Nurses and Standard/Universal Precautions
Analysis of Barriers Affecting Strict Compliance

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Dedication

In memory of Meta Snyder, RN, MPH

Nurse, colleague and friend who taught me the dedication of nurses and the sorrow of occupational illnesses

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Abstract of Dissertation

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Goals: This research aimed to identify potentially important risk factors and barriers for less than strict compliance with universal/standard precautions by nurses in health care settings. The study outcomes were compliance with the use of personal protective equipment (PPE), specifically gloves, eye shields and respiratory shields. The study also looked at possible novel predictors of compliance including: availability of various types of PPE including size, material, style, and certain patient characteristics including age, English as a second language, and nurses' perception of the patient's potential risk status.

Methods: Members of the Massachusetts Nurses Association (MNA) were surveyed in 2009, utilizing both previously validated questions and questions developed specifically for this research. Analysis was completed using SAS V 9.1.

Results: While there was a low response rate (n=95) the MNA respondents are similar demographically to respondents in previous surveys. Compliance was not universal, even when PPE were available. Study results supported previously identified barriers to compliance including lack of training, workplace safety climate, and availability of PPE. Lack of availability of PPE was negatively associated with strict compliance. Higher scores for workplace safety climate, increased age, and longer nursing work experience were positively associated with compliance. The surveyed nurses also reported variation in compliance based on patient

characteristics: pediatric patients (up to age 18), older adults (age 65+), those perceived to be low risk and those who spoke English as a second language.

Discussion: Variation in compliance by patient demographics indicated that nurses employ personal assessment of risk regarding whether to wear PPE. Lack of gloves in appropriate sizes was negatively associated with strict compliance. Lack of training in universal/standard precautions was a surprising finding, with more than half the respondents receiving 30 minutes or less in annual training. Higher workplace safety climate was positively associated with additional training and compliance with eye shield and respiratory shield compliance.

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Glossary of Terms

Bloodborne Pathogens (BBP) BBP are pathogenic microorganisms that are present in human blood and can cause disease in humans.

Bureau of Labor Statistics (BLS) The federal agency which serves as principal fact-finding agency for the Federal Government in the broad field of labor economics and statistics; an agency within the U.S. Department of Labor.

Centers for Disease Control and Prevention (CDC) The federal agency which serves as the national focus to improve the health of the people of the United States; an agency within the U.S. Department of Health and Human Services.

Health Care Workers (HCW) Workers in the health care field including physicians, nurses, aides, laboratory technicians and others with responsibility for patient care.

Healthcare-Associated Infection (HAI) The term used by CDC since 2007 to replace the term nosocomial infections.

Health Infection Control Practices Advisory Committee (HICPAC) HICPAC is a federal advisory committee made up of 14 external infection control experts who provide advice and guidance to the Centers for Disease Control and Prevention (CDC) and the Secretary of the Department of Health and Human Services (HHS) regarding the practice of health care infection control, strategies for surveillance and prevention and control of health care associated infections in United States health care facilities.

The Joint Commission The Joint Commission is the nation's predominant standards-setting and accrediting body in health care formerly known as Joint Commission on Accreditation of Healthcare Organizations (JCAHO).

Massachusetts Nurses Association (MNA) MNA is the largest union and professional association of registered nurses in the state, and the third largest in the nation, representing more than 23,000 members working in 85 health care facilities, including 51 acute care hospitals, as well as a growing number of nurses working in schools, visiting nurse associations, public health departments, home health, and state agencies.

Methicillin-resistant *Staphylococcus aureus* (MRSA) infection is caused by a strain of staphylococcus bacteria that has become resistant to the antibiotics commonly used to treat ordinary staphylococcus infections.

Multidrug Resