurse commented, "Policy states that PPE should be worn – management does not enforce it."

Nurse anesthetist and surgical technologist respondents both noted that hospital policy and procedure has a positive influence on their use of PPE as rules (policies) should be followed. One nurse anesthetist responded, "Wanting to abide by hospital policy is certainly an influence in my decision to use or not use PPE." One surgical technologist concurred, "If there is a policy, then there is a safety reason for it and I will be very influenced."

Finally, these same two groups, nurse anesthetists and surgical technologists also commented that hospital policy had no effect on their use of PPE. But rather, they would use PPE regardless of what the policy did or did not require as they were motivated by self protection. One nurse anesthetist said, "I would use the recommended precautions regardless of hospital or OSHA standards." Two surgical technologists shared similar views, one commented, "Of course I feel the need to follow policy but would do the right thing on my own without policy." Another noted, "I use it because I believe in the benefits, not because of a hospital policy. Whether the policy is present or not I would still use the same PPE.

Please Explain How Regulatory and Federal Agency Requirements Influence the Use of PPE

This sixth open-ended question asked respondents to explain how their perception of how regulatory and federal agency requirements influence the use of PPE. The table below sorts responses by frequency (counts) and by respondent groups. Following the table, responses are discussed by group and some sample, verbatim examples are provided.

Table 12

Regulatory and Federal Agency Requirements and the Use of PPE

Regulatory and Federal Agency Requirements	Surgical Team Member				
	Anesthesiologist	CRNA	Registered Nurse	Surgeon	Surgical Technologist
Positive Effect (Rules Should be Followed)	3	15			15
Overly Bureaucratic	3			6	
No Effect		15		6	15
Not Aware of Requirements		9			
Provide Support for Practice			21		

Anesthesiologists

When asked to comment on how regulatory and federal agency requirements influence the use or nonuse of PPE, remarks from anesthesiologists could be divided into two separate groups. Respondents remarked that there was either a positive effect as a result of these requirements or that regulatory requirements were not realistic in contemporary health care settings and overly bureaucratic. An example of a response indicating a positive effect of the requirements on the use of PPE is, “The policies and procedures of OSHA, which are similar to our hospital policies, mandate the use of PPE for staff and patient protection.” Whereas, an example of a response indicating the requirements are not positive is, “Regulatory and federal agency requirements are frequently out of touch with clinical realities.” An example where the respondent views regulatory requirements as overly bureaucratic follows.

> Typical of all regulatory agencies, the guidelines are taken to the maximal degree to apply to all case scenarios. I don’t believe that the extreme PPE requirements are necessary for the majority of cases that I perform based on risk assessment. Open exposure to blood and body fluids is what I try to prevent.

Nurse Anesthetists

Nurse anesthetist respondents also commented that regulatory agency requirements had a positive effect on the use of PPE. However, as many suggested, the regulations had no effect and fewer were not aware of the requirements. An example of responses suggesting the requirements have a positive effect on the use of PPE is, “OSHA makes recommendations to make a workplace safe therefore requirements from them are to protect me, I would be remiss if I did not use them.” An example of a response demonstrating the requirements have no effect on the use of PPE, “I don’t care who requires it, I do it because that’s what I believe is right.”

Registered Nurses

Registered nurse respondents suggested that regulatory and federal agency requirements regarding the use of PPE provided support for their practice. Often the circulating nurse in the operating room is the one care provider responsible for enforcing rules. As such, these regulations provide support to nurses when they are required to correct another team member's behavior. One respondent commented, "I have always protected myself and their ruling just makes my choice so much easier. Plus, I protect myself for my own benefit but also for my family's safety." Nurse respondents, more than any other group, believe that following regulatory and federal agency requirements are in everyone's best interest. "These organizations encourage the use of PPE for my well being as a healthcare provider." Another respondent noted, "These agencies are there for my protection and have set standards after review of many incidents."

Surgeons

Surgeon respondents, like their anesthesiologist colleagues, viewed regulatory and federal agency requirements regarding the use of PPE as overly bureaucratic, or like their nurse anesthetist colleagues as having no effect. Describing the bureaucratic nature of these agencies, one surgeon commented, "Regulations have much less impact on my decisions than anything else. Most people that are making the regulations obviously do not perform the tasks they are regulating very often." An example of the requirements having no effect was expressed by this respondent, "It should be done because it is the right thing to do, not because JCAHO [The Joint Commission] says so."

Surgical Technologists

Surgical technologist respondents commented that regulatory and federal agency requirements either had a positive effect or no effect on their use of PPE. “The fact that it’s a federal agency influences it to the maximum. If we choose to ignore the standards who is to say that we could be, in time, fined for not following the protocol.” Another respondent noted that requirements had a positive influence when commenting, “OSHA sets standards that protect me and the patient. If my employer is ever visited by OSHA, I do not want him getting a fine because of me.” Many surgical technologists commented that they would use PPE regardless of the requirements. These respondents viewed PPE as a means of self-protection. “I would wear the PPE whether OSHA required it or not. It makes sense and is the right thing to do for everyone concerned.” Finally, one experienced surgical technologist said this, “I have been in practice of using PPE for 20 years, and will continue to do so whether OSHA/Joint Commission requires this practice. It is a personal decision.”

Across Group Analysis

Anesthesiologists, nurse anesthetists, and surgical technologists all responded that regulatory and federal agency requirements had a positive effect on their use of PPE. They noted that rules should be followed and they did not want to be responsible for their hospital failing an accreditation survey or being fined for noncompliance with regulations. Nurse anesthetists, surgeons, and surgical technologists indicated that these requirements had no effect on their use of PPE. Respondents stated they would use PPE regardless of the regulations to protect themselves and their patients and because it was the right thing to do. Only the two physician groups, anesthesiologists, and surgeons, remarked that the rules were overly bureaucratic, created and imposed by administrators who were out of touch with the realities of today's clinical settings. Finally, registered nurses as enforcers of hospital, regulatory, and federal requirements saw the rules as providing support for their practice. In essence, adding clout to hospital mandates that surgical team members properly wear PPE.

In Your Opinion, what Would Increase the Likelihood of PPE Use by All Members of Surgical Teams in General

This seventh and last open-ended question asked respondents what they thought would increase the likelihood of PPE use by all surgical team members. The table below sorts responses by frequency (counts) and by respondent groups. Following the table, responses are discussed by group and some sample, verbatim examples are provided

Table 13

Increasing the Likelihood of PPE Use

Action to Increase Likelihood of Use	Surgical Team Member				
	Anesthesiologist	CRNA	Registered Nurse	Surgeon	Surgical Technologist
Improve Availability	34	30	12	19	10
Leadership	33	22	33	21	55
Education	25	12	41	23	26
Improve Product	22	18	21	26	28
Influence of Younger Generation	4				
Peer Pressure					8
Example from Infected Peer		4			14
Example Set by Surgeon			6		
Robust Evidence				9	

Anesthesiologists

The most frequent response to this question by anesthesiologists was that improving the availability of PPE would increase the likelihood of its use. One anesthesiologist commented, “Make it easy to utilize PPE by having it available.” Another noted, “Immediate availability at the point of use/need and not outside the room would make it easier to comply.” The next most frequent response to this question by anesthesiologists was that improved leadership behaviors would increase the likelihood of PPE use. One respondent stated, “In areas where it is not being used when it should be, peer pressure, unit policy, and leadership need to step to the plate.”

Improved education followed improved leadership as a method of increasing the likelihood of PPE use by all surgical team members. One respondent suggested, “Increased education. Most people aren’t careful because they are lazy, and maybe if they know better they would be more careful.” Another suggested, “Literature based education, clearly demonstrating the use of PPE for preventing spread of disease.”

The next most common response by anesthesiologists to this question was to improve the quality of the product. “Easy to use, comfortable, functional PPE” was one response while another anesthesiologist suggested, “more user friendly devices – increased sensitivity of gloves, clear visibility of goggles, over glasses fit, light weight gowns” would increase the likelihood of PPE use.

The last response from anesthesiologists was influence of the younger generation. Respondents who listed influence of the younger generation as a means of increasing the likelihood of PPE use by surgical team members suggested that because younger practitioners never knew a time before mandated use of PPE they would be more comfortable using the available products. “The younger generation uses PPE all the time, they were exposed to it in training. The older generation won’t change. So we just need to wait until the older generation is gone.”

Nurse Anesthetists

Nurse anesthetist respondents also suggested improving the availability of PPE in order to increase the likelihood of its use as their most common response. One respondent wrote, “Have EASY access to other PPE near sites of need... e.g., each OR, each holding area slot (all glove sizes and waterless hand cleaning dispensers) vs. just nearby. It should be EASY ACCESS so there really isn’t an excuse.” The second most common response from nurse anesthetists was to improve leadership. One respondent suggested “Hospital leadership has to require 100% compliance and they have to role model the expected behavior.” Improved product was the third most common response from nurse anesthetist respondents. One respondent wrote, “Better equipment, more eye toward design and less toward cost.” While another noted, “PPE needs to be lightweight, easy to use, made of high quality, not the cheapest on the market.”

The last two common responses from nurse anesthetists when asked what would increase the likelihood of PPE use were increased education and examples from infected peers. “Education that stresses the gravity of negative consequences, such as infections, illness, and possibly death resulting from pathogens that penetrate clothing, mucous membranes and broken skin not protected by PPEs.” was recommended by one respondent. Another wrote, “During training sessions, giving staff the statistical or academic reason for following particular rules makes it a logical thing to do for everyone’s protection.” Finally, “showing complications of exposure from a member of a surgical team who did not use PPE" represents comments related to an example from an infected peer.

Registered Nurses

When registered nurses were asked what would increase the likelihood of PPE use by members of surgical teams, the most common answer was education followed by improved leadership, improved product, improved availability, and positive examples set by surgeons. "Proper education of the surgical staff regarding the reason for using PPE" was the comment from one respondent while another said, "communication of regulations and consequences of not following OSHA and JCAHO standards." Improved leadership was identified by many respondents as a means of improving compliance. Standards exist in each organization but enforcement may not. "Management must stay actively involved to ensure that PPE are worn appropriately" was one comment. Another respondent wrote, "Consistent enforcement of policy by supervisors. They need to be checking on it through observation and disciplining those who do not comply." Examples of comments related to improved product included, "Cooler gowns, clearer goggles or shields, and better gloves would be a good start." Another nurse suggested, "PPE needs to be both effective and comfortable if it is to be worn. Right now, PPE may be effective but it is far from comfortable." Respondents suggested that use of PPE would be increased if it was immediately available at the point of use. One nurse stated, "If disposable eye-wear was stocked and available 100% of the time in the OR suite instead of just in the central supply area." Finally, nurses look to their surgeon colleagues to set the tone for use or nonuse of PPE. One nurse respondent suggested "Having the surgeons lead by doing or insisting on the PPE." Another noted, "Doctors insisting on it – your job depending on it."

Surgeons

When asked what would increase the likelihood of PPE use by surgical team members, the most common response from surgeon respondents was improved product. This was followed by education, improved availability, leadership, and finally robust evidence that PPE is effective in preventing the spread of bloodborne pathogens. With respect to the issue of improved product, one surgeon commented, "Gloves that retained dexterity with 2 pairs on and less confining eye wear. It would also be nice if gowns were not so hot." Another noted, "PPEs which do not interfere with technical performance or cause distraction/discomfort." Education was often addressed by respondents concurrently with leadership. One surgeon wrote, "More education and more oversight by the hospital." Another suggested, "Better education and leadership through nursing administration." Availability of PPE was addressed in very brief comments, "Availability of PPE at OR door" and many times just as "availability". Finally, unique to this group of respondents, robust evidence that PPE is effective as a safety device was identified as a means of increasing the likelihood of using the products. "Proof that said equipment does indeed eliminate the risk of bloodborne pathogen transfer" was noted by one surgeon respondent. Another commented, "Evidence based recommendations proving SIGNIFICANT benefit in using these intrusive, expensive and cumbersome devices." These comments suggest that surgeons are somewhat skeptical of the efficacy of available PPE.

Surgical Technologists

When surgical technologists were asked what would increase the likelihood of PPE use by surgical team members the most common answer was leadership followed by improved product, improved education, an example from an infected peer, improved availability, and peer pressure. This group overwhelmingly identified the need for improved leadership if PPE is to be used consistently by surgical team members. This surgical technologist's comments represent the general feeling of all other respondents.

> A leadership that requires total compliance and routinely enforces it on all levels. Surgeon to mopper. I would like to see a leadership that is not afraid to stand up and enforce these basic safety actions to surgeons and anesthesiologists as well as all other personnel in the working environment. There seem to be those who are or consider themselves above compliance.

Similar to other respondent groups, surgical technologists identified the need to improve the comfort and function of available PPEs in order to increase the likelihood of their use. One respondent noted, "Stronger and more sensitive gloves, more comfortable masks, less heat-trapping liquid-proof gowns, and non-vision distorting/comfortable protective goggles." Education was the third most commonly identified item needed to increase the likelihood of PPE use. "I said it once and I'll say it again… 'EDUCATION' over and over again until everyone gets it!" noted one respondent. Another said, "I think more education of the risks of not wearing PPE would increase use. Some people that do not use PPE properly tend to have an attitude that 'it won't happen to them'."

Like nurse anesthetist respondents, this group noted that an example from an infected peer would increase the likelihood of PPE use. "If someone came down with a disease" noted one respondent. Another wrote, "If there was a documented case of transmission in the work place. That would definitely influence some to change their attitude of ‘it won’t happen to me’.” Improved availability was also identified by this group as a means of increasing the likelihood of PPE use. “Greater availability. I’ve been in facilities where finding eye protection is very difficult.” Another suggested, “ The availability of PPE would increase the likelihood of its use. There are times in my workplace when all glove sizes are not restocked around the operating room and the person needing gloves can’t find any that will fit.” Finally the notion of peer pressure was identified by this group of respondents as one thing that would increase the likelihood of PPE use. Comments supporting this response were generally limited to “peer pressure”.

Across Group Analysis

Four responses common to all groups were identified when respondents were asked, “In your opinion, what would increase the likelihood of PPE use by all members of surgical teams in general?” These four responses were improved availability, improved leadership, improved education, and improved product. There was no identified pattern of response frequency when examined across the groups concurrently.

In addition to the four common responses above, groups identified additional items either unique to the group or shared with one other group. Anesthesiologists identified the on-going workplace influence of the younger generation as a phenomenon that would result in increased use of PPE. As members of the younger generations have never practiced in an environment where PPE use was not the expected behavior, self protection with these products is second nature to them. Both nurse anesthetists and surgical technologists identified examples from an infected peer as something that would increase the use of PPE. Infection from a bloodborne pathogen acquired from an exposure occurring when not protected with appropriate PPE would put a face to what is generally an anonymous statistic. Surgical team members were noted to view infection from bloodborne pathogens as something that happens to someone else. Registered nurses responded that positive examples set by surgeons would increase the likelihood of PPE use. Surgical team members identify the surgeon as leader. Leader behaviors are copied. If the surgeon sets the expectation that all team members wear protection, it is more likely, according to registered nurse respondents, that team members will comply. Surgeon respondents however are looking for robust evidence that PPE will prevent the spread of infection. There is clearly a disconnect between these two professional groups and their views regarding PPE. Finally, surgical technologists responded that peer pressure would increase the use of PPE. Like many behaviors, we are more likely to wear PPE if a majority of our colleagues are also wearing it and the use of PPE is the cultural norm in the specific environment.

Themes Common to all Respondent Groups

Responses to open-ended questions were considered themes when they appeared in each professional group's response to one question and also appeared across multiple questions. Four themes emerged from the qualitative data, availability, education, leadership, and performance (previously improve product or comfort/function). These themes appeared in the following four questions: reasons for no, limited, or occasional use of PPE, barriers to overcome to consistently use PPE, effect of leaders' attitudes and the use of PPE, and finally increasing the likelihood of PPE use. The themes did not appear in the remaining three questions regarding patient care needs and the use of PPE, hospital policy and the use of PPE, and regulatory and federal agency requirements and the use of PPE.

Each respondent group identified limited availability of PPE as a reason for why it is not consistently used. To improve availability, respondents noted that PPE must be immediately available at the point of use and restocked on a frequent basis. Education was identified as a theme by respondents. Frequent education for all groups, keeping surgical team members aware and alert to the need for PPE, the proper use of PPE, and the potential consequences of not using PPE was recommended. Leadership was also identified as a theme by all groups. Respondents noted that while most organizations have written guidelines requiring the use of PPE, the lack of visible and consistent leadership in the clinical area enforcing these guidelines served as a detriment to the use of PPE. Finally, performance of available PPE was identified by all respondent groups as a theme. To encourage PPE use by members of surgical teams, manufacturers should focus on developing PPE that is comfortable, easy to use, and effective in preventing exposure to bloodborne pathogens.

Summary

Manifest and latent content analysis was used to analyze the responses to open-ended questions. Emerging from the data were four unique themes, availability, education, leadership, and performance. These themes support the theoretical frameworks chosen to inform this study.

During the analysis, there were a number of written responses that were not stated often enough by any group to be counted but deserve to be mentioned here as they are relevant to the use of PPE in the clinical setting. An anesthesiologist noted, “People view

PPE as protection for themselves and not for the environment they're working in. Consistently I see people put PPE on and proceed to contaminate everything around them by not removing contaminated wear, revisiting clean equipment and supplies." I've observed this in my practice as well. Well intentioned health care providers forget to change their gloves when moving from a contaminated area to a clean one. One of the registered nurse respondents remarked, "Our professional organizations play an important role in our on-going education and exposure to current best practices or changes in standards. Through their publications, these organizations can ensure we have the latest guidelines and science at our fingertips." As a former member of the AORN board of directors, I concur with this nurse's sentiment. In addition to employers, national organizations share the burden of providing their members with current information regarding the proper use of PPE. Finally, a surgeon respondent remarked, "Although blunt needles aren't technically PPEs – I feel they are an important part of preventing bloodborne infection. After all, the most needle stick injuries in any hospital happen in the operating room with suture needles." The introduction of blunt suture needles for use when closing surgical incisions occurred as a response by suture manufacturers to the fact that indeed, the most needle stick injuries that occur in hospitals happen in the operating room with suture needles. Blunt needles make it more difficult for the operator to injure him/her self or an assistant. Surgeons and hospitals have been slow to adopt these products. Unfortunately, while perhaps well meaning in their product development, manufacturers of blunt needles have priced them higher than the traditional sharp closure needles, making the argument for their introduction that much more difficult.

The next chapter will present the quantitative analysis. The last chapter will discuss the results of the study including the implications of the research for surgical team members, limitations of the research, and recommendations for further research.

CHAPTER V

QUANTITATIVE ANALYSIS

Results of the quantitative research are presented in this chapter, which is organized into four sections. In the first section are the preliminary analyses which include data screening and descriptive statistics such as means, standard deviations, and frequencies. The second section is the results of the principal component analysis conducted on the 11 items that make up question 8 (Members of the surgical team take measures to protect themselves against exposure to blood and body fluids during operative/invasive procedures) and the 18 items that make up question 14 (To what degree each of the following factors influence your use of personal protective equipment). The third section, reports the primary analysis of the 6 general and 42 specific research questions posed in this study. This chapter concludes with the fourth section, a summary of the results.

Preliminary Analyses

This section contains the preliminary analysis which includes both the data screening and descriptive statistics. Descriptive statistics include means, standard deviations, and frequencies.

Data Screening

Data were downloaded from Excel into SPSS version 16. Out of the 1,878 participants, there were missing data on several of the participants. The participants with missing data were only dropped from the analysis if they did not have data for that particular question. No data imputations were used in this study. There were no outliers and the residuals in the analyses were normally distributed so no transformations were required. Therefore, demographic and descriptive statistics were computed.

Descriptive Statistics

Table 14 includes the descriptive statistics for the participants on all of the measures used in this investigation. Responses to the Likert type survey question 8 that inquired about the type of protections participants used depending on potential risk revealed that the protection least used was a plastic water impervious apron with an average use of 3.29. The most used was to cover cuts with a waterproof dressing (M = 1.32) followed closely by using 1-pair of gloves (M = 1.38; See Table 14). Survey question 14, also a Likert type question, asked about the influence of certain factors on the use of personal protective equipment. Participants indicated they were the least influenced by patient objection (M = 4.0) and the amount of time available (M = 3.09). The factor that had the greatest influence was education and training (M = 1.34; See Table 14).

Principal Component Analysis

Principal component analysis was used to obtain sets of stable factors that would work as dependent variables for the multiple linear regression analyses. Both questions 8 and 14 were factored to obtain sets of meaningful constructs that made the interpretation of the specific research question possible. Factor rotation was used to enhance interpretation (Kerlinger & Lee, 2000; Newman et al., 2006; Rummel, 1970; Stevens, 2002; Tabachnick & Fidell, 2007). The varimax method of orthogonal rotation was used in this study. This method produced either high or near zero factor loading, making the factor easier to interpret.

Table 14
Descriptive Statistics for Item Responses

Variables	*N*	*M*	*SD*
Awareness of Federal Regulations	1869	3.25	0.87
Awareness of Hospital Regulations	1843	3.28	0.87
What influences the measures you take to protect yourself against exposure (survey question 8)			
Wear gloves, 1 pair	1755	1.38	0.92
Wear gloves, 2 pairs (Double glove)	1752	2.52	1.25
Wear mask	1855	1.08	0.38
Wear eye protection/full face visor	1842	1.65	1.02
Wear a plastic/water impervious apron	1764	3.29	1.08
Wear a standard gown	1750	2.13	1.32
Wear an extra-reinforced gown	1775	2.95	1.27
Avoid passing sharp objects by hand	1800	1.77	1.15
Avoid use of sharp objects when possible	1808	1.78	1.19
Disinfect blood spillages with chlorine disinfectant	1797	1.67	1.15
Cover cuts or abrasions with a waterproof dressing	1827	1.32	0.85
Have you sustained an inoculation injury (survey question 11)	1828	0.61	0.49
Factors that influence your use of personal protective equipment (survey question 14)			
Previous inoculation injury	1826	2.72	1.62
Past experience	1824	1.84	1.19
Education and training	1848	1.34	0.64
Example set by peer	1836	2.16	1.07
Example set by senior personnel/leadership	1835	2.27	1.16
Hospital policy	1840	1.83	0.93
OSHA requirement	1834	1.82	0.96
Patient with bloodborne viral infection	1830	1.45	0.88
Patient suspected of having a blood borne viral infection	1839	1.49	0.91
Risk based on lifestyle, sexual orientation, or nationality	1840	2.24	1.26
Risk assessment based on likelihood of exposure to blood	1831	1.59	0.94
Gloves (single or double) interfere with dexterity	1827	2.82	1.30
Amount of time available	1822	3.09	1.18
Availability of protective clothing	1823	2.77	1.29
Goggles/Face shields limit vision	1823	2.81	1.29
Extra-reinforced surgical gowns are too warm	1821	3.31	1.26
Urgency of patient care needs	1828	2.70	1.21
Patient objection to	1784	4.00	0.91
Patient Needs Conflict with use of PPE	1855	3.15	0.74
Attitudes Regarding the use of PPE	1855	1.91	1.41
Hospital Required Use of PPE	1849	1.56	1.14
Federal Required Use of PPE	1845	1.56	1.13

To start with, a principal component analysis (PCA) was conducted on the 11 items that comprised question 8 with an orthogonal rotation (varimax). The Kaiser-Meyer-Olkin (KMO) measure verified the sampling adequacy for the analysis, KMO = .631 which is above the .5 cutoff (Field, 2009). The Bartlett's test of sphericity $\chi 2$ (55) = 1861.794, $p < .001$, indicating that correlations between items were significantly large enough for PCA. Three components had Eigenvalues greater than 1 and in combination explained 47.28% of the variance. A scree plot also indicated that there was a three factor solution and therefore, three components were retained to represent question 8 and are shown in Table 15. Factor names that resulted are my interpretation of the items that clustered together. The items that clustered together on the components suggested that Factor 1 is Barriers, Factor 2 is Practices, and Factor 3 is Standard Protection.

Table 15

Principal Components Analysis Results for Question 8 (Measures taken to protect against exposure)

Measure Taken to Protect Against Exposure	Rotated Factor Loadings		
	Barriers	Practices	Standard Protection
Wear gloves, 2 pairs (Double glove)	**.801**	-.055	.229
Wear an extra-reinforced gown	**.687**	.117	.142
Wear gloves, 1 pair	**-.612**	.191	.423
Wear a plastic/water impervious apron	**.465**	.372	.071
Avoid use of sharp objects when possible	-.056	**.752**	-.094
Avoid passing sharp objects by hand	-.050	**.719**	-.235
Cover cuts or abrasions with a waterproof dressing	.079	**.552**	.188
Disinfect blood spillages with chlorine disinfectant	.122	**.509**	.168
Wear a standard gown	.126	-.109	**.629**
Wear mask	-.025	.046	**.576**
Wear eye protection/full face visor	.374	.177	**.564**
Eigenvalues	2.230	1.759	1.211
% of variance	20.275	15.991	11.010

Note. Loadings over .40 appear in bold

Next, a principal component analysis (PCA) was conducted on the 18 items that comprised question 14 (Factors that influence your use of personal protection) with an orthogonal rotation (varimax). The Kaiser-Meyer-Olkin (KMO) measure verified the sampling adequacy for the analysis, KMO = .774 which is above the .5 cutoff (Field, 2009). The Bartlett's test of sphericity $\chi 2$ (153) = 12619.1, $p < .001$, indicating that correlations between items were significantly large enough for PCA. Four components had Eigenvalues greater than 1 and in combination explained 59.14% of the variance. A scree plot also indicated that there was a four factor solution and therefore, four components were retained to represent question 14 and are shown in Table 16. The items that clustered together on the components suggested that Factor 1 is Deterrents, Factor 2 is Risk Assessment, Factor 3 is Rules and Role Models and Factor 4 is Experience.

Because only stable factors that were replicable were desired, the data set was split in half and a PCA was conducted on both halves. Only the factors that were stable were retained. All of the factors presented in Tables 15 and 16 replicated with very slight variations in order. Therefore, the three factors from question 8 and the four factors from question 14 were retained and then subsequently used to test the general and specific research hypotheses. Factor scores were calculated in the principal component analysis and saved as separate variables in the SPSS data set.

Table 16

Principal Components Analysis Results for Question 14 (Factors that influence use of personal protective equipment)

Factor that Influences Use of PPE	Component			
	Deterr-ents	Risk Assess-ment	Rules & Role Models	Experi-ence
Amount of time available	**.795**	.137	.043	.049
Urgency of patient care needs	**.740**	.135	.007	.011
Goggles/Face shields limit vision	**.726**	.067	-.127	.005
Availability of protective clothing	**.722**	.093	.076	.059
Gloves (single or double) interfere with dexterity	**.641**	.101	-.092	.046
Extra-reinforced surgical gowns are too warm	**.618**	.036	.018	.062
Patient objection to	**.518**	.003	.122	-.005
Patient suspected of having a blood borne viral infection	.095	**.916**	.134	.011
Patient with blood borne viral infection	.104	**.908**	.117	.018
Risk assessment based on likelihood of exposure to blood	.112	**.744**	.149	.007
Risk assessment based on lifestyle, sexual orientation, or nationality	.145	**.703**	.069	.094
Hospital policy	-.004	.161	**.799**	-.033
Example set by peer	.137	.099	**.780**	.023
Example set by senior personnel/leadership	.151	.089	**.773**	.017
OSHA requirement	-.064	.189	**.758**	-.020
Education and training	-.156	-.033	**.553**	.201
Past experience	.071	.076	.060	**.856**
Previous inoculation injury	.094	.033	.058	**.850**
Eigenvalues	4.332	2.957	1.907	1.449
% of variance	24.065	16.429	10.593	8.05

Note. Loadings over .40 appear in bold

Primary Analysis

This section reviews the statistical results and presents the findings in table form for the research hypotheses. General Research Hypotheses were derived from the original research questions and investigated and reported individually. However, due to the large number of hypotheses only the significant hypotheses are reported in this section. A complete reporting of all of the SPSS outputs for all of the research questions can be found in Appendix E.

General Hypothesis 1(GH1) There is a relationship that exists between surgical team members influencing their choices of wearing or not wearing PPE during operative/invasive procedures.

Specific hypothesis 1a (SH1a). To test the hypothesis derived from question number 8 in the survey, i.e., what influences the measures you take to protect yourself against exposure, a simultaneous multiple linear regression analysis was conducted. The hypothesis was supported ([$F(13)(1360) = 56.365$, $p < .001$, $R^2 = .350$]). Type of profession accounted for a significant proportion of unique variance for Anesthesiologists (standardized $B = 1.041$, $p < .001$), CRNA (standardized $B = 1.058$, $p < .001$), Registered Nurses (standardized $B = 0.614$, $p < .001$), Surgeons (standardized $B = 0.504$, $p = .001$) and Surgical Technologists (standardized $B = 0.524$, $p = .012$). Overall, the combination of profession, age, geographic location, length of time in profession, and awareness of hospital and federal regulations variables predicted statistically significant variance in the dependent variable (Factor 1A; Barriers). See Table 17 for the summary of regression results.

Table 17

Regression 1: Question 8 – Barriers[a] and Demographics

Variable	B	SE B	*B*	*t*	*p*
(Constant)	-1.524	0.768		-1.985	0.047
Profession					
Anesthesiologist	2.603	0.473	1.041	5.501	0.000
Nurse Anesthetist	2.460	0.473	1.058	5.203	0.000
Registered Nurse	1.675	0.474	0.614	3.536	0.000
Surgeon	1.565	0.475	0.504	3.295	0.001
Surgical Technologist	1.189	0.473	0.524	2.515	0.012
Age	-0.004	0.004	-0.046	-1.209	0.227
Geographic Location					
Northeast	-0.126	0.581	-0.050	-0.216	0.829
Midwest	-0.067	0.581	-0.030	-0.116	0.908
South	-0.155	0.581	-0.073	-0.266	0.790
West	-0.104	0.582	-0.039	-0.178	0.859
Time in Profession	0.006	0.003	0.067	1.657	0.098
Question 7: Awareness					
Federal Regulations	-0.035	0.055	-0.030	-0.636	0.525
Hospital Policy	-0.016	0.055	-0.013	-0.283	0.777

Note. $F_{13,1360} = 56.365$ with an $R^2 = .350$ and a $p < .001$

[a] Dependent variable.

Specific hypothesis 1b (SH1b). To test the hypothesis derived from question number 8 in the survey, i.e., what influences the measures you take to protect yourself against exposure, a simultaneous multiple linear regression analysis was conducted. The hypothesis was supported ([$F(13)(1360) = 10.871$, $p < .001$, $R^2 = .094$]). Overall, the combination of profession, age, geographic location, length of time in profession, and awareness of hospital and federal regulations variables predicted statistically significant variance in the dependent variable (Factor 2A; Practices). None of these variables accounted for a significant proportion of unique variance. See Table 18 for the summary of regression results.

Table 18

Regression 2: Question 8 – Practices[a] and Demographics

Variable	B	SE B	*B*	*t*	*p*
(Constant)	-0.231	0.901		-0.256	0.798
Profession					
Anesthesiologist	0.335	0.555	0.135	0.603	0.547
Nurse Anesthetist	0.058	0.555	0.025	0.105	0.916
Registered Nurse	0.359	0.556	0.132	0.645	0.519
Surgeon	0.700	0.557	0.227	1.256	0.209
Surgical Technologist	0.785	0.555	0.348	1.415	0.157
Age	0.005	0.004	0.053	1.180	0.238
Geographic Location					
Northeast	-0.145	0.682	-0.059	-0.213	0.832
Midwest	0.035	0.682	0.016	0.051	0.959
South	-0.054	0.681	-0.026	-0.079	0.937
West	0.133	0.683	0.050	0.195	0.846
Time in Profession	0.002	0.004	0.020	0.424	0.672
Question 7: Awareness					
Federal Regulations	-0.118	0.064	-0.101	-1.836	0.067
Hospital Policy	-0.022	0.065	-0.019	-0.343	0.732

Note. $F_{13,1360} = 10.871$ with an $R^2 = .094$ and a $p < .001$
[a] Dependent variable.

Specific hypothesis 1c (SH1c). To test the hypothesis derived from question number 8 in the survey, i.e., what influences the measures you take to protect yourself against exposure, a simultaneous multiple linear regression analysis was conducted. The hypothesis was supported ([$F(13)(1360) = 20.122$, $p < .001$, $R^2 = .161$]). A significant proportion of unique variance was accounted for by Age (standardized $B = 0.165$, $p <$

.001) and time in profession (standardized *B* = -0.091, *p* = 0.048). Overall, the combination of profession, age, geographic location, length of time in profession, and awareness of hospital and federal regulations variables predicted statistically significant variance in the dependent variable (Factor 3A; Standard Protection). See Table 19 for the summary of regression results.

Table 19

Regression 3: Question 8-Standard Protection[a] and Demographics

Variable	B	SE B	*B*	*t*	*p*
(Constant)	-0.201	0.872		-0.230	0.818
Profession					
Anesthesiologist	0.159	0.537	0.063	0.295	0.768
Nurse Anesthetist	0.140	0.537	0.060	0.261	0.794
Registered Nurse	-0.665	0.538	-0.244	-1.236	0.217
Surgeon	-0.217	0.539	-0.070	-0.403	0.687
Surgical Technologist	-0.607	0.537	-0.268	-1.131	0.258
Age	0.016	0.004	0.165	3.848	0.000
Geographic Location					
Northeast	-0.113	0.660	-0.045	-0.171	0.865
Midwest	-0.182	0.659	-0.082	-0.275	0.783
South	-0.048	0.659	-0.023	-0.073	0.942
West	-0.082	0.660	-0.031	-0.125	0.901
Time in Profession	-0.008	0.004	-0.091	-1.976	0.048
Question 7: Awareness					
Federal Regulations	0.051	0.062	0.043	0.815	0.415
Hospital Policy	-0.072	0.062	-0.061	-1.151	0.250

Note. $F_{13,1360}$ = 20.122 with an R^2 = .161 and a $p < .001$
[a] Dependent variable.

Specific hypothesis 1d (SH1d). To test the hypothesis derived from question number 14 in the survey, i.e., what influences the use of PPE, a simultaneous multiple linear regression analysis was conducted. The hypothesis was supported ([$F(13)(1539) = 4.588$, $p < .001$, $R^2 = .037$]). Overall, the combination of profession, age, geographic location, length of time in profession, awareness of hospital and federal regulations variables predicted statistically significant variance in the dependent variable (Factor 1B; Deterrents). See Table 20 for the summary of regression results.

Table 20

Regression 4: Question 14-Deterrents[a] and Demographics

Variable	B	SE B	*Β*	*t*	*p*
(Constant)	-0.973	0.624		-1.561	0.119
Profession					
Anesthesiologist	-0.030	0.508	-0.012	-0.058	0.954
Nurse Anesthetist	0.061	0.508	0.026	0.121	0.904
Registered Nurse	0.183	0.510	0.069	0.359	0.720
Surgeon	0.137	0.510	0.045	0.269	0.788
Surgical Technologist	0.387	0.508	0.172	0.762	0.446
Age					
	0.007	0.004	0.075	1.773	0.077
Geographic Location					
Northeast	0.162	0.457	0.064	0.354	0.723
Midwest	0.305	0.455	0.138	0.670	0.503
South	0.218	0.455	0.103	0.478	0.633
West	0.314	0.457	0.121	0.687	0.492
Time in Profession					
	-0.002	0.004	-0.019	-0.427	0.669
Question 7: Awareness					
Federal Regulations	-0.032	0.063	-0.028	-0.510	0.610
Hospital Policy	0.109	0.064	0.095	1.711	0.087

Note. $F_{13,1539} = 4.588$ with an $R^2 = .037$ and a $p <. 001$

[a] Dependent variable.

Specific hypothesis 1e(SH1e). To test the hypothesis derived from question number 14 in the survey, i.e., what influences the use of PPE, a simultaneous multiple linear regression analysis was conducted. The hypothesis was supported ([$F(13)(1539) = 4.968$, $p < .001$, $R^2 = .040$]). Type of profession accounted for a significant proportion of unique variance for CRNAs (standardized *B* = -0.467, *p* = 0.031). Overall, the combination of profession, age, geographic location, length of time in profession, awareness of hospital and federal regulations variables predicted statistically significant variance in the dependent variable (Factor 2B; Risk Assessment). See Table 21 for the summary of regression results.

Table 21

Regression 5: Question 14-Risk Assessment[a] and Demographics

Variable	B	SE B	*B*	*t*	*p*
(Constant)	0.426	0.626		0.682	0.496
Profession					
Anesthesiologist	-0.869	0.509	-0.342	-1.705	0.088
Nurse Anesthetist	-1.098	0.510	-0.467	-2.156	0.031
Registered Nurse	-0.852	0.512	-0.319	-1.664	0.096
Surgeon	-0.449	0.512	-0.148	-0.879	0.380
Surgical Technologist	-0.839	0.510	-0.372	-1.647	0.100
Age	0.001	0.004	0.011	0.252	0.801
Geographic Location					
Northeast	0.409	0.458	0.161	0.892	0.373
Midwest	0.332	0.457	0.150	0.726	0.468
South	0.276	0.457	0.130	0.604	0.546
West	0.409	0.459	0.157	0.892	0.373
Time in Profession	-0.004	0.004	-0.050	-1.101	0.271
Question 7: Awareness					
Federal Regulations	0.027	0.063	0.024	0.426	0.670
Hospital Policy	0.012	0.064	0.010	0.183	0.854

Note. $F_{13,1539} = 4.968$ with an $R^2 = .040$ and a $p < .001$
[a] Dependent variable.

Specific hypothesis 1f (SH1f). To test the hypothesis derived from question number 14 in the survey, i.e., what influences the use of PPE, a simultaneous multiple linear regression analysis was conducted. The hypothesis was supported ([F(13)(1539) = 18.564, $p < .001$, $R^2 = .136$]). Overall, the combination of profession, age, geographic location, length of time in profession, awareness of hospital and federal regulations variables predicted statistically significant variance in the dependent variable (Factor 3B; Rules and Role Models). See Table 22 for the summary of regression results.

Table 22

Regression 6: Question 14-Rules and Role Models[a] and Demographics

Variable	B	SE B	*B*	*t*	*p*
(Constant)	-0.233	0.589		-0.396	0.693
Profession					
Anesthesiologist	-0.206	0.479	-0.082	-0.431	0.667
Nurse Anesthetist	-0.387	0.479	-0.166	-0.808	0.419
Registered Nurse	-0.916	0.482	-0.345	-1.902	0.057
Surgeon	0.094	0.481	0.031	0.195	0.845
Surgical Technologist	-0.733	0.479	-0.328	-1.530	0.126
Age	0.002	0.004	0.025	0.630	0.529
Geographic Location					
Northeast	0.709	0.431	0.282	1.646	0.100
Midwest	0.841	0.430	0.383	1.956	0.051
South	0.785	0.430	0.373	1.827	0.068
West	0.858	0.431	0.332	1.988	0.047
Time in Profession	0.006	0.004	0.069	1.616	0.106
Question 7: Awareness					
Federal Regulations	0.052	0.059	0.046	0.885	0.376
Hospital Policy	-0.148	0.060	-0.129	-2.463	0.014

Note. $F_{13,1539} = 18.564$ with an $R^2 = .136$ and a $p < .001$
[a] Dependent variable.

Specific hypothesis 1g (SH1g). To test the hypothesis derived from question number 14 in the survey, i.e., what influences the use of PPE, a simultaneous multiple linear regression analysis was conducted. The hypothesis was supported ([F(13)(1539) = 3.426, p < .001, R^2 = .028]). Overall, the combination of profession, age, geographic location, length of time in profession, awareness of hospital and federal regulations variables predicted statistically significant variance in the dependent variable (Factor 4B; Experience). See Table 23 for the summary of regression results.

Table 23

Regression 7: Question 14-Experience[a] and Demographics

Variable	B	SE B	*B*	*t*	*p*
(Constant)	-0.967	0.628		-1.539	0.124
Profession					
Anesthesiologist	0.935	0.511	0.369	1.828	0.068
Nurse Anesthetist	1.007	0.512	0.430	1.969	0.049
Registered Nurse	0.793	0.514	0.297	1.542	0.123
Surgeon	0.658	0.514	0.217	1.280	0.201
Surgical Technologist	0.856	0.512	0.380	1.673	0.094
Age	0.001	0.004	0.010	0.247	0.805
Geographic Location					
Northeast	0.281	0.460	0.111	0.610	0.542
Midwest	0.276	0.459	0.125	0.602	0.548
South	0.337	0.459	0.159	0.734	0.463
West	0.189	0.460	0.073	0.410	0.682
Time in Profession	-0.007	0.004	-0.083	-1.831	0.067
Question 7: Awareness					
Federal Regulations	-0.128	0.063	-0.113	-2.027	0.043
Hospital Policy	0.096	0.064	0.084	1.503	0.133

Note. $F_{13,1539}$ = 3.426 with an R^2 = .028 and a p < .001
[a] Dependent variable.

Demographic variables of profession, age, geographic location, length of time in profession, and awareness of hospital and federal regulations all predicted statistically significant variance in seven specific hypotheses. Demographics predicted the factor Barriers with a significant proportion of unique variance accounted for by profession. Each professional group uses PPE but will use it differently depending upon their role and clinical setting. Demographics predicted the factor Standard Protection with a significant proportion of unique variance accounted for by age and time in profession. The analysis suggests that while holding age constant, time in profession has a negative relationship to the factor Standard Protection. The longer the respondent has been in their profession, the less likely they are to use the factor Standard Protection. Standard Protection is comprised of wearing a standard gown, wearing a mask, and wearing eye protection or a full face visor. Of these, wearing eye protection is generally most neglected. Demographics predicted the factor Risk Assessment with a significant proportion of unique variance accounted for by profession for CRNAs. Anesthesia providers are generally behind the surgical drape and protected from exposure to blood or body fluids. As such their use of double gloves, eye protection, or reinforced gowns is limited. This finding suggests that CRNAs are significantly less likely to utilize the factor Risk Assessment than other professional groups when selecting appropriate PPE. The factor ties PPE decisions to suspected or confirmed blood borne infection status, lifestyle, or likelihood of exposure to blood. Finally, demographics predicted the factors Practices, Deterrents, Rules and Role Models, and Experience with none of the variables accounting for a significant proportion of unique variance.

General Hypothesis 2(GH2) There is a significant relationship between previous accidental exposure to blood or body fluids influencing surgical team members regarding the use of PPE.

Specific hypothesis 2b (SH2b). To test the hypothesis derived from question number 8 in the survey, i.e., what influences the measures you take to protect yourself against exposure, a simultaneous multiple linear regression analysis was conducted. The hypothesis was supported ([$F(1)(1379) = 15.278$, $p < .001$, $R^2 = .011$]). The variable inoculation injury predicted statistically significant variance in the dependent variable (Factor 2A; Practice). See Table 24 for the summary of regression results.

Table 24

Regression 9: Question 8-Practices[a] and Inoculation

Variable	B	SE B	*B*	*t*	*p*
(Constant)	-0.124	0.043		-2.918	0.004
Inoculation injury	0.215	0.055	0.105	3.909	0.000

Note. $F_{1,1379} = 15.278$ with an $R^2 = .011$ and a $p < .001$
[a] Dependent variable.

Specific hypothesis 2e (SH2e). To test the hypothesis derived from question number 14 in the survey, i.e., what influences the use of PPE, a simultaneous multiple linear regression analysis was conducted. The hypothesis was supported ([$F(1)(1563) = 11.65$, $p = .001$, $R^2 = .007$]). The variable inoculation injury predicted statistically significant variance in the dependent variable (Factor 2B; Risk Assessment). See Table 25 for the summary of regression results.

Table 25

Regression 12: Question 14-Risk Assessment[a] and Inoculation

Variable	B	SE B	*B*	*t*	*p*
(Constant)	-0.108	0.041		-2.646	0.008
Inoculation injury	0.176	0.052	0.086	3.413	0.001

Note. $F_{1,1563}$ = 11.650 with an R^2 = .007 and a p = .001
[a] Dependent variable.

Specific hypothesis 2f (SH2f). To test the hypothesis derived from question number 14 in the survey, i.e., what influences the use of PPE, a simultaneous multiple linear regression analysis was conducted. The hypothesis was supported ([F(1)(1563) = 8.788, p = .003, R^2 = .006]). The variable inoculation injury predicted statistically significant variance in the dependent variable (Factor 3B; Rules and Role Models). See Table 26 for the summary of regression results.

Table 26

Regression 13: Question 14-Rules and Role Models[a] and Inoculation

Variable	B	SE B	*B*	*t*	*p*
(Constant)	-0.083	0.041		-2.033	0.042
Inoculation injury	0.154	0.052	0.075	2.964	0.003

Note. $F_{1,1563}$ = 8.788 with an R^2 = .006 and a p = .003
[a] Dependent variable.

Specific hypothesis 2g (SH2g). To test the hypothesis derived from question number 14 in the survey, i.e., what influences the use of PPE, a simultaneous multiple linear regression analysis was conducted. The hypothesis was supported ([F(1)(1563) = 661.932, p < .001, R^2 = .298]). The variable inoculation injury predicted statistically significant variance in the dependent variable (Factor 4B; Experience). See Table 27 for the summary of regression results.

Table 27

Regression 14: Question 14-Experience[a] and Inoculation

Variable	B	SE B	*B*	*t*	*p*
(Constant)	0.681	0.034		19.95323	.000
Inoculation injury	-1.117	0.043	-0.545	-25.728	.000

Note. $F_{1,1563}$ = 661.932 with an R^2 = .298 and a $p < .001$
[a] Dependent variable.

Previous inoculation injury predicted statistically significant variance in the factors Practice from question 8 and Risk Assessment, Rules and Role Models, and Experience from question 14. Quantitative data analysis supports the conclusion that experience may be the best teacher where the use of PPE is concerned. Surgical team members who have sustained prior accidental exposure to blood or body fluids are more likely to use PPE consistently than those who have not.

General Hypothesis 3(GH3) There is a significant relationship between federal (OSHA) regulations influencing surgical team members and the use of PPE.

Specific hypothesis 3a (SH3a). To test the hypothesis derived from question number 8 in the survey, i.e., what influences the measures you take to protect yourself against exposure, a simultaneous multiple linear regression analysis was conducted. The hypothesis was supported ([$F(1)(1393) = 9.126$, $p = .003$, $R^2 = .007$]). The variable federal required use of PPE predicted statistically significant variance in the dependent variable (Factor 1A; Barriers). See Table 28 for the summary of regression results.

Table 28

Regression 15: Question 8 - Barriers[a] and Federal Required Use of PPE

Variable	B	SE B	*B*	*t*	*p*
(Constant)	-0.110	0.045		-2.420	0.016
Federal Required Use of PPE	0.071	0.024	0.081	3.021	0.003

Note. $F_{1,1393}$ = 9.126 with an R^2 = .007 and a p = .003
[a] Dependent variable.

Specific hypothesis 3b (SH3b). To test the hypothesis derived from question number 8 in the survey, i.e., what influences the measures you take to protect yourself against exposure, a simultaneous multiple linear regression analysis was conducted. The hypothesis was supported ([$F(1)(1393) = 29.537$, $p < .001$, $R^2 = .021$]). The variable federal required use of PPE predicted statistically significant variance in the dependent variable (Factor 2A; Practices). See Table 29 for the summary of regression results.

Table 29

Regression 16: Question 8-Practices[a] and Federal Required Use of PPE

Variable	B	SE B	*B*	T	*p*
(Constant)	-0.201	0.045		-4.449	0.000
Federal Required Use of PPE	0.128	0.024	0.144	5.435	0.000

Note. $F_{1,1393}$ = 29.537 with an R^2 = .021 and a $p < .001$
[a] Dependent variable.

Specific hypothesis 3c (SH3c). To test the hypothesis derived from question number 8 in the survey, i.e., what influences the measures you take to protect yourself against exposure, a simultaneous multiple linear regression analysis was conducted. The hypothesis was supported ([$F(1)(1393) = 12.354$, $p < .001$, $R^2 = .009$]). The variable federal required use of PPE predicted statistically significant variance in the dependent variable (Factor 3A; Standard Protection). See Table 30 for the summary of regression results.

Table 30

Regression 17: Question 8-Standard Protection[a] and Federal Required Use of PPE

Variable	B	SE B	*B*	*t*	*p*
(Constant)	-0.132	0.046		-2.897	0.004
Federal Required Use of PPE	0.084	0.024	0.094	3.515	0.000

Note. $F_{1,1393}$ = 12.354 with an R^2 = .009 and a $p < .001$
[a] Dependent variable.

Specific hypothesis 3e (SH3e). To test the hypothesis derived from question number 14 in the survey, i.e., what influences the use of PPE, a simultaneous multiple linear regression analysis was conducted. The hypothesis was supported ([$F(1)(1578)$ = 12.354, $p < .001$, R^2 = .012]). The variable federal required use of PPE predicted statistically significant variance in the dependent variable (Factor 2B; Risk Assessment). See Table 31 for the summary of regression results.

Table 31

Regression 19: Question 14-Risk Assessment[a] and Federal Required Use of PPE

Variable	B	SE B	*B*	*t*	*p*
(Constant)	-0.148	0.043		-3.451	0.001
Federal Required Use of PPE	0.095	0.022	0.107	4.285	0.000

Note. $F_{1,1578}$ = 18.362 with an R^2 = .012 and a $p < .001$
[a] Dependent variable.

Specific hypothesis 3f (SH3f). To test the hypothesis derived from question number 14 in the survey, i.e., what influences the use of PPE, a simultaneous multiple linear regression analysis was conducted. The hypothesis was supported ([$F(1)(1578) = 310.334$, $p < .001$, $R^2 = .164$]). The variable federal required use of PPE predicted statistically significant variance in the dependent variable (Factor 3B; Rules and Role Models). See Table 32 for the summary of regression results.

Table 32

Regression 20: Question 14-Rules and Role Models[a] and Federal Required Use of PPE

Variable	B	SE B	*B*	*t*	*p*
(Constant)	-0.564	0.039		-14.335	0.000
Federal Required Use of PPE	0.361	0.020	0.405	17.616	0.000

Note. $F_{1,1578} = 310.334$ with an $R^2 = .164$ and a $p < .001$
[a] Dependent variable.

Federal required use of PPE predicted statistically significant variance in the factors Barriers, Practices, and Standard Protection from question 8, and Risk Assessment, and Rules and Role Models from question 14. The factor Rules and Role Models includes OSHA requirement. Federal regulations require the assessment of risk of exposure and implementation of concomitant appropriate amounts of PPE. Each of these factors encompass elements of escalating implementation of PPE based on the degree of anticipated risk.

General Hypothesis 4(GH4) There is a significant relationship between hospital policies and procedures and surgical team members' use of PPE.

Specific hypothesis 4a (SH4a). To test the hypothesis derived from question number 8 in the survey, i.e., what influences the measures you take to protect yourself against exposure, a simultaneous multiple linear regression analysis was conducted. The hypothesis was supported ([$F(1)(1395) = 12.096$, $p = .001$, $R^2 = .009$]). The variable hospital policy and procedure required use of PPE predicted statistically significant variance in the dependent variable (Factor 1A; Barriers). See Table 33 for the summary of regression results.

Table 33

Regression 22: Question 8-Barriers[a] and Hospital Required Use of PPE

Variable	B	SE B	*B*	*t*	*p*
(Constant)	-0.126	0.045		-2.797	0.005
Hospital Required Use of PPE	0.082	0.024	0.093	3.478	0.001

Note. $F_{1,1395} = 12.096$ with an $R^2 = .009$ and a $p = .001$
[a] Dependent variable.

Specific hypothesis 4b (SH4b). To test the hypothesis derived from question number 8 in the survey, i.e., what influences the measures you take to protect yourself against exposure, a simultaneous multiple linear regression analysis was conducted. The hypothesis was supported ([$F(1)(1395) = 24.698$, $p < .001$, $R^2 = .017$]). The variable hospital policy and procedure required use of PPE predicted statistically significant variance in the dependent variable (Factor 2A; Practices). See Table 34 for the summary of regression results.

Table 34

Regression 23: Question 8-Practices[a] and Hospital Required Use of PPE

Variable	B	SE B	*B*	*t*	*p*
(Constant)	-0.181	0.045		-4.018	0.000
Hospital Required Use of PPE	0.116	0.023	0.132	4.970	0.000

Note. $F_{1,1395} = 24.698$ with an $R^2 = .017$ and a $p < .001$
[a] Dependent variable.

Specific hypothesis 4c (SH4c). To test the hypothesis derived from question number 8 in the survey, i.e., what influences the measures you take to protect yourself against exposure, a simultaneous multiple linear regression analysis was conducted. The hypothesis was supported ([$F(1)(1395) = 4.595$, $p = .032$, $R^2 = .003$]). The variable hospital policy and procedure required use of PPE predicted statistically significant variance in the dependent variable (Factor 3A; Standard Protection). See Table 35 for the summary of regression results.

Table 35

Regression 24: Question 8-Standard Protection[a] and Hospital Required Use of PPE

Variable	B	SE B	*B*	*t*	*p*
(Constant)	-0.077	0.045		-1.691	0.091
Hospital Required Use of PPE	0.051	0.024	0.057	2.144	0.032

Note. $F_{1,1395} = 4.595$ with an $R^2 = .003$ and a $p = .032$
[a] Dependent variable.

Specific hypothesis 4e (SH4e). To test the hypothesis derived from question number 14 in the survey, i.e., what influences the use of PPE, a simultaneous multiple linear regression analysis was conducted. The hypothesis was supported ([F(1)(1828) = 6.115, p = .014, R^2 = .004]). The variable hospital policy and procedure required use of PPE predicted statistically significant variance in the dependent variable (Factor 2B; Risk Assessment). See Table 36 for the summary of regression results.

Table 36

Regression 26: Question 14-Risk Assessment[a] and Hospital Required Use of PPE

Variable	B	SE B	*B*	*t*	*p*
(Constant)	-0.082	0.042		-1.944	0.052
Hospital Required Use of PPE	0.053	0.022	0.062	2.473	0.014

Note. $F_{1,1582}$ = 6.115 with an R^2 = .004 and a p = .014
[a] Dependent variable.

Specific hypothesis 4f (SH4f). To test the hypothesis derived from question number 14 in the survey, i.e., what influences the use of PPE, a simultaneous multiple linear regression analysis was conducted. The hypothesis was supported ([F(1)(1582) = 272.189, p < .001, R^2 = .147]). The variable hospital policy and procedure required use of PPE predicted statistically significant variance in the dependent variable (Factor 3B; Rules and Role Models). See Table 37 for the summary of regression results.

Table 37

Regression 27: Question 14-Rules and Role Models[a] and Hospital Required Use of PPE

Variable	B	SE B	*B*	*t*	*p*
(Constant)	-0.519	0.039		-13.321	0.000
Hospital Required Use of PPE	0.329	0.020	0.383	16.498	0.000

Note. $F_{1,1582}$ = 272.189 with an R^2 = .147 and a $p < .001$
[a] Dependent variable.

Hospital policy and procedure predicted statistically significant variance in the factors Barriers, Practices, and Standard Protection from question 8, and Risk Assessment, and Rules and Role Models from question 14. The factor Rules and Role Models includes hospital policy. Hospital policy and procedures are modeled after federal regulations. These results are similar to those found in the previous hypothesis concerning federal regulations.

General Hypothesis 5(GH5) There is a significant relationship between Hospital leaders' attitudes and surgical team members use of PPE.

Specific hypothesis 5a (SH5a). To test the hypothesis derived from question number 8 in the survey, i.e., what influences the measures you take to protect yourself against exposure, a simultaneous multiple linear regression analysis was conducted. The hypothesis was supported ([$F(1)(1401) = 16.353$, $p < .001$, $R^2 = .012$]). The variable hospital leaders' attitudes about the use of PPE predicted statistically significant variance in the dependent variable (Factor 1A; Barriers). See Table 38 for the summary of regression results.

Table 38

Regression 29: Question 8-Barriers[a] and Attitudes Regarding the use of PPE

Variable	B	SE B	*B*	*t*	*p*
(Constant)	-0.143	0.045		-3.193	0.001
Attitudes Regarding the use of PPE	0.077	0.019	0.107	4.044	0.000

Note. $F_{1,1401} = 16.353$ with an $R^2 = .012$ and a $p < .001$
[a] Dependent variable.

Specific hypothesis 5b (SH5b). To test the hypothesis derived from question number 8 in the survey, i.e., what influences the measures you take to protect yourself against exposure, a simultaneous multiple linear regression analysis was conducted. The hypothesis was supported ([$F(1)(1401) = 16.943$, $p < .001$, $R^2 = .012$]). The variable hospital leaders' attitudes about the use of PPE predicted statistically significant variance in the dependent variable (Factor 2A; Practices). See Table 39 for the summary of regression results.

Table 39

Regression 30: Question 8-Practices[a] and Attitudes Regarding the use of PPE

Variable	B	SE B	*B*	*t*	p
(Constant)	-0.149	0.045		-3.331	0.001
Attitudes Regarding the use of PPE	0.078	0.019	0.109	4.116	0.000

Note. $F_{1,1401} = 16.943$ with an $R^2 = .012$ and a $p < .001$
[a] Dependent variable.

Specific hypothesis 5c (SH5c). To test the hypothesis derived from question number 8 in the survey, i.e., what influences the measures you take to protect yourself against exposure, a simultaneous multiple linear regression analysis was conducted. The hypothesis was supported ([$F(1)(1401) = 18.322$, $p < .001$, $R^2 = .013$]). The variable hospital leaders' attitudes about the use of PPE predicted statistically significant variance in the dependent variable (Factor 3A; Standard Protection). See Table 40 for the summary of regression results.

Table 40

Regression 31: Question 8-Standard Protection[a] and Attitudes Regarding the use of PPE

Variable	B	SE B	*B*	*t*	*p*
(Constant)	-0.153	0.045		-3.413	0.001
Attitudes Regarding the use of PPE	0.081	0.019	0.114	4.280	0.000

Note. $F_{1,1401} = 18.322$ with an $R^2 = .013$ and a $p < .001$
[a] Dependent variable.

Specific hypothesis 5e (SH5e). To test the hypothesis derived from question number 14 in the survey, i.e., what influences the use of PPE, a simultaneous multiple linear regression analysis was conducted. The hypothesis was supported ([$F(1)(1584) = 7.03$, $p = .008$, $R^2 = .004$]). The variable hospital leaders' attitudes about the use of PPE predicted statistically significant variance in the dependent variable (Factor 2B; Risk Assessment). See Table 41 for the summary of regression results.

Table 41

Regression 33: Question 14-Risk Assessment[a] and Attitudes Regarding the Use of PPE

Variable	B	SE B	*B*	*t*	*p*
(Constant)	-0.091	0.042		-2.171	0.030
Attitudes Regarding the use of PPE	0.047	0.018	0.066	2.652	0.008

Note. $F_{1,1584} = 7.030$ with an $R^2 = .004$ and a p = .008
[a] Dependent variable.

Specific hypothesis 5f (SH5f). To test the hypothesis derived from question number 14 in the survey, i.e., what influences the use of PPE, a simultaneous multiple linear regression analysis was conducted. The hypothesis was supported ([$F(1)(1584) = 336.968$, $p < .001$, $R^2 = .175$]). The variable hospital leaders' attitudes about the use of PPE predicted statistically significant variance in the dependent variable (Factor 3B; Rules and Role Models). See Table 42 for the summary of regression results.

Table 42

Regression 34: Question 14-Rules and Role Models[a] and Attitudes Regarding the Use of PPE

Variable	B	SE B	*B*	*t*	*p*
(Constant)	-0.563	0.038		-14.696	0.000
Attitudes Regarding the use of PPE	0.294	0.016	0.419	18.357	0.000

Note. $F_{1,1584} = 336.968$ with an $R^2 = .175$ and a $p < .001$
[a] Dependent variable.

Hospital leaders' attitudes about the use of PPE predicted statistically significant variance in the factors Barriers, Practices, and Standard Protection from question 8, and Risk Assessment, and Rules and Role Models from question 14. The factor Rules and Role Models includes example set by senior personnel/leadership. Leaders influence clinical practice by establishing, communicating, and enforcing standards, creating an environment where safety is valued. These factors all promote a safe environment.

General Hypothesis 6(GH6) There is a significant relationship between patients' needs and the use of PPE by members of surgical teams.

Specific hypothesis 6a (SH6a). To test the hypothesis derived from question number 8 in the survey, i.e., what influences the measures you take to protect yourself against exposure, a simultaneous multiple linear regression analysis was conducted. The hypothesis was supported ([$F(1)(1400) = 61.504$, $p < .001$, $R^2 = .042$]). The variable patients' needs predicted statistically significant variance in the dependent variable (Factor 1A; Barriers). See Table 43 for the summary of regression results.

Table 43

Regression 36: Question 8-Barriers[a] and Patient Needs Conflict with Use of PPE

Variable	B	SE B	*B*	*t*	*p*
(Constant)	0.890	0.116		7.642	0.000
Patient Needs Conflict with use of PPE	-0.283	0.036	-0.205	-7.842	0.000

Note. $F_{1,1400} = 61.504$ with an $R^2 = .042$ and a $p < .001$
[a] Dependent variable.

Specific hypothesis 6c (SH6c). To test the hypothesis derived from question number 8 in the survey, i.e., what influences the measures you take to protect yourself against exposure, a simultaneous multiple linear regression analysis was conducted. The hypothesis was supported ([$F(1)(1583) = 32.961$, $p < .001$, $R^2 = .023$]). The variable patients' needs predicted statistically significant variance in the dependent variable (Factor 3A; Standard Protection). See Table 44 for the summary of regression results.

Table 44

Regression 38: Question 14-Standard Protection[a] and Patient Needs Conflict with Use of PPE

Variable	B	SE B	*B*	*t*	*p*
(Constant)	654	0.117		5.596	0
Patient Needs Conflict with use of PPE	-0.208	0.036	-0.152	-5.741	0

Note. $F_{1,1583} = 32.961$ with an $R^2 = .023$ and a $p < .001$
[a] Dependent variable.

Specific hypothesis 6d (SH6d). To test the hypothesis derived from question number 8 in the survey, i.e., what influences the measures you take to protect yourself against exposure, a simultaneous multiple linear regression analysis was conducted. The hypothesis was supported ([$F(1)(1583) = 281.673$, $p < .001$, $R^2 = .151$]). The variable patients' needs predicted statistically significant variance in the dependent variable (Factor 1B; Deterrents). See Table 45 for the summary of regression results.

Table 45

Regression 39: Question 14-Deterrents[a] and Patient Needs Conflict with Use of PPE

Variable	B	SE B	*B*	*t*	*p*
(Constant)	-1.662	0.102		-16.327	0.000
Patient Needs Conflict with use of PPE	0.527	0.031	0.389	16.783	0.000

Note. $F_{1,1583} = 281.673$ with an $R^2 = .151$ and a $p < .001$
[a] Dependent variable.

Specific hypothesis 6e (SH6e). To test the hypothesis derived from question number 14 in the survey, i.e., what influences the use of PPE, a simultaneous multiple linear regression analysis was conducted. The hypothesis was supported ([$F(1)(1583) =$

4.692, p = .030, R^2 = .003]). The variable patients' needs predicted statistically significant variance in the dependent variable (Factor 2B; Risk Assessment). See Table 46 for the summary of regression results.

Table 46

Regression 40: Question 14-Risk Assessment[a] *and Patient Needs Conflict with the Use of PPE*

Variable	B	SE B	*B*	*t*	*p*
(Constant)	-0.234	0.110		-2.134	0.033
Patient Needs Conflict with use of PPE	0.073	0.034	0.054	2.166	0.030

Note. $F_{1,1583}$ = 4.692 with an R^2 = .003 and a p = .030
[a] Dependent variable.

Specific hypothesis 6f (SH6f). To test the hypothesis derived from question number 14 in the survey, i.e., what influences the use of PPE, a simultaneous multiple linear regression analysis was conducted. The hypothesis was supported ([F(1)(1583) = 35.166, p < .001, R^2 = .022]). The variable patients' needs predicted statistically significant variance in the dependent variable (Factor 3B; Rules and Role Models). See Table 47 for the summary of regression results.

Table 47

Regression 41: Question 14-Rules and Role Models[a] *and Patient Needs Conflict with the Use of PPE*

Variable	B	SE B	*B*	*t*	*p*
(Constant)	0.632	0.109		5.777	0.000
Patient Needs Conflict with use of PPE	-0.200	0.034	-0.147	-5.930	0.000

Note. $F_{1,1583}$ = 35.166 with an R^2 = .022 and a p < .001
[a] Dependent variable.

Specific hypothesis 6g (SH6g). To test the hypothesis derived from question number 14 in the survey, i.e., what influences the use of PPE, a simultaneous multiple linear regression analysis was conducted. The hypothesis was supported ([F(1)(1583) = 4.804, p = .029, R^2 = .003]). The variable patients' needs predicted statistically significant variance in the dependent variable (Factor 4B; Experience). See Table 48 for the summary of regression results.

Table 48

Regression 42: Question 14-Experience[a] and Patient Needs Conflict with the Use of PPE

Variable	B	SE B	*B*	*t*	*p*
(Constant)	-0.234	0.110		-2.123	0.034
Patient Needs Conflict with use of PPE	0.075	0.034	0.055	2.192	0.029

Note. $F_{1,1583}$ = 4.804 with an R^2 =.003 and a p = .029
[a] Dependent variable.

Patients' needs predicted statistically significant variance in the factors Barriers and Standard Protection from question 8 and predicted Deterrents, Risk Assessment, Rules and Role Models, and Experience from question 14. Urgency of patient care needs is one component of the factor Deterrents, as is amount of time available. A summary table of hypotheses is presented in Appendix F (see Table 49).

Summary

This chapter has presented the results of the quantitative analysis. The final chapter will discuss the findings of both the qualitative and quantitative analysis as well as the relationships between them. Theoretical implications based on the findings, limitations of the study, and areas for future research will be presented

CHAPTER VI

DISCUSSION

This is the final chapter of this dissertation and it is divided into 3 sections. The first section will discuss the six individual research questions including implications and recommendations for further research. The second section is a discussion of the study's limitations and the final section is a summary.

Discussion of Research Questions

This section will discuss the findings of the analyses. Each research question will be presented, briefly discussed and followed by the implications and recommendations for further research.

Research Question 1: What differences (perceptual and demographic) exist between surgical team members (surgeons, anesthesiologists, nurse anesthetists, registered nurses, and surgical technologists) that influence their choices of wearing or not wearing PPE during operative/invasive procedures?

Respondent demographics (profession, age, geographic location, length of time in profession, and awareness of hospital and federal regulations) predicted all factors. However, demographics had a weak influence on the factors Deterrents, Risk Assessment, and Experience while having a stronger influence on the remaining factors, Barriers, Practices, Standard Protection, and Rules and Role Models.

Type of profession accounted for a significant proportion of unique variance (R^2 = .350) in the factor Barriers (double gloving, wearing a reinforced gown, single gloving, or wearing a plastic apron). For all professional groups the relationship was positive as indicated by regression weights (Anesthesiologists [standardized B = 1.041, $p < .001$], CRNA [standardized *B* = 1.058, $p < .001$], Registered Nurses [standardized *B* = 0.614, $p < .001$], Surgeons [standardized *B* = 0.504, $p = .001$] and Surgical Technologists [standardized *B* = 0.524, $p = .012$]). This is congruent with the qualitative data. Each professional group uses PPE, the team member's function determines what type of PPE is most appropriate. Anesthesiologists, nurse anesthetists, and registered nurses normally would wear less PPE than their surgeon or surgical technologist colleagues.

Age (standardized *B* = 0.165, $p < .001$) and time in profession (standardized *B* = -0.091, $p = 0.048$) accounted for a significant proportion of unique variance ($R^2 = .161$) in the factor Standard Protection (wearing a standard gown, a mask, and eye protection). Respondents with more experience in their profession are less likely to use standard protection than respondents with less experience. Findings from the qualitative data in this study also support these differences. Influence of the younger generation was perceived by respondents as one phenomenon that would increase the likelihood of PPE use. Akduman et al. (1999) also found that generational differences influenced the use of PPE. In their study, medical students were more likely to wear goggles and residents were more likely to double glove. In this study the average age of respondents was 48 years with an average time in profession of 19 years. This was a well experienced sample.

Being a nurse anesthetist accounted for a significant proportion of unique variance ($R^2 = .040$) in the factor Risk Assessment (patient suspected of bloodborne infection, patient with known bloodborne infection, risk assessment based on likelihood of exposure to blood, and risk assessment based on lifestyle, sexual orientation, or nationality). This finding is not supported in the qualitative data nor in the literature. In this study, nurse anesthetists were less likely to use risk assessment (standardized *B* = -0.467, $p = 0.031$) as a means of selecting PPE. There were no other variables accounting for significant proportions of unique variance.

There were four principal differences found between surgical team members influencing their choices of wearing or not wearing PPE during operative/invasive procedures. Functional (i.e. profession or role based) differences exist between the groups. Age and experience (i.e., time in profession) differences exist among members of the groups. Finally, nurse anesthetists were less likely to consider the components of the factor risk assessment to determine the level of PPE to use.

Implications

Hospital leaders, educators and trainers of surgical teams, and PPE device manufacturers share the common goal of improving the proper and consistent use of PPE by members of surgical teams during operative/invasive procedures. Findings from this research question can guide interventions supporting that common goal. The theory of reasoned action holds that behaviors are a result of thoughtful reasoning (Azjen & Fishbein, 1980) influenced by intentions which are either personal or social. The personal component of intention is made up of attitudes toward an action and is shaped by beliefs about the consequences of specific behavior. Education helps to shape attitudes. PPE use will improve through exposure to effective training and continuing professional education (CPE) that recognizes the differences between groups and incorporates the concepts of the theory of reasoned action. Training and CPE should focus on the potential consequences of using or not using PPE properly as well as provide novel ways to overcome the deficiencies of PPE available today (i.e., protective eyewear fogging or two pairs of gloves cramping the hand). The use of PPE will be positively influenced if the wearer believes that PPE is effective in reducing risk of infection or negatively influenced if he or she does not.

Further Research

Future research examining differences between members of surgical teams and their use of PPE could approach the question through a case study or ethnography of surgical teams. This approach would allow the researcher to explore the dynamics among members of surgical teams and how those dynamics influence the use or nonuse of PPE. Another potentially interesting study would be to examine generational differences among surgical team members and how these differences affect the use of PPE. Are there differences in team behavior based on age and/or time in profession or are differences due to initial education and training? How might the findings of this study have differed with a younger and less experienced sample or a sample that had recently completed initial education and training? CRNAs as a professional group were significantly less likely to use the factor risk assessment than all other groups. This finding deserves a closer look. To accomplish this, an investigator might more closely examine the factor itself, refine the survey and repeat the study, or through a qualitative lens explore the phenomenon of risk assessment. Finally when examining differences between different professional members of surgical teams, research to examine the differences between team members who had previous experience in a different role (i.e., began as a surgical technologist but is now a registered nurse, or began as a registered nurse but is now a physician, etc.) would add to the existing body of knowledge.

Question 2: How does previous accidental exposure to blood or body fluids influence surgical team members regarding the use of PPE?

Previous accidental exposure to blood or body fluids was predictive for the factors Practice, Risk Assessment, Rules and Role Models, and Experience. All factors except for Experience were weakly associated with previous accidental exposure. Previous inoculation injury accounted for thirty percent of the variance in the factor Experience, a strong association. When asked what would increase the likelihood of PPE use, two groups, nurse anesthetists and surgical technologists identified an example from an infected peer. They perceived this example would motivate others to change their current practices. A surgical technologist remarked, "If something happened to them personally, causing them to have to take an HIV test, or if someone died from lack of use." Previous exposure to blood or body fluids strongly influences surgical team members regarding the use of PPE.

The decision to take measures to protect oneself should not be motivated from a potentially lethal exposure to another's blood or body fluids. However, both the qualitative and quantitative analysis in this study suggests that it might be. Previous research has not investigated the relationship between the consistent use of PPE and accidental exposure to blood or body fluids. Multiple studies have demonstrated a low compliance rate among surgical team members and their use of PPE (Akduman et al., 1999; Cutter & Jordan, 2004; Gershon et al., 1995; Nelsing et al., 1997). One of these studies determined that three quarters of respondents (145 of 196 respondents) reported having been accidentally exposed to blood or body fluids during the previous decade

(Cutter & Jordan, 2004). Surgical team members are frequently exposed to blood or body fluids while performing operative or invasive procedures.

Implications

The experiential learning theory suggests that new actions and behaviors occur when lived experiences are transformed into already established cognitive frameworks (Kolb, 1984). Personal experience is an important component of the model as learners' use concrete experience to grasp new information. Designing educational experiences that include the use of simulation, practice, or role play and place learners in unexpected situations where they are potentially at risk for exposure to blood or body fluids is an effective learning strategy based on the findings of this study. Simulation and role play allow learners to try out new behaviors in safe, experimental settings. In addition, training programs that include personal testimony from surgical team members who developed a bloodborne infection after an exposure during which they did not use proper PPE may help increase learning.

Further Research

Different types of teaching methods should be studied to determine which method is more effective in increasing the use of PPE by team members. Methods such as weekly lectures, brief hallway in-services, scrub sink posters, classroom training, or others should be investigated and compared to determine which method results in the greatest increase in compliance. Little is known about the effectiveness of continuing professional education and its impact on the care provider (Rocco, 2009). For this education to be useful it should result in new behaviors, consistent application, and improved outcomes. In addition to various methods of training, the frequency of training events should be studied to determine what interval results in the most meaningful behavior change. Is weekly, monthly, quarterly, semi-annually, annually, or some combination the most effective training schedule to influence clinical practice? The transfer of training inventory developed by Holton, Bates, and Ruona (2000) could be used to investigate this.

Because actual reporting of bloodborne exposure is low (Osborne, 2003), research measuring the effect of previous exposure and subsequent exposure reporting would be useful to help develop targeted training that improves PPE use. Future studies investigating PPE use might examine team members' experiences after being exposed to blood or body fluids during surgical or invasive procedures and the effect the exposure has on subsequent compliance with PPE. Is there a difference in behavior based on age, gender, or rank?

Question 3: How do federal (OSHA) regulations influence surgical team members regarding the use of PPE?

Federally required use of PPE predicted the factors Barriers, Practices, Standard Protection, Risk Assessment, and Rules and Role Models. All factors except for Rules and Role Models were weakly associated with federally required use of PPE. Federally required use of PPE accounted for sixteen percent of the variance in the factor Rules and Role Models, a moderate association. Rules and Role Models includes such concepts as hospital policy, OSHA requirement, example set by peer or senior personnel/leadership, and education and training. This factor aligns with two themes from the qualitative analysis, leadership and education. One respondent noted, "The policies and procedures of OSHA, which are similar to our hospital policies, mandate the use of PPE for staff and patient protection." Another said, "I don't care who requires it, I do it because that's what I believe is right." These statements are good examples of the fourth and sixth stages of Kohlberg's theory of moral development (Kohlberg, 1984). The fourth stage of moral development, maintaining social order, focuses on following rules, respecting authority, and doing one's duty. The sixth and last stage, universal principles, suggests that moral reasoning is founded upon abstract reasoning and universal principles. People at this stage of development operationalize principles of justice even when they conflict with rules or law. They do so because it's the right thing to do. Therefore federal regulations strongly influence surgical team members regarding the use of PPE.

Implications

Surgical team members recognize that federal regulations require the use of PPE when exposure to blood or body fluids can be reasonably anticipated. However, mandated PPE use has not resulted in improved compliance (Akduman et al., 1999; Cutter & Jordan, 2004; Gershon et al., 1995; Nelsing et al., 1997; Taylor, 2006). Most surgical team members recognize that federal mandates are meant to provide for their safety. This was also the case in this study. Two groups of respondents, anesthesiologists and surgeons resented the intrusion of government into their professional practice and felt that regulations were created by bureaucrats who were not familiar with the work environment and thus not well positioned to be creating legal mandates for practice. Failure of surgical team members to properly and consistently use PPE during operative/invasive procedures is not due to a lack of federal regulation, but a lack of confidence that PPE is necessary or effective, or the benefit of wearing PPE is outweighed by the discomfort.

Further Research

Studies that demonstrate the effectiveness of PPE in preventing transmission of bloodborne disease, not just exposure to blood or body fluids, to surgical team members is needed in order to hardwire its use. Pender's health promotion model (Pender, Murdaugh, & Parsons, 2006) holds that behavior will be exhibited if the benefits to the behavior outweigh the barriers. PPE that obstruct vision, reduces dexterity or tactile abilities, or is uncomfortable will not be worn. PPE that does not hinder the wearer in the delivery of care is more likely to be worn. Researchers along with PPE manufacturers should focus their efforts on targeted product development, improving the performance of currently available PPE. Gowns that are cooler, gloves that are more comfortable, and eyewear that does not fog or obscure vision will be more readily accepted by surgical team members than what is currently sold on the market. Finally, Kohlberg (1984) held that moral development occurs through social interaction. This could be tested by comparing the use of PPE among different surgical teams. Teams led by surgeons who encourage or require the use of PPE during surgery compared to teams led by surgeons who do not, or are silent regarding the use of PPE, would form the basis for a very interesting observational study.

Question 4: How do hospital policies and procedures influence surgical team members regarding the use of PPE?

Hospital policies and procedures predicted the factors Barriers, Practices, Standard Protection, Risk Assessment, and Rules and Role Models. All factors except for Rules and Role Models were weakly associated with hospital policies and procedures. Hospital policies and procedures accounted for fifteen percent of the variance in the factor Rules and Role Models, a moderate association. As stated previously, Rules and Role Models included such concepts as hospital policy, OSHA requirement, example set by peer or senior personnel/leadership, and education and training. This factor aligns with two themes from the qualitative analysis, leadership and education. Qualitative responses to this question focused upon respondents perception of leadership behaviors, "The policy is there but rarely reinforced. The wearing of eye protection is the most ignored. People will put double gloves on but not wear a face shield – go figure." Hospital policies and procedures strongly influence surgical team members regarding the use of PPE.

Implications

In previous research, perceived organizational commitment to safety was found to be a correlate of compliance with PPE use (Gershon et al., 1995) and in this study, policy and procedure were associated with leadership attitudes. Healthcare organizations have adopted policy requiring the use of PPE. Failure of surgical team members to use PPE is not due to a lack of organizational policy but rather a failure of the organization's leaders to enforce its policies. According to the TRA, people will behave in a certain manner (i.e., consistently and properly wear PPE) when they believe that others important to them (i.e., their superiors) think they should. The implications of this question are similar to those associated with the question concerning the influence of hospital leaders' attitudes.

Further Research

Research investigating the effect of published policy on PPE use should examine the relationship between educational offerings concerning an organization's PPE policy and the subsequent use of PPE. Most organizations review established policy during initial employee on-boarding and then perhaps certain policies, annually. Research investigating the effect of more frequent (monthly, quarterly, semi-annually, etc.) policy review and the use of PPE would be informative. Medical staff (independent licensed practitioners not the interns and residents) are rarely, if ever, presented with an organization's specific policies but rather are expected to be familiar with requirements as an outcome of their training. Longitudinal research investigating the effect of policy education in medical school training or during subsequent internships and/or residencies would help to determine which approach results in the consistent use of PPE once the participant establishes independent practice.

Question 5: How do hospital leaders' attitudes encourage or discourage the use of PPE by members of surgical teams?

Hospital leaders' attitudes predicted the factors Barriers, Practices, Standard Protection, Risk Assessment, and Rules and Role Models. All factors except for Rules and Role Models were weakly associated with hospital leaders' attitudes. Hospital leaders' attitudes accounted for seventeen percent of the variance in the factor Rules and Role Models, a moderate association. As stated previously, Rules and Role Models included such concepts as hospital policy, OSHA requirement, example set by peer or senior personnel/leadership, and education and training. This factor aligns with one theme from the qualitative analysis, leadership. Comments from respondents in the qualitative section of this question were divided into two distinct categories; leaders' attitudes were perceived to strongly influence the use of PPE or perceived to weakly influence the use of PPE. One respondent noted, "The higher ups don't seem to take this seriously. They teach one thing but they themselves do the opposite…very frustrating."

While another commented, “Everyday first thing at the morning meeting she stresses wearing protection, not wearing protection will grant you a warning.” Hospital leaders’ attitudes strongly influence surgical team members regarding the use of PPE, either positively or negatively.

Implications

In the theory of reasoned action (Azjen & Fishbein, 1980), intentions to perform a certain behavior are personal or social. The social component of intention is the subjective norm and is related to a person’s understanding of social pressures to perform or not perform an action. The use of PPE will be positively influenced by the subjective norm if surgical team members feel that others important to them (i.e., peers, supervisors) believe they should use PPE. Hospital administrators and leaders of surgical teams will improve team members’ compliance with the use of PPE if they consistently articulate the expectation of PPE use, use PPE when appropriate themselves, and promptly respond when expectations are not met or policies are violated.

The theory of emotionally intelligent leadership (EIL; Shankman & Allen, 2008) informs this study. Three areas of consciousness are involved in EIL, consciousness of context, consciousness of self, and consciousness of others. The consciousness of others includes domains such as inspiration, influence, coaching, and change agent. EIL emphasizes leader awareness and the importance of behaviors that coach, influence, and inspire others to change behavior.

Further Research

Future research should focus on determining which specific leader behaviors result in maximum compliance with PPE use: frequent rounding, consistent discipline, leading by example, other actions, or a specific combination of all actions. Research conducted to determine the effect of perceived positional power of noncompliant team members on the use of PPE by subordinate team members would be useful in developing educational programs geared towards eliminating this perceived power influence. In other words, if the surgeon doesn't use PPE, does his/her surgical team? And if not, what interventions are effective in modifying the behavior of the subordinate team member independent of what the surgeon does? A specific research question around who surgical team members identify as the leader, administration or the primary surgeon, would be useful to determine specifically whose behavior needs to be modified.

Question 6: What is the influence of patients' needs on the use of PPE by surgical team members?

Patients' needs predicted the factors Barriers, Standard Protection, Deterrents, Risk Assessment, Rules and Role Models, and Experience. All factors except for Deterrents were weakly associated with patients' needs. Patients' needs accounted for fifteen percent of the variance in the factor Deterrents, a moderate association. Deterrents includes such concepts as amount of time available, urgency of patient care needs, performance of the PPE (fogging and comfort), availability of the PPE, and patient objection. This factor aligns with two themes from the qualitative analysis, availability and performance. All respondent groups indicated they would provide emergency care to patients if needed, without stopping for PPE, potentially placing themselves at risk for contact with pathogens. One respondent commented, "If a patient has a critical need and I don't have on PPE, I would tend to take care of the critical need rather than delay to place

PPE." Patients' needs strongly influence surgical team members regarding the use of PPE.

This finding was supported in the literature in at least one study. The conflict between healthcare workers' need to protect themselves and to provide care for patients was identified as a factor affecting compliance with PPE (Gershon et al., 1995). Caregivers will help patients at all costs. This natural tendency could be mitigated by ensuring that plentiful and effective PPE is immediately available at the point of care.

Implications

Rosenstock's health belief model (1966), suggests that people will take certain actions if they believe they are susceptible to an illness, if they believe that taking action will be beneficial, and the barriers to action are less than the cost of the action itself. Similarly, the health promotion model (Pender, Murdaugh, & Parsons, 2006) suggests that people will engage in health promoting behavior if they feel in control of their health, and benefits to behavior outweigh the barriers. The theme of availability is supported by both of these theories. Readily available PPE (i.e., at arm's reach) is more likely to be used by care providers during unforeseen patient needs than PPE that is not readily available. Readily available requires that PPE is strategically stocked at the point of care, and maintained in all sizes. Surgical team members will be more likely to wear PPE if it readily available and, if in the process of donning the PPE, the patient is not harmed. The provision of regular, simulated learning experiences as previously discussed, would also help care providers to prepare for unplanned urgencies and emergencies involving possible exposure to blood or body fluid. Regular drills help to develop comfort and competence in advance of an urgent patient care need.

Healthcare organizations must continually balance the cost quality equation. The cost of placing PPE in all possible needed locations would be prohibitive; however, organizations should ensure that PPE is appropriately distributed in the areas it will most likely be needed. In addition, PPE provided by organizations must be of sufficient quality to protect the wearer. Type and quality of PPE is continually evolving. Products are improved through research and development by manufacturers and these improvements in quality improve performance. Not long ago hospitals and care providers were concerned about the development of latex allergy, a potentially career ending illness for surgical team members (Cuming, 2002). Today, many hospitals use latex free products, powder free products, or products with very low levels of residual latex, reducing the risk of allergy development for both the wearer and the patient. While the use of PPE during unexpected patient care needs can be improved, it most likely cannot be solved as there will be those instances when PPE is not donned in advance of administering to the urgent needs of a patient.

Further Research

Location of PPE should be studied to determine which locations result in the greatest compliance with PPE use. Specifically, should all PPE, or combinations of PPE, be available in multiple locations inside and outside of each operating or procedure room? Does this increased availability result in increased compliance with PPE use? Is this increased availability and use financially sustainable?

Summary

Leaders and educators of surgical team members can use the findings of this study to design targeted interventions (education, policy, etc.) that will result in the increased use of PPE during operative/invasive procedures. Manufacturers of PPE can use the findings of this study to guide on-going research and development in order to design products that will be more readily accepted by surgical team members. The four themes that emerged from the qualitative data (availability, education, leadership, and performance), combined with the answers to specific research questions and theoretical considerations allow for the synthesis of theory and intervention to shape desired behavior.

Limitations

There were two principal limitations to this study. First, respondents were accessed through their affiliation with one of five professional organizations. Consequently, only surgical team members who were also members of their professional organization had the opportunity to be included. Because membership in the professional organization is not a requirement for membership on a surgical team, some surgical team members were not afforded the opportunity to participate. This limits generalization of these results to surgical team members who are also members of their professional organization.

The second limitation of this study was the number of surgeons who responded. Two hundred and seventy one completed surveys from each professional group were required. Only two hundred and thirty-five completed surveys were obtained from the surgeon group, thirty-six fewer than required. This shortfall limits generalization of the surgeon group results beyond participants in this study.

Summary

Using a mixed methods survey, this ex post facto, non-experimental study sought to (a) examine factors surgical team members perceive influence choices of wearing or not wearing PPE during operative/invasive procedures and (b) determine what would influence the consistent use of PPE by surgical team members. The primary research question for the study was: What differences (perceptual and demographic) exist between surgical team members that influence their choices of wearing or not wearing PPE during operative/invasive procedures? There were four principal differences found between surgical team members influencing their choices of wearing or not wearing PPE during operative/invasive procedures. Functional (i.e. profession or role based) differences exist between the groups. Age and experience (i.e., time in profession) differences exist among members of the groups. Finally, being a nurse anesthetist influences the use of risk assessment to determine the level of PPE to use.

Four common themes emerged across all groups informing the two study purposes. Those themes were: availability, education, leadership, and performance.

Subsidiary research questions examined the influence of perceptions about previous accidental exposure to blood or body fluids, federal regulations, hospital policy and procedure, leaders' attitudes, and patients' needs on the use of PPE. Each of these perceptions was found to strongly influence surgical team members and their use of PPE during operative/invasive procedures.

Implications based on the findings affect organizational policy, purchasing and distribution decisions, curriculum design and instruction, leader behavior, and finally partnership with PPE manufacturers. Surgical team members must balance their innate need to care for patients with their need to protect themselves from possible exposure to blood borne pathogens while following policy. Results of this study will help team members, leaders, and educators achieve this balance.

REFERENCES

Ajzen, I., & Fishbein, M. (1980). Understanding attitude and predicting behavior. Englewood Cliffs, NJ: Prentice Hall.

Akduman, D., Kim, L., Parks, R., L'Ecuyer, P., Mutha, S., Jeffe, D., et al. (1999). Use of personal protective equipment and operating room behaviors in four surgical subspecialties: Personal protective equipment and behaviors in surgery. Infection Control and Hospital Epidemiology, 20(2), 110-114.

Association of periOperative Registered Nurses, Inc. (2005a). Recommended practices for standard and transmission based precautions in the perioperative practice setting. In R. Conner & D. Reno (Eds.), Standards, recommended practices, and guidelines (pp. 447-451). Denver, CO: Author.

Association of periOperative Registered Nurses, Inc. (2005b). Sharps injury prevention in the perioperative setting. In R. Conner & D. Reno (Eds.), Standards, recommended practices, and guidelines (pp. 199-204). Denver, CO: Author.

Association of periOperative Registered Nurses, Inc. (2008a). Prevention of transmissible infections. In R. Conner & D. Reno (Eds.), Perioperative standards and recommended practices (pp. 619-629). Denver, CO: Author.

Association of periOperative Registered Nurses, Inc. (2008b). Perioperative staffing. In R. Conner & D. Reno (Eds.), Perioperative standards and recommended practices (pp. 257-264). Denver, CO: Author.

Baker, A. C., Jensen, P. J. & Kolb, D. A. (2002). *Conversational learning: an experiential approach to knowledge creation.* Westport, CT: Quorum.

Becker, M. H., ed. (1974). The health belief model and personal health behavior. *Health Education Monographs, 2*, 324-473.

Boyatzis, R. E. (1998). Transforming qualitative information. Thousand Oaks, CA: Sage Publications Inc.

Brazen, L. & Roth, R. A. (1995). Using learning style preferences for perioperative clinical education. *AORN Journal, 61*(1), 189-195.

Brown, D. J. (2002). Attitudes of attending surgeons regarding reporting habits for needle-sticks and other bloodborne pathogen exposures: Applying the theory of reasoned action. M.P.H. dissertation, Southern Connecticut State University, United States -- Connecticut. Retrieved April 20, 2008, from ProQuest Digital Dissertations database. (Publication No. AAT 1410630)

Burns, N. & Grove, S.K. (2004). *The practice of nursing research: Conduct, critique & utilization* (5th ed.). Philadelphia: Saunders.

Canales, M. K. & French, H. (2003). Experiential learning as service for others. *AORN Journal, 77*(6), 1232-1239.

Center for Disease Control and Prevention. (1996). *Universal precautions for prevention of transmission of HIV and other bloodborne infections*. Retrieved October 20, 2006, from http://www.cdc.gov/ncidod/bp_universal _precautions.html

Center for Disease Control and Prevention. (1998). Public Health Service guidelines for the management of health care worker exposures to HIV and recommendations for postexposure prophylaxis. *Morbidity and Mortality Weekly Report*, 47(7), 1-28.

Center for Disease Control and Prevention. (2001). Updated U.S. Public Health Service guidelines for the management of occupational exposures to HIV, HCV, and HIV and recommendations for postexposure prophylaxis. *Morbidity and Mortality Weekly Report, 50*(11), 1-42.

Center for Disease Control and Prevention. (2002). *Preventing occupational HIV transmission to healthcare personnel*. [Brochure]. Retrieved October 20, 2006, from http://www.cdc.gov/hiv/resources/factsheets/PDF/hcwprev.pdf

Chow, M. C. (2005). Identification of factors that influence the behavioural intentions of nurses toward mechanically ventilated patients: A test of the theory of reasoned action. Ph.D. dissertation, Hong Kong Polytechnic University (Hong Kong), Hong Kong. Retrieved April 20, 2008, from *ProQuest Digital Dissertations database*. (Publication No. AAT 3190930)

Council on Surgical and Perioperative Patient Safety. (n.d.). *Welcome to the CSPS team web site.* Retrieved May 10, 2008, from http://www.csps.org/index.html

Cuming, R. G. (2002). Reducing the hazards of exposure to cornstarch glove powder. *AORN Journal 76*(2), 288-295.

Cuming, R. G., Rocco, T. S., & McEachern, A. (2008). Improving compliance with occupational safety and health administration standards. *AORN Journal 87*(2), 347-356.

Cutter, J., & Jordan, S. (2004). Uptake of guidelines to avoid and report exposure to blood and body fluids. *Journal of Advanced Nursing, 46*(4), 441-452.

Dillman, D. A. (2000). *Mail and Internet surveys: The tailored design method* (2nd ed). New York: Wiley.

Field, A. (2009). *Discovering statistics using SPSS* (3rd ed). Thousand Oaks, CA: Sage Publications Inc.

Fink, A. (2002). How to sample in surveys (2nd ed.). Thousand Oaks, CA: Sage Publications Inc.

Fink, A. (2003a). The survey handbook (2nd ed.). Thousand Oaks, CA: Sage Publications Inc.

Fink, A. (2003b). How to manage, analyze, and interpret survey data (2nd ed.). Thousand Oaks, CA: Sage Publications Inc.

Fishbein, M., & Ajzen, I. (1975). Belief, attitude, intention and behavior: An introduction to theory and research. Reading, MA: Addison-Wesley.

Gay, L.R., Mills, G.E., & Airasian, P. (2006). Educational research: Competencies for analysis and application (8th ed.). Upper Saddle River, NJ: Prentice-Hall.

Gershon, R. R., Vlahov, D., Felknor, S. A., Vesley, D., Johnson, P. C., Delclos, G.L., et al. (1995). Compliance with universal precautions among health care workers at three regional hospitals. American Journal of Infection Control, 23(4), 225-236.

Gile, T.J. (2001). The OSHA lowdown on occupational exposure to bloodborne pathogens. Medical Laboratory Observer. Retrieved January 28, 2007, from http://www.mlo-online.com/ce/pdfs/june01.pdf

Glanz, K., Rimer, B. K. & Lewis, F. M. (2002). *Health behavior and health education: Theory, research and practice.* San Francisco, CA: Wiley & Sons.

Grant, B. P. (2000). Factors that influence health care worker compliance with the activation of safe needle devices. M.P.H. dissertation, Southern Connecticut State University, United States -- Connecticut. Retrieved July 6, 2008, from Dissertations & Theses: Full Text database. (Publication No. AAT 1400079)

Greene, J. C. & Caracelli, V. J. (1997). Crafting mixed-method evaluation designs. In J. C. Greene & V. J. Caracelli (Eds.), Advances in mixed-method evaluation: The challenges and benefits of integrating diverse paradigms (pp.19-32). San Francisco, CA: Jossey-Bass.

Holodnick, C. L., & Barkauskas, V. H. (2000). Reducing percutaneous injuries in the OR by educational methods. AORN Journal, 72(3), 461-464, 468-472, 475-476.

Holton, E. F. III, Bates, R. A., Ruona, W. E. A. (2000). Development and validation of a generalized learning transfer system inventory. *Human Resource Development Quarterly, 11*(4), 333-360.

Josiah, M. R. (2006). Evaluating the determinants of a successful organ donor process in a multi-hospital system. Ph.D. dissertation, The Pennsylvania State University, United States -- Pennsylvania. Retrieved April 20, 2008, from ProQuest Digital Dissertations database. (Publication No. AAT 3231842)

Kerlinger, F. N., & Lee, H. B. (2000). *Foundations of behavioral research* (4th ed.). Fort Worth, TX: Harcourt College.

King, A. N. (2006). Factors influencing the decision to be tested for HIV among heterosexual college students. Ph.D. dissertation, Southern Illinois University at Carbondale, United States -- Illinois. Retrieved April 20, 2008, from ProQuest Digital Dissertations database. (Publication No. AAT 3215052)

Kohlberg, L. (1984). *The philosophy of moral development moral stages and the idea of justice.* Cambridge: Harper & Rowe.

Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development*. Englewood Cliffs, NJ: Prentice-Hall.

Makary, M. A., Al-Attar, A., Holzmueller, C. G., Sexton, J. B., Syin, D. Gilson, M. M., et al. (2007). Needlestick injuries among surgeons in training. The New England Journal of Medicine, 356(26), 2693-2699.

McNeil, K., Newman, I., & Kelly, F. J. (1996). *Testing research hypotheses with the general linear model.* Carbondale, IL: Southern Illinois University Press.

Miller, S. P. (1988). Fishbein model of Reasoned Action applied to cardiovascular health behaviors. Cardiovascular Nursing, 24(6), 38-39.

Nelsing, S., Nielsen, T.L., & Nielsen, J.O. (1997). Noncompliance with universal precautions and the associated risk of mucocutaneous blood exposure among Danish physicians. Infection Control and Hospital Epidemiology, 18(10), 692-698.

Newman, I. & McNeil, K. (1998). *Conducting survey research in the social sciences.* Lanham, MD: University Press of America.

Newman, I., Newman, C., Brown, R., & McNeely, S. (2006). *Conceptual statistics for beginners* (3rd ed.). Lanham, MD: University Press of America.

Osborne, S. (2003). Perceptions that influence occupational exposure reporting. AORN Journal, 78(2), 262-272.

Occupational Safety and Health Act, United States Code, Title 29, Chapter 15 §651 et seq. (1970).

Occupational Safety and Health Administration (OSHA). (n.d. a). OSHA's 30th anniversary. Retrieved February 1, 2007, from http://www.osha.gov/as/opa/osha-at-30.html

OSHA. (n.d. b). Frequently asked questions. Retrieved February 1, 2007 from http://www.osha.gov/as/opa/osha-faq.html

OSHA. (n.d. c). Healthcare facilities OSHA standards. Retrieved February 2, 2007 from http://www.osha.gov/SLTC/healthcarefacilities/standards.html

OSHA. (1991). Occupational exposure to bloodborne pathogens – OSHA. Final rule. Federal Register, 56 (235), 64004-182.

OSHA. (2003). Personal protective equipment. Retrieved February 8, 2007 from http://www.osha.gov/Publications/osha3151.pdf

Osterweil, N. (2006). 9/11 First responders suffered major lung function loss. Medpage today. Retrieved October 20, 2006, from http://www.medpagetoday.com/Pulmonary/SmokingCOPD/tb/3839

Pender, N. J., Murdaugh, C. L., & Parsons, M. A. (2006). *Health promotion in nursing practice* (5th ed.). Upper Saddle River, NJ: Prentice Hall.

Pereira, P. A. (2004). Attitudes of nurses and nursing students toward various groups of people with body piercings. M.S.N. dissertation, Texas Tech University, United States -- Texas. Retrieved April 20, 2008, from ProQuest Digital Dissertations database. (Publication No. AAT 1419507)

Protogerou, C. M. (2007). A cross-cultural study of psychosocial factors influencing young peoples' intended non-condom use. Ph.D. dissertation, University of Bath (United Kingdom), England. Retrieved April 20, 2008, from ProQuest Digital Dissertations database. (Publication No. AAT C829805)

Rocco, T. S. (2009). Informing learning for today's professionals: Lessons from the social critique of mandatory continuing education. In A. P. Grace, T. S. Rocco, and associates (Eds.), *Challenging the professionalization of adult education: John Ohliger and contradictions in modern practice* (pp. 165-182). San Francisco, CA: Jossey-Bass.

Rosenstock, I. M. (1966). Why people use health services. *Millbank Memorial Fund Quarterly, 44*(3), 94-127.

Rosentreter, J. & Talboy, M. L. (2003). A didactic and experiential approach to nursing education. *AORN Journal, 78*(2), 274-288.

Rummel, R. J. (1970). *Applied factor analysis.* Evanston, IL: Northwestern University Press.

Sewchuk, D. H. (2005). Experiential learning – A theoretical framework for perioperative education. *AORN Journal, 81*(6), 1311-1318.

Shankman, M. L., & Allen, S. J. (2008). *Emotionally intelligent leadership: A guide for* college students. San Francisco: Jossey – Bass.

Sheehan, K. B., & McMillan, S. J. (1999). Response variation in e-mail surveys: An exploration. Retrieved July 1, 2005 from: http://web.utk.edu/~sjmcmill/Research/MS1257.doc

Spillane, J. (2006). Toxic dust takes its toll. Nursing Spectrum. Retrieved October 20, 2006, from http://community.nursingspectrum.com/MagazineArticles/article.cfm?AID=23236

Stevens, J. (2002). *Applied multivariate statistics for the social sciences* (4th ed.). Philadelphia, PA: Lawrence Erlbaum Associates.

Stuppy, D. J., Armstrong, M. L., & Casals-Ariet, C. (1988). Attitudes of health care providers and students towards tattooed people. Journal of Advanced Nursing, 27, 1165-1170.

Tabachnick, B. G. & Fidell, L. S. (2007). *Using multivariate statistics* (5th ed.). Boston, MA: Pearson

Tashakkori, A. & Teddlie, C. (Eds.). (2003). *Handbook of mixed methods in social and behavioral research*. Thousand Oaks, CA: Sage Publications Inc.

Taylor, D.L. (2006). Bloodborne pathogen exposure in the OR – What research has taught us and where we need to go. AORN Journal, 83(4), 834-846.

The Joint Commission on Accreditation of Healthcare Organizations, Inc. (2008). *Comprehensive accreditation manual for hospitals: The official handbook.* (pp.290). Oakbrook Terrace, IL: Author.

Thrasher, R. G. (2006). Using the theory of reasoned action to examine the gambling behaviors of college athletes and other students. Ph.D. dissertation, University of Louisville, United States -- Kentucky. Retrieved April 20, 2008, from ProQuest Digital Dissertations database. (Publication No. AAT 3228058)

Turnbeaugh, T. M. (1997). Needlestick safety: Impact of the health belief model, locus of control, and policy on needlestick occurrence among emergency room and operating room personnel. Ph.D. dissertation, Saint Louis University, United States -- Missouri. Retrieved July 6, 2008, from Dissertations & Theses: Full Text database. (Publication No. AAT 9803833)

Yarbrough, S. S., & Braden, C. J. (2001). Utility of health belief model as a guide for explaining or predicting breast cancer screening behaviours. *Journal of Advanced Nursing, 33*(5), 677-688.

Appendix A : Role Definitions of Surgical Team Members

Role Definitions of Select Surgical Team Members

Anesthesiologist:	The anesthesiologist is a physician specially trained to administer anesthetic agents to the surgical patient. He or she is responsible for monitoring and regulation of the patient’s physiologic status during surgery. The anesthesiologist is trained to render immediate care in the event of physiologic crisis.
CRNA:	The certified registered nurse anesthetist is a registered nurse who has received additional education and training to render the same care as an anesthesiologist and who works in collaboration with surgeons, anesthesiologists, dentists, podiatrists, and other qualified healthcare professionals. When anesthesia is administered by a nurse anesthetist, it is recognized as the practice of nursing.
Registered Nurse:	The registered nurse is licensed under the nurse practice act in her or her state, the registered nurse in the operating room functions in one of two roles, circulating nurse or scrub nurse. The circulating nurse is responsible for all nursing care the patient receives as well as the overall coordination of activities in the operating room. The scrub nurse is responsible for the sterile field, operating instruments, and assisting the surgical team.

Surgeon:	The surgeon may be a medical doctor, doctor of osteopathy, doctor of podiatric medicine, or doctor of dental science, licensed under the medical practice act in his or her state. The surgeon's primary duty is to perform the necessary invasive procedure.
Surgical Technologist:	The surgical technologist functions in a sterile capacity during the procedure and is responsible for the sterile field, operating instruments, and assisting the surgical team. In most States the surgical technologist functions under the direct supervision of a registered nurse.

Appendix B : Survey Instrument

Factors influencing surgical team members' choices of wearing or not wearing personal protective equipment (PPE) during operative/invasive procedures: A survey.

Survey Instrument

Estimated time to complete the survey is approximately 10 minutes.

1. What is your current age in years? _____ Years

2. What is your gender? _____ Male _____ Female

3. What is your geographic location?

   Northeast _____
   Midwest _____
   South _____
   West _____
   Other _____

4. Which of the following best describes your profession?

   Anesthesiologist _____
   CRNA _____
   Registered Nurse _____
   Surgeon _____
   Surgical Technologist _____
   Other, please state ______________________________

5. How long have you been in this profession?

   _____ Years

6. To which of the following professional organizations do you belong? (Select all that apply)

   American Association of Nurse Anesthetists _____
   American College of Surgeons _____
   American Society of Anesthesiologists _____
   Association of periOperative Registered Nurses _____
   Association of Surgical Technologists _____

7. Please indicate how much you agree or disagree with these statements:

	Strongly Disagree	Disagree	Agree	Strongly Agree
I am very aware of Federal regulations (OSHA/Joint Commission) regarding the use of PPE.	1	2	3	4
I am very aware of hospital policy and procedure regarding the use of PPE.	1	2	3	4

8. Members of the surgical team take measures to protect themselves against exposure to blood and body fluids during operative/invasive procedures. For each precaution listed below, please check the box that most accurately describes what influences the measures you take.

Select only one box per item.

Protective Measures	All Patients	Patients suspected as having a blood borne infection, e.g. HIV, Hepatitis B, Hepatitis C	Patients known to have a blood borne infection	Never
a. Wear gloves, 1 pair				
b. Wear gloves, 2 pairs (Double glove)				
c. Wear mask				
d. Wear eye protection/full face visor				
e. Wear a plastic/water impervious apron				
f. Wear a standard gown				
g. Wear an extra-reinforced gown				
h. Avoid passing sharp objects by hand				
i. Avoid use of sharp objects when possible				
j. Disinfect blood spillages with a chlorine releasing disinfectant				
k. Cover cuts or abrasions with a waterproof dressing				

Other precautions, please describe:

____

____

9. Provide the reason(s) for no, limited, or occasional use of personal protective equipment during operative/invasive procedures.

____

____

10. What barriers must be overcome to consistently use personal protective equipment during operative/invasive procedures?

____

____

11. Inoculation injury is a term that includes needlestick injury or injuries from other sharp instruments/devices and splashes of blood to mucous membranes or broken skin. Have you sustained such an injury?
If no, skip to question #14 Yes _____ No _____

12. When was the last time you sustained an inoculation injury?
_____ Years

13. Please briefly describe the circumstances surrounding your injury and your use or nonuse of PPE at the time:

____

____

14. Please indicate to what degree each of the following factors influence your use of personal protective equipment.

	Strong Influence	Some Influence	Limited Influence	No Influence	Not Applicable
a. Previous inoculation injury					
b. Past experience					
c. Education and training					
d. Example set by peer					
e. Example set by senior personnel/leadership					
f. Hospital policy					
g. OSHA requirement					
h. Patient with blood borne viral infection					
i. Patient suspected of having a blood borne viral infection					
j. Risk assessment based on judgments related to lifestyle, sexual orientation, or nationality					
k. Risk assessment based on likelihood of exposure to blood or body fluids					
l. Gloves (single or double) interfere with dexterity					
m. Amount of time available					
n. Availability of protective clothing					
o. Goggles/Face shields limit vision					
p. Extra-reinforced surgical gowns are too warm					
q. Urgency of patient care needs					
r. Patient objection to use of PPE					

Other, please describe:

____

____

15. Patient care needs conflict with the use of PPE:

All of the time _____
Some of the time _____
Rarely _____
Never _____
Please explain how patient care needs do or do not conflict with the use of PPE:

____

____

16. In my hospital/workplace the leader's attitudes regarding the use of PPE:

Strongly encourages my use of PPE _____
Somewhat encourages my use of PPE _____
Somewhat discourages my use of PPE _____
Strongly discourages my use of PPE _____
No effect _____
Not applicable _____
Please explain what influences the choice you selected above:

____

____

17. Hospital policy and procedure regarding the use of PPE:

Strongly encourages my use of PPE _____
Somewhat encourages my use of PPE _____
Somewhat discourages my use of PPE _____
Strongly discourages my use of PPE _____
No effect _____
Not applicable _____
Please explain what influences the choice you selected above:

____

____

18. Regulatory and federal agency (OSHA/Joint Commission) requirements regarding the use of PPE:

Strongly encourages my use of PPE _____
Somewhat encourages my use of PPE _____
Somewhat discourages my use of PPE _____
Strongly discourages my use of PPE _____
No Effect _____
Not applicable _____
Please explain what influences the choice you selected above:

____

____

19. In your opinion, what would increase the likelihood of PPE use by all members of surgical teams in general?

____

____

20. Is there anything else regarding the use of PPE you would like to mention?

____

____

Thank you for taking the time to complete this questionnaire. You may contact the researcher via e-mail at rcuming@bellsouth.net or by telephone at (954) 260-1119.

Appendix C: Original Survey Instrument

Questionnaire

Factors influencing compliance with universal precautions and reporting of percutaneous and mucocutaneous exposure to blood and body fluids

1. Which of the following best describes your profession? Please tick.

Surgeon
Obstetrician/Gynaecologist
Scrub Nurse
Midwife
Other, please state ______________________________

2. Which of the following best describes your grade?
Consultant
Staff Grade
Senior Registrar
Registrar
Senior House Officer
House Officer
Nursing Sister
Staff Nurse
Enrolled Nurse
Midwifery Sister
Staff Midwife
Other, please state ___________________________

3. How long have you been qualified as a doctor/nurse/midwife?
Less than 1 year
1 – 5 years
6 – 10 years
11 – 15 years
Over 15 years

4. How long have you been in your present position?

Less than 1 year
1 – 5 years
6 – 10 years
11 – 15 years
Over 15 years

5. For each precaution, please tick the box that most accurately describes what influences the measures you take to protect yourself against exposure to blood and body fluids during surgery/deliveries.

	All patients	Patients suspected as having a blood borne infection, e.g. HIV, hepatitis B, hepatitis C	Patients known to have a blood borne infection	Never
a. Wear gloves, 1 pair	☐	☐	☐	☐
b. Double glove	☐	☐	☐	☐
c. Wear mask	☐	☐	☐	☐
d. Wear eye protection/full face visor	☐	☐	☐	☐
e. Wear a plastic apron	☐	☐	☐	☐
f. Wear a cotton gown	☐	☐	☐	☐
g. Wear a water impermeable gown	☐	☐	☐	☐
h. Avoid passing sharp objects by hand	☐	☐	☐	☐
i. Avoid use of sharps where possible	☐	☐	☐	☐
j. Disinfect blood spillages with a chlorine releasing disinfectant	☐	☐	☐	☐
k. Cover cuts and abrasions with a waterproof dressing	☐	☐	☐	☐

Other, please describe:

____

____

6. Universal precautions is a term used to describe routinely wearing the appropriate protective clothing whenever exposure to blood and body fluids is anticipated, irrespective of the patient's risk status for carrying a blood borne virus, for example HIV, Hepatitis B or Hepatitis C. Are you familiar with this term?

Yes _____ No _____

7. Please indicate what factors influence your choice of protective clothing?

	Yes	No
a. Previous inoculation injury	☐	☐
b. Past experience	☐	☐
c. Education and training	☐	☐
d. Example set by colleagues	☐	☐
e. Example set by senior personnel	☐	☐
f. Patient has blood borne viral infection	☐	☐
g. Patient suspected as having a blood borne viral infection	☐	☐
h. Risk assessment based on judgments related to lifestyle, sexual orientation or nationality	☐	☐
i. Risk assessment based on likelihood of exposure to blood or other body fluids	☐	☐
j. Gloves would interfere with dexterity	☐	☐
k. Amount of time available	☐	☐
l. Availability of protective clothing	☐	☐
m. Universal precautions are unnecessary because of low incidence of blood borne viral infections in Wales	☐	☐
n. Patients would object	☐	☐

Other, please describe:

____

____

8. Inoculation injury is a term that includes needlestick injury or injuries from other sharp instruments and splashes of blood to mucous membranes or broken skin. Have you sustained such an injury within the past:

Less than 1 year

1 – 5 years

6 – 10 years

Never

9. If yes, please briefly describe the circumstances surrounding your injury:

____

____

10. Are you familiar with the procedure for reporting inoculation injuries in your Trust?

Yes _____ No _____

11. If you have had an inoculation injury, did you report it in accordance with your Trust's procedure for reporting inoculation injuries?

Yes _____ No _____

12. If the answer to question 11 is no, please indicate what factors influenced your decision not to report your injury.

a. Did not know what action to take	☐	☐
b. Did not know where to find relevant policy/procedure	☐	☐
c. Lack of time	☐	☐
d. Reporting mechanism too cumbersome	☐	☐
e. Patient was not "high risk"	☐	☐
f. Inoculation injuries are an occupational hazard	☐	☐
g. Scared of reprisals from senior staff	☐	☐

Other, please describe:

____

____

____

13. Comments:

____

____

____

____

Thank you for taking the time to complete this questionnaire.

Appendix D: Sample Survey Solicitation and Web Link

NEEDED: SURGEONS TO COMPLETE A BRIEF SURVEY ABOUT THE USE OF PERSONAL PROTECTIVE EQUIPMENT DURING SURGERY.

Fellows of the American College of Surgeons are being invited to participate in a brief study that focuses on the use or nonuse of personal protective equipment during operative/invasive procedures. Members of surgical teams are inconsistent in their use of personal protective equipment during surgery. This survey will explore factors that influence theses practice patterns.

If you would like to participate in this study click here which will serve as your consent to participate. The survey will take approximately 10 minutes to complete. All responses to the survey will be completely anonymous, and no protected health information will be collected.

The principal investigator of this study is Richard Cuming, RN who can be reached at rcuming@bellsouth.net. If you have questions about your rights as a research subject, contact Dr. Jonathan Tubman, the Chairperson of the Florida International University Institutional Review Board at 305-348-3024 or 305-348-2494. Dr. Tubman is the designated person to receive calls from all research respondents regarding the rights of human subjects.

Appendix E: SPSS Outputs

Regression 1

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Hospital_Regulations, Northeast, Age, CRNA, West, Surgeon, Anesthesiologist, Midwest, Registered_Nurse, Time_in_Profession, Federal_Regulations, Surgical_Technologist, South[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Factor_8_A

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.592[a]	.350	.344	.81393264

a. Predictors: (Constant), Hospital_Regulations, Northeast, Age, CRNA, West, Surgeon, Anesthesiologist, Midwest, Registered_Nurse, Time_in_Profession, Federal_Regulations, Surgical_Technologist, South

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	485.433	13	37.341	56.365	.000[a]
	Residual	900.981	1360	.662		
	Total	1386.415	1373			

a. Predictors: (Constant), Hospital_Regulations, Northeast, Age, CRNA, West, Surgeon, Anesthesiologist, Midwest, Registered_Nurse, Time_in_Profession, Federal_Regulations, Surgical_Technologist, South

b. Dependent Variable: Factor_8_A

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-1.524	.768		-1.985	.047

a. Dependent Variable: Factor_8_A

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	Anesthesiologist	2.603	.473	1.041	5.501	.000
	CRNA	2.460	.473	1.058	5.203	.000
	Registered_Nurse	1.675	.474	.614	3.536	.000
	Surgeon	1.565	.475	.504	3.295	.001
	Surgical_Technologist	1.189	.473	.524	2.515	.012
	Age	-.004	.004	-.046	-1.209	.227
	Northeast	-.126	.581	-.050	-.216	.829
	Midwest	-.067	.581	-.030	-.116	.908
	South	-.155	.581	-.073	-.266	.790
	West	-.104	.582	-.039	-.178	.859
	Time_in_Profession	.006	.003	.067	1.657	.098
	Federal_Regulations	-.035	.055	-.030	-.636	.525
	Hospital_Regulations	-.016	.055	-.013	-.283	.777

a. Dependent Variable: Factor_8_A

Regression 2

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Hospital_Regulations, Northeast, Age, CRNA, West, Surgeon, Anesthesiologist, Midwest, Registered_Nurse, Time_in_Profession, Federal_Regulations, Surgical_Technologist, South[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Factor_8_B

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	128.963	13	9.920	10.871	.000[a]
	Residual	1241.030	1360	.913		
	Total	1369.993	1373			

a. Predictors: (Constant), Hospital_Regulations, Northeast, Age, CRNA, West, Surgeon, Anesthesiologist, Midwest, Registered_Nurse, Time_in_Profession, Federal_Regulations, Surgical_Technologist, South

b. Dependent Variable: Factor_8_B

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.231	.901		-.256	.798
	Anesthesiologist	.335	.555	.135	.603	.547
	CRNA	.058	.555	.025	.105	.916
	Registered_Nurse	.359	.556	.132	.645	.519
	Surgeon	.700	.557	.227	1.256	.209
	Surgical_Technologist	.785	.555	.348	1.415	.157
	Age	.005	.004	.053	1.180	.238
	Northeast	-.145	.682	-.059	-.213	.832
	Midwest	.035	.682	.016	.051	.959
	South	-.054	.681	-.026	-.079	.937
	West	.133	.683	.050	.195	.846
	Time_in_Profession	.002	.004	.020	.424	.672
	Federal_Regulations	-.118	.064	-.101	-1.836	.067
	Hospital_Regulations	-.022	.065	-.019	-.343	.732

a. Dependent Variable: Factor_8_B

Regression 3

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.402[a]	.161	.153	.92400715

a. Predictors: (Constant), Hospital_Regulations, Northeast, Age, CRNA, West, Surgeon, Anesthesiologist, Midwest, Registered_Nurse, Time_in_Profession, Federal_Regulations, Surgical_Technologist, South

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	223.334	13	17.180	20.122	.000[a]
	Residual	1161.153	1360	.854		
	Total	1384.487	1373			

a. Predictors: (Constant), Hospital_Regulations, Northeast, Age, CRNA, West, Surgeon, Anesthesiologist, Midwest, Registered_Nurse, Time_in_Profession, Federal_Regulations, Surgical_Technologist, South

b. Dependent Variable: Factor_8_C

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.201	.872		-.230	.818
	Anesthesiologist	.159	.537	.063	.295	.768
	CRNA	.140	.537	.060	.261	.794
	Registered_Nurse	-.665	.538	-.244	-1.236	.217
	Surgeon	-.217	.539	-.070	-.403	.687
	Surgical_Technologist	-.607	.537	-.268	-1.131	.258
	Age	.016	.004	.165	3.848	.000
	Northeast	-.113	.660	-.045	-.171	.865
	Midwest	-.182	.659	-.082	-.275	.783
	South	-.048	.659	-.023	-.073	.942
	West	-.082	.660	-.031	-.125	.901
	Time_in_Profession	-.008	.004	-.091	-1.976	.048
	Federal_Regulations	.051	.062	.043	.815	.415
	Hospital_Regulations	-.072	.062	-.061	-1.151	.250

a. Dependent Variable: Factor_8_C

Regression 4

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.193[a]	.037	.029	.98380950

a. Predictors: (Constant), Hospital_Regulations, Age, Northeast, CRNA, West, Surgeon, Anesthesiologist, Midwest, Registered_Nurse, Time_in_Profession, Federal_Regulations, South, Surgical_Technologist

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	57.734	13	4.441	4.588	.000[a]
	Residual	1489.569	1539	.968		
	Total	1547.303	1552			

a. Predictors: (Constant), Hospital_Regulations, Age, Northeast, CRNA, West, Surgeon, Anesthesiologist, Midwest, Registered_Nurse, Time_in_Profession, Federal_Regulations, South, Surgical_Technologist

b. Dependent Variable: Factor_14_A

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.973	.624		-1.561	.119
	Anesthesiologist	-.030	.508	-.012	-.058	.954
	CRNA	.061	.508	.026	.121	.904
	Registered_Nurse	.183	.510	.069	.359	.720
	Surgeon	.137	.510	.045	.269	.788
	Surgical_Technologist	.387	.508	.172	.762	.446
	Age	.007	.004	.075	1.773	.077
	Northeast	.162	.457	.064	.354	.723
	Midwest	.305	.455	.138	.670	.503
	South	.218	.455	.103	.478	.633
	West	.314	.457	.121	.687	.492
	Time_in_Profession	-.002	.004	-.019	-.427	.669
	Federal_Regulations	-.032	.063	-.028	-.510	.610
	Hospital_Regulations	.109	.064	.095	1.711	.087

a. Dependent Variable: Factor_14_A

Regression 5

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.201[a]	.040	.032	.98730948

a. Predictors: (Constant), Hospital_Regulations, Age, Northeast, CRNA, West, Surgeon, Anesthesiologist, Midwest, Registered_Nurse, Time_in_Profession, Federal_Regulations, South, Surgical_Technologist

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	62.953	13	4.843	4.968	.000[a]
	Residual	1500.186	1539	.975		
	Total	1563.140	1552			

a. Predictors: (Constant), Hospital_Regulations, Age, Northeast, CRNA, West, Surgeon, Anesthesiologist, Midwest, Registered_Nurse, Time_in_Profession, Federal_Regulations, South, Surgical_Technologist

b. Dependent Variable: Factor_14_B

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	.426	.626		.682	.496
	Anesthesiologist	-.869	.509	-.342	-1.705	.088
	CRNA	-1.098	.510	-.467	-2.156	.031
	Registered_Nurse	-.852	.512	-.319	-1.664	.096
	Surgeon	-.449	.512	-.148	-.879	.380
	Surgical_Technologist	-.839	.510	-.372	-1.647	.100
	Age	.001	.004	.011	.252	.801
	Northeast	.409	.458	.161	.892	.373
	Midwest	.332	.457	.150	.726	.468
	South	.276	.457	.130	.604	.546
	West	.409	.459	.157	.892	.373
	Time_in_Profession	-.004	.004	-.050	-1.101	.271
	Federal_Regulations	.027	.063	.024	.426	.670
	Hospital_Regulations	.012	.064	.010	.183	.854

a. Dependent Variable: Factor_14_B

Regression 6

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.368[a]	.136	.128	.92886243

a. Predictors: (Constant), Hospital_Regulations, Age, Northeast, CRNA, West, Surgeon, Anesthesiologist, Midwest, Registered_Nurse, Time_in_Profession, Federal_Regulations, South, Surgical_Technologist

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	208.217	13	16.017	18.564	.000[a]
	Residual	1327.827	1539	.863		
	Total	1536.044	1552			

a. Predictors: (Constant), Hospital_Regulations, Age, Northeast, CRNA, West, Surgeon, Anesthesiologist, Midwest, Registered_Nurse, Time_in_Profession, Federal_Regulations, South, Surgical_Technologist

b. Dependent Variable: Factor_14_C

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.233	.589		-.396	.693
	Anesthesiologist	-.206	.479	-.082	-.431	.667
	CRNA	-.387	.479	-.166	-.808	.419
	Registered_Nurse	-.916	.482	-.345	-1.902	.057
	Surgeon	.094	.481	.031	.195	.845
	Surgical_Technologist	-.733	.479	-.328	-1.530	.126
	Age	.002	.004	.025	.630	.529
	Northeast	.709	.431	.282	1.646	.100
	Midwest	.841	.430	.383	1.956	.051
	South	.785	.430	.373	1.827	.068
	West	.858	.431	.332	1.988	.047
	Time_in_Profession	.006	.004	.069	1.616	.106
	Federal_Regulations	.052	.059	.046	.885	.376
	Hospital_Regulations	-.148	.060	-.129	-2.463	.014

a. Dependent Variable: Factor_14_C

Regression 7

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.168[a]	.028	.020	.99123082

a. Predictors: (Constant), Hospital_Regulations, Age, Northeast, CRNA, West, Surgeon, Anesthesiologist, Midwest, Registered_Nurse, Time_in_Profession, Federal_Regulations, South, Surgical_Technologist

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	43.764	13	3.366	3.426	.000[a]
	Residual	1512.127	1539	.983		
	Total	1555.891	1552			

a. Predictors: (Constant), Hospital_Regulations, Age, Northeast, CRNA, West, Surgeon, Anesthesiologist, Midwest, Registered_Nurse, Time_in_Profession, Federal_Regulations, South, Surgical_Technologist

b. Dependent Variable: Factor_14_D

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.967	.628		-1.539	.124
	Anesthesiologist	.935	.511	.369	1.828	.068
	CRNA	1.007	.512	.430	1.969	.049
	Registered_Nurse	.793	.514	.297	1.542	.123
	Surgeon	.658	.514	.217	1.280	.201
	Surgical_Technologist	.856	.512	.380	1.673	.094
	Age	.001	.004	.010	.247	.805
	Northeast	.281	.460	.111	.610	.542
	Midwest	.276	.459	.125	.602	.548
	South	.337	.459	.159	.734	.463
	West	.189	.460	.073	.410	.682
	Time_in_Profession	-.007	.004	-.083	-1.831	.067
	Federal_Regulations	-.128	.063	-.113	-2.027	.043
	Hospital_Regulations	.096	.064	.084	1.503	.133

a. Dependent Variable: Factor_14_D

Regression 8

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Inoculation_Injury[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Factor_8_A

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.496	1	2.496	2.496	.114[a]
	Residual	1379.010	1379	1.000		
	Total	1381.506	1380			

a. Predictors: (Constant), Inoculation_Injury

b. Dependent Variable: Factor_8_A

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.062	.043		1.448	.148
	Inoculation_Injury	-.087	.055	-.043	-1.580	.114

a. Dependent Variable: Factor_8_A

Regression 9

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Inoculation_Injury[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Factor_8_B

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.105[a]	.011	.010	.99777880

a. Predictors: (Constant), Inoculation_Injury

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	15.210	1	15.210	15.278	.000[a]
	Residual	1372.881	1379	.996		
	Total	1388.091	1380			

a. Predictors: (Constant), Inoculation_Injury

b. Dependent Variable: Factor_8_B

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.124	.043		-2.918	.004
	Inoculation_Injury	.215	.055	.105	3.909	.000

a. Dependent Variable: Factor_8_B

Regression 10

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Inoculation_Injury[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Factor_8_C

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.040[a]	.002	.001	.98775695

a. Predictors: (Constant), Inoculation_Injury

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.205	1	2.205	2.260	.133[a]
	Residual	1345.440	1379	.976		
	Total	1347.646	1380			

a. Predictors: (Constant), Inoculation_Injury

b. Dependent Variable: Factor_8_C

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.051	.042		1.197	.231
	Inoculation_Injury	-.082	.054	-.040	-1.503	.133

a. Dependent Variable: Factor_8_C

Regression 11

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Inoculation_Injury[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Factor_14_A

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.013[a]	.000	.000	.99511444

a. Predictors: (Constant), Inoculation_Injury

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.251	1	.251	.253	.615[a]
	Residual	1547.765	1563	.990		
	Total	1548.016	1564			

a. Predictors: (Constant), Inoculation_Injury

b. Dependent Variable: Factor_14_A

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.013	.041		.317	.751
	Inoculation_Injury	-.026	.052	-.013	-.503	.615

a. Dependent Variable: Factor_14_A

Regression 12

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Inoculation_Injury[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Factor_14_B

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.086[a]	.007	.007	.99265299

a. Predictors: (Constant), Inoculation_Injury

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11.480	1	11.480	11.650	.001[a]
	Residual	1540.118	1563	.985		
	Total	1551.597	1564			

a. Predictors: (Constant), Inoculation_Injury

b. Dependent Variable: Factor_14_B

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.108	.041		-2.646	.008
	Inoculation_Injury	.176	.052	.086	3.413	.001

a. Dependent Variable: Factor_14_B

Regression 13

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Inoculation_Injury[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Factor_14_C

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.075[a]	.006	.005	.99844831

a. Predictors: (Constant), Inoculation_Injury

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.760	1	8.760	8.788	.003[a]
	Residual	1558.153	1563	.997		
	Total	1566.914	1564			

a. Predictors: (Constant), Inoculation_Injury

b. Dependent Variable: Factor_14_C

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.083	.041		-2.033	.042
	Inoculation_Injury	.154	.052	.075	2.964	.003

a. Dependent Variable: Factor_14_C

Regression 14

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Inoculation_Injury[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Factor_14_D

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.545[a]	.298	.297	.83421592

a. Predictors: (Constant), Inoculation_Injury

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	460.649	1	460.649	661.932	.000[a]
	Residual	1087.717	1563	.696		
	Total	1548.366	1564			

a. Predictors: (Constant), Inoculation_Injury

b. Dependent Variable: Factor_14_D

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.681	.034		19.953	.000
	Inoculation_Injury	-1.117	.043	-.545	-25.728	.000

a. Dependent Variable: Factor_14_D

Regression 15

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Federal_Required_Use_of_PPE[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Factor_8_A

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.081[a]	.007	.006	.99239358

a. Predictors: (Constant), Federal_Required_Use_of_PPE

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.988	1	8.988	9.126	.003[a]
	Residual	1371.889	1393	.985		
	Total	1380.877	1394			

a. Predictors: (Constant), Federal_Required_Use_of_PPE

b. Dependent Variable: Factor_8_A

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.110	.045		-2.420	.016
	Federal_Required_Use_of_PPE	.071	.024	.081	3.021	.003

a. Dependent Variable: Factor_8_A

Regression 16

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Federal_Required_Use_of_PPE[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Factor_8_B

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.144[a]	.021	.020	.98990335

a. Predictors: (Constant), Federal_Required_Use_of_PPE

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	28.944	1	28.944	29.537	.000[a]
	Residual	1365.013	1393	.980		
	Total	1393.956	1394			

a. Predictors: (Constant), Federal_Required_Use_of_PPE

b. Dependent Variable: Factor_8_B

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.201	.045		-4.449	.000
	Federal_Required_Use_of_PPE	.128	.024	.144	5.435	.000

a. Dependent Variable: Factor_8_B

Regression 17

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.094[a]	.009	.008	.99680086

a. Predictors: (Constant), Federal_Required_Use_of_PPE

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	12.275	1	12.275	12.354	.000[a]
	Residual	1384.101	1393	.994		
	Total	1396.377	1394			

a. Predictors: (Constant), Federal_Required_Use_of_PPE

b. Dependent Variable: Factor_8_C

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.132	.046		-2.897	.004
	Federal_Required_Use_of_PPE	.084	.024	.094	3.515	.000

a. Dependent Variable: Factor_8_C

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	12.275	1	12.275	12.354	.000[a]
	Residual	1384.101	1393	.994		
	Total	1396.377	1394			

a. Predictors: (Constant), Federal_Required_Use_of_PPE

b. Dependent Variable: Factor_8_C

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.132	.046		-2.897	.004
	Federal_Required_Use_of_PPE	.084	.024	.094	3.515	.000

a. Dependent Variable: Factor_8_C

Regression 18

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Federal_Required_Use_of_PPE[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Factor_14_A

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.047[a]	.002	.002	1.00026521

a. Predictors: (Constant), Federal_Required_Use_of_PPE

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.549	1	3.549	3.547	.060[a]
	Residual	1578.837	1578	1.001		

a. Predictors: (Constant), Federal_Required_Use_of_PPE

b. Dependent Variable: Factor_14_A

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Total	1582.386	1579			

a. Predictors: (Constant), Federal_Required_Use_of_PPE

b. Dependent Variable: Factor_14_A

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.065	.043		1.512	.131
	Federal_Required_Use_of_PPE	-.042	.022	-.047	-1.883	.060

a. Dependent Variable: Factor_14_A

Regression 19

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Federal_Required_Use_of_PPE[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Factor_14_B

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.107[a]	.012	.011	.99560323

a. Predictors: (Constant), Federal_Required_Use_of_PPE

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	18.201	1	18.201	18.362	.000[a]
	Residual	1564.154	1578	.991		
	Total	1582.355	1579			

a. Predictors: (Constant), Federal_Required_Use_of_PPE

b. Dependent Variable: Factor_14_B

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.148	.043		-3.451	.001
	Federal_Required_Use_of_PPE	.095	.022	.107	4.285	.000

a. Dependent Variable: Factor_14_B

Regression 20

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Federal_Required_Use_of_PPE[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Factor_14_C

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.405[a]	.164	.164	.91567619

a. Predictors: (Constant), Federal_Required_Use_of_PPE

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	260.203	1	260.203	310.334	.000[a]
	Residual	1323.094	1578	.838		
	Total	1583.298	1579			

a. Predictors: (Constant), Federal_Required_Use_of_PPE

b. Dependent Variable: Factor_14_C

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.564	.039		-14.335	.000
	Federal_Required_Use_of_PPE	.361	.020	.405	17.616	.000

a. Dependent Variable: Factor_14_C

Regression 21

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Federal_Required_Use_of_PPE [a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Factor_14_D

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.025[a]	.001	.000	.99886401

a. Predictors: (Constant), Federal_Required_Use_of_PPE

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.990	1	.990	.992	.319[a]
	Residual	1574.417	1578	.998		
	Total	1575.407	1579			

a. Predictors: (Constant), Federal_Required_Use_of_PPE

b. Dependent Variable: Factor_14_D

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.036	.043		.838	.402
	Federal_Required_Use_of_PPE	-.022	.022	-.025	-.996	.319

a. Dependent Variable: Factor_14_D

Regression 22

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11.980	1	11.980	12.096	.001[a]
	Residual	1381.664	1395	.990		
	Total	1393.644	1396			

a. Predictors: (Constant), Hospital_Required_Use_of_PPE

b. Dependent Variable: Factor_8_A

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.126	.045		-2.797	.005
	Hospital_Required_Use_of_PPE	.082	.024	.093	3.478	.001

a. Dependent Variable: Factor_8_A

Regression 23

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Hospital_Required_Use_of_PPE[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Factor_8_B

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.132[a]	.017	.017	.99079186

a. Predictors: (Constant), Hospital_Required_Use_of_PPE

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	24.245	1	24.245	24.698	.000[a]
	Residual	1369.428	1395	.982		

a. Predictors: (Constant), Hospital_Required_Use_of_PPE

b. Dependent Variable: Factor_8_B

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Total	1393.673	1396			

a. Predictors: (Constant), Hospital_Required_Use_of_PPE

b. Dependent Variable: Factor_8_B

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.181	.045		-4.018	.000
	Hospital_Required_Use_of_PPE	.116	.023	.132	4.970	.000

a. Dependent Variable: Factor_8_B

Regression 24

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Hospital_Required_Use_of_PPE[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Factor_8_C

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.057[a]	.003	.003	1.00122129

a. Predictors: (Constant), Hospital_Required_Use_of_PPE

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.606	1	4.606	4.595	.032[a]
	Residual	1398.409	1395	1.002		
	Total	1403.016	1396			

a. Predictors: (Constant), Hospital_Required_Use_of_PPE

b. Dependent Variable: Factor_8_C

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.077	.045		-1.691	.091
	Hospital_Required_Use_of_PPE	.051	.024	.057	2.144	.032

a. Dependent Variable: Factor_8_C

Regression 25

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Hospital_Required_Use_of_PPE[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Factor_14_A

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.024[a]	.001	.000	.99998301

a. Predictors: (Constant), Hospital_Required_Use_of_PPE

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.921	1	.921	.921	.337[a]
	Residual	1581.946	1582	1.000		
	Total	1582.867	1583			

a. Predictors: (Constant), Hospital_Required_Use_of_PPE

b. Dependent Variable: Factor_14_A

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.034	.042		.801	.423
	Hospital_Required_Use_of_PPE	-.021	.022	-.024	-.960	.337

a. Dependent Variable: Factor_14_A

Regression 26

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Hospital_Required_Use_of_PPE[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Factor_14_B

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.062[a]	.004	.003	1.00021001

a. Predictors: (Constant), Hospital_Required_Use_of_PPE

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6.117	1	6.117	6.115	.014[a]
	Residual	1582.665	1582	1.000		
	Total	1588.782	1583			

a. Predictors: (Constant), Hospital_Required_Use_of_PPE

b. Dependent Variable: Factor_14_B

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.082	.042		-1.944	.052
	Hospital_Required_Use_of_PPE	.053	.022	.062	2.473	.014

a. Dependent Variable: Factor_14_B

Regression 27

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	232.211	1	232.211	272.189	.000[a]
	Residual	1349.638	1582	.853		
	Total	1581.849	1583			

a. Predictors: (Constant), Hospital_Required_Use_of_PPE

b. Dependent Variable: Factor_14_C

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.519	.039		-13.321	.000
	Hospital_Required_Use_of_PPE	.329	.020	.383	16.498	.000

a. Dependent Variable: Factor_14_C

Regression 28

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Hospital_Required_Use_of_PPE[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Factor_14_D

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.020[a]	.000	.000	1.00066854

a. Predictors: (Constant), Hospital_Required_Use_of_PPE

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.642	1	.642	.641	.423[a]
	Residual	1584.116	1582	1.001		

a. Predictors: (Constant), Hospital_Required_Use_of_PPE

b. Dependent Variable: Factor_14_D

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Total	1584.758	1583			

a. Predictors: (Constant), Hospital_Required_Use_of_PPE

b. Dependent Variable: Factor_14_D

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.029	.042		.685	.494
	Hospital_Required_Use_of_PPE	-.017	.022	-.020	-.801	.423

a. Dependent Variable: Factor_14_D

Regression 29

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Attitudes_Regarding_the_use_of_PPE[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Factor_8_A

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.107[a]	.012	.011	.99318465

a. Predictors: (Constant), Attitudes_Regarding_the_use_of_PPE

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	16.130	1	16.130	16.353	.000[a]
	Residual	1381.968	1401	.986		
	Total	1398.099	1402			

a. Predictors: (Constant), Attitudes_Regarding_the_use_of_PPE

b. Dependent Variable: Factor_8_A

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.143	.045		-3.193	.001
	Attitudes_Regarding_the_use_of_PPE	.077	.019	.107	4.044	.000

a. Dependent Variable: Factor_8_A

Regression 30

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Attitudes_Regarding_the_use_of_PPE[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Factor_8_B

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.109[a]	.012	.011	.99478640

a. Predictors: (Constant), Attitudes_Regarding_the_use_of_PPE

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	16.766	1	16.766	16.943	.000[a]
	Residual	1386.430	1401	.990		
	Total	1403.196	1402			

a. Predictors: (Constant), Attitudes_Regarding_the_use_of_PPE

b. Dependent Variable: Factor_8_B

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.149	.045		-3.331	.001

a. Dependent Variable: Factor_8_B

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	Attitudes_Regarding_the_use_of_PPE	.078	.019	.109	4.116	.000

a. Dependent Variable: Factor_8_B

Regression 31

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Attitudes_Regarding_the_use_of_PPE[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Factor_8_C

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.114[a]	.013	.012	.99536845

a. Predictors: (Constant), Attitudes_Regarding_the_use_of_PPE

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	18.153	1	18.153	18.322	.000[a]
	Residual	1388.052	1401	.991		
	Total	1406.205	1402			

a. Predictors: (Constant), Attitudes_Regarding_the_use_of_PPE

b. Dependent Variable: Factor_8_C

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.153	.045		-3.413	.001
	Attitudes_Regarding_the_use_of_PPE	.081	.019	.114	4.280	.000

a. Dependent Variable: Factor_8_C

Regression 32

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Attitudes_Regarding_the_use_of_PPE[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Factor_14_A

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.026[a]	.001	.000	.99902416

a. Predictors: (Constant), Attitudes_Regarding_the_use_of_PPE

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.088	1	1.088	1.090	.297[a]
	Residual	1580.910	1584	.998		
	Total	1581.998	1585			

a. Predictors: (Constant), Attitudes_Regarding_the_use_of_PPE

b. Dependent Variable: Factor_14_A

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.037	.042		.886	.376
	Attitudes_Regarding_the_use_of_PPE	-.018	.018	-.026	-1.044	.297

a. Dependent Variable: Factor_14_A

Regression 33

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6.978	1	6.978	7.030	.008[a]
	Residual	1572.232	1584	.993		
	Total	1579.210	1585			

a. Predictors: (Constant), Attitudes_Regarding_the_use_of_PPE

b. Dependent Variable: Factor_14_B

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.091	.042		-2.171	.030
	Attitudes_Regarding_the_use_of_PPE	.047	.018	.066	2.652	.008

a. Dependent Variable: Factor_14_B

Regression 34

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Attitudes_Regarding_the_use_of_PPE[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Factor_14_C

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.419[a]	.175	.175	.90825925

a. Predictors: (Constant), Attitudes_Regarding_the_use_of_PPE

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	277.977	1	277.977	336.968	.000[a]
	Residual	1306.697	1584	.825		

a. Predictors: (Constant), Attitudes_Regarding_the_use_of_PPE

b. Dependent Variable: Factor_14_C

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Total	1584.673	1585			

a. Predictors: (Constant), Attitudes_Regarding_the_use_of_PPE

b. Dependent Variable: Factor_14_C

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.563	.038		-14.696	.000
	Attitudes_Regarding_the_use_of_PPE	.294	.016	.419	18.357	.000

a. Dependent Variable: Factor_14_C

Regression 35

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Attitudes_Regarding_the_use_of_PPE[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Factor_14_D

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.003[a]	.000	.000	.99974773

a. Predictors: (Constant), Attitudes_Regarding_the_use_of_PPE

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.011	1	.011	.011	.915[a]
	Residual	1583.201	1584	.999		
	Total	1583.212	1585			

a. Predictors: (Constant), Attitudes_Regarding_the_use_of_PPE

b. Dependent Variable: Factor_14_D

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.005	.042		.123	.902
	Attitudes_Regarding_the_use_of_PPE	-.002	.018	-.003	-.106	.915

a. Dependent Variable: Factor_14_D

Regression 36

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Patient_Needs_Conflict_with_use_of_PPE[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Factor_8_A

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.205[a]	.042	.041	.97980473

a. Predictors: (Constant), Patient_Needs_Conflict_with_use_of_PPE

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	59.045	1	59.045	61.504	.000[a]
	Residual	1344.024	1400	.960		
	Total	1403.069	1401			

a. Predictors: (Constant), Patient_Needs_Conflict_with_use_of_PPE

b. Dependent Variable: Factor_8_A

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.890	.116		7.642	.000

a. Dependent Variable: Factor_8_A

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	Patient_Needs_Conflict_with_use_of_PPE	-.283	.036	-.205	-7.842	.000

a. Dependent Variable: Factor_8_A

Regression 37

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Patient_Needs_Conflict_with_use_of_PPE[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Factor_8_B

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.014[a]	.000	.000	1.00133429

a. Predictors: (Constant), Patient_Needs_Conflict_with_use_of_PPE

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.291	1	.291	.290	.590[a]
	Residual	1403.738	1400	1.003		
	Total	1404.029	1401			

a. Predictors: (Constant), Patient_Needs_Conflict_with_use_of_PPE

b. Dependent Variable: Factor_8_B

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.063	.119		.529	.597
	Patient_Needs_Conflict_with_use_of_PPE	-.020	.037	-.014	-.539	.590

a. Dependent Variable: Factor_8_B

Regression 38

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Patient_Needs_Conflict_with_use_of_PPE[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Factor_8_C

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.152[a]	.023	.022	.98321839

a. Predictors: (Constant), Patient_Needs_Conflict_with_use_of_PPE

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	31.864	1	31.864	32.961	.000[a]
	Residual	1353.406	1400	.967		
	Total	1385.270	1401			

a. Predictors: (Constant), Patient_Needs_Conflict_with_use_of_PPE

b. Dependent Variable: Factor_8_C

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.654	.117		5.596	.000
	Patient_Needs_Conflict_with_use_of_PPE	-.208	.036	-.152	-5.741	.000

a. Dependent Variable: Factor_8_C

Regression 39

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	239.947	1	239.947	281.673	.000[a]
	Residual	1348.501	1583	.852		
	Total	1588.448	1584			

a. Predictors: (Constant), Patient_Needs_Conflict_with_use_of_PPE

b. Dependent Variable: Factor_14_A

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-1.662	.102		-16.327	.000
	Patient_Needs_Conflict_with_use_of_PPE	.527	.031	.389	16.783	.000

a. Dependent Variable: Factor_14_A

Regression 40

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Patient_Needs_Conflict_with_use_of_PPE[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Factor_14_B

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.054[a]	.003	.002	.99284215

a. Predictors: (Constant), Patient_Needs_Conflict_with_use_of_PPE

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.625	1	4.625	4.692	.030[a]
	Residual	1560.419	1583	.986		

a. Predictors: (Constant), Patient_Needs_Conflict_with_use_of_PPE

b. Dependent Variable: Factor_14_B

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Total	1565.044	1584			

a. Predictors: (Constant), Patient_Needs_Conflict_with_use_of_PPE

b. Dependent Variable: Factor_14_B

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.234	.110		-2.134	.033
	Patient_Needs_Conflict_with_use_of_PPE	.073	.034	.054	2.166	.030

a. Dependent Variable: Factor_14_B

Regression 41

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Patient_Needs_Conflict_with_use_of_PPE[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Factor_14_C

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.147[a]	.022	.021	.99144637

a. Predictors: (Constant), Patient_Needs_Conflict_with_use_of_PPE

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	34.567	1	34.567	35.166	.000[a]
	Residual	1556.035	1583	.983		
	Total	1590.602	1584			

a. Predictors: (Constant), Patient_Needs_Conflict_with_use_of_PPE

b. Dependent Variable: Factor_14_C

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.632	.109		5.777	.000
	Patient_Needs_Conflict_with_use_of_PPE	-.200	.034	-.147	-5.930	.000

a. Dependent Variable: Factor_14_C

Regression 42

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Patient_Needs_Conflict_with_use_of_PPE[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Factor_14_D

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.055[a]	.003	.002	.99932915

a. Predictors: (Constant), Patient_Needs_Conflict_with_use_of_PPE

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.797	1	4.797	4.804	.029[a]
	Residual	1580.877	1583	.999		
	Total	1585.674	1584			

a. Predictors: (Constant), Patient_Needs_Conflict_with_use_of_PPE

b. Dependent Variable: Factor_14_D

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.234	.110		-2.123	.034

a. Dependent Variable: Factor_14_D

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	Patient_Needs_Conflict_with_use_of_PPE	.075	.034	.055	2.192	.029

a. Dependent Variable: Factor_14_D

Appendix F: Hypothesis Summary

Table 49

Summary Table

Model	Hypotheses	*p*	R^2	Significance
GH1	There is a relationship that exists between surgical team members that influence their choices of wearing or not wearing PPE during operative/invasive procedures.			
SH1a	Profession, age, geographic location, length of time in profession and being aware of hospital and federal regulations does predict the Factor 1 under what influences you to protect yourself against exposure (Barriers)	<0.001	0.35	Yes
SH1b	Profession, age, geographic location, length of time in profession and being aware of hospital and federal regulations does predict the Factor 2 under what influences you to protect yourself against exposure (Practices).	<0.001	0.094	Yes
SH1c	Profession, age, geographic location, length of time in profession and being aware of hospital and federal regulations does predict the Factor 3 under what influences you to protect yourself against exposure (Standard Protection)	<0.001	0.161	Yes
SH1d	Profession, age, geographic location, length of time in profession and being aware of hospital and federal regulations does predict the Factor 1 under what influences your use of personal protective equipment (Deterrents).	<0.001	0.037	Yes
SH1e	Profession, age, geographic location, length of time in profession and being aware of hospital and federal regulations does predict the Factor 2 under what influences your use of personal protective equipment (Risk Assessment).	<0.001	0.04	Yes

Model	Hypotheses	p	R^2	Significance
SH1f	Profession, age, geographic location, length of time in profession and being aware of hospital and federal regulations does predict the Factor 3 under what influences your use of personal protective equipment (Rules and Role Models).	<0.001	0.136	Yes
SH1g	Profession, age, geographic location, length of time in profession and being aware of hospital and federal regulations does predict the Factor 4 under what influences your use of personal protective equipment (Experience).	<0.001	0.028	Yes
GH2	There is a significant relationship between previous accidental exposure to blood or body fluids influences surgical team members regarding the use of PPE.			
SH2a	There is a significant relationship between inoculation injury and Factor 1 under what influences you to protect yourself against exposure (Barriers).	0.114	0.002	No
SH2b	There is a significant relationship between inoculation injury and Factor 2 under what influences you to protect yourself against exposure (Practice).	<0.001	0.011	Yes
SH2c	There is a significant relationship between inoculation injury and Factor 3 under what influences you to protect yourself against exposure (Standard Protection).	0.113	0.002	No
SH2d	There is a significant relationship between inoculation injury and Factor 1 under what influences your use of personal protective equipment (Deterrents).	0.615	0	No
SH2e	There is a significant relationship between inoculation injury and Factor 2 under what influences your use of personal protective equipment (Risk Assessment).	0.001	0.007	Yes

Model	Hypotheses	p	R^2	Significance
SH2f	There is a significant relationship between inoculation injury and Factor 3 under what influences your use of personal protective equipment (Rules and Role Models).	0.003	0.006	Yes
SH2g	There is a significant relationship between inoculation injury and Factor 4 under what influences your use of personal protective equipment (Experience).	<0.001	29.8	Yes
GH 3	There is a significant relationship between federal (OSHA) regulations influence surgical team members and the use of PPE			
SH3a	There is a significant relationship between federal required use of PPE and Factor 1 under what influences you to protect yourself against exposure (Barriers).	0.003	0.007	Yes
SH3b	There is a significant relationship between federal required use of PPE and Factor 2 under what influences you to protect yourself against exposure (Practice).	<0.001	0.021	Yes
SH3c	There is a significant relationship between federal required use of PPE and Factor 3 under what influences you to protect yourself against exposure (Standard Protection).	<0.001	0.009	Yes
SH3d	There is a significant relationship between federal required use of PPE and Factor 1 under what influences your use of personal protective equipment (Deterrents).	0.06	0.002	No
SH3e	There is a significant relationship between federal required use of PPE and Factor 2 under what influences your use of personal protective equipment (Risk Assessment).	<0.001	0.012	Yes

Model	Hypotheses	p	R^2	Signifi-cance
SH3f	There is a significant relationship between federal required use of PPE and Factor 3 under what influences your use of personal protective equipment (Rules and Role Models).	<0.001	0.164	Yes
SH3g	There is a significant relationship between federal required use of PPE and Factor 4 under what influences your use of personal protective equipment (Experience).	0.319	0.001	No
GH 4	There is a significant relationship between hospital policies and procedures and surgical team members' use of PPE.			
SH4a	There is a significant relationship between hospital policies and procedures required use of PPE and Factor 1 under what influences you to protect yourself against exposure (Barriers).	0.001	0.009	Yes
SH4b	There is a significant relationship between hospital policies and procedures required use of PPE and Factor 2 under what influences you to protect yourself against exposure (Practice).	<0.001	0.017	Yes
SH4c	There is a significant relationship between hospital policies and procedures required use of PPE and Factor 3 under what influences you to protect yourself against exposure (Standard Protection).	0.032	0.003	Yes
SH4d	There is a significant relationship between hospital policies and procedures required use of PPE and Factor 1 under what influences your use of personal protective equipment (Deterrents).	0.337	0.001	No
SH4e	There is a significant relationship between hospital policies and procedures required use of PPE and Factor 2 under what influences your use of personal protective equipment (Risk Assessment).	0.014	0.004	Yes

Model	Hypotheses	p	R^2	Significance
SH4f	There is a significant relationship between hospital policies and procedures required use of PPE and Factor 3 under what influences your use of personal protective equipment (Rules and Role Models).	<0.001	0.147	Yes
SH4g	There is a significant relationship between hospital policies and procedures required use of PPE and Factor 4 under what influences your use of personal protective equipment (Experience).	0.423	0	No
GH 5	There is a significant relationship between Hospital leaders' attitudes that encourage or discourage and the use of PPE by members of surgical teams.			
SH5a	There is a significant relationship between hospital leaders' attitudes about the use of PPE and Factor 1 under what influences you to protect yourself against exposure (Barriers).	<0.001	0.012	Yes
SH5b	There is a significant relationship between hospital leaders' attitudes about the use of PPE and Factor 2 under what influences you to protect yourself against exposure (Practice).	<0.001	0.012	Yes
SH5c	There is a significant relationship between hospital leaders' attitudes about the use of PPE and Factor 3 under what influences you to protect yourself against exposure (Standard Protection).	<0.001	0.013	Yes
SH5d	There is a significant relationship between hospital leaders' attitudes about the use of PPE and Factor 1 under what influences your use of personal protective equipment (Deterrents).	0.297	0.001	No
SH5e	There is a significant relationship between hospital leaders' attitudes about the use of PPE and Factor 2 under what influences your use of personal protective equipment (Risk Assessment).	0.008	0.004	Yes

Model	Hypotheses	*p*	R^2	Signifi-cance
SH5f	There is a significant relationship between hospital leaders' attitudes about the use of PPE and Factor 3 under what influences your use of personal protective equipment (Rules and Role Models).	<0.001	0.175	Yes
SH5g	There is a significant relationship between hospital leaders' attitudes about the use of PPE and Factor 4 under what influences your use of personal protective equipment (Experience).	0.915	0	No
GH 6	There is a significant relationship between patients' needs that predict the use of PPE by members of surgical teams.			
SH6a	There is a significant relationship between patients' needs and Factor 1 under what influences you to protect yourself against exposure (Barriers).	<0.001	0.042	Yes
SH6b	There is a significant relationship between patients' needs and Factor 2 under what influences you to protect yourself against exposure (Practice).	0.59	0	No
SH6c	There is a significant relationship between patients' needs and Factor 3 under what influences you to protect yourself against exposure (Standard Protection).	<0.001	0.023	Yes
SH6d	There is a significant relationship between patients' needs and Factor 1 under what influences your use of personal protective equipment (Deterrents).	<0.001	0.151	Yes
SH6e	There is a significant relationship between patients' needs and Factor 2 under what influences your use of personal protective equipment (Risk Assessment).	<0.001	0.003	Yes
SH6f	There is a significant relationship between patients' needs and Factor 3 under what influences your use of personal protective equipment (Rules and Role Models).	<0.001	0.022	Yes

Model	Hypotheses	p	R^2	Signifi-cance
SH6g	There is a significant relationship between patients' needs and Factor 4 under what influences your use of personal protective equipment (Experience).	0.029	0.003	Yes

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PUBLICATIONS AND PRESENTATIONS

Cohen, S., Crego, N., Cuming, R., & Smyth, M. (2002). The Synergy model and the role of clinical nurse specialists in a multi-hospital system. *American Journal of Critical Care 11*(5), 436-446.

Cuming, R. (2008). [Review of the book Coaching, counseling, and mentoring: How to choose and use the right technique to boost employee performance]. *AORN Journal 87*(4), 839 – 840.

Cuming, R. (2002). Oral intake; thromboembolism; bacterial penetration; nurse staffing levels – Evidence for practice. *AORN Journal 76*(6), 1091-1092.

Cuming, R. (2002). Reducing the hazards of exposure to cornstarch glove powder. *AORN Journal 76*(2), 288-295.

Cuming, R. (2001). Perioperative nursing needs a new voice. *Vital Signs.11*(22), 7,11.

Cuming, R. (2000). The nurses behind the masks. *Vital Signs. 10*(21), 14-15.

Cuming, R. & Nemec, J. (2002). Perioperative hypothermia: Complications and consequences. *Vital Signs 12*(21), 10-11.

Cuming, R. & Nemec, J. (2002). Process improvement at Broward General turns up the heat. *Vital Signs 12*(22), 7

Cuming, R. G., Rocco, T. S., McEachern, A. (2008). Improving compliance with occupational safety and health administration standards. *AORN Journal 87*(2), 347-356.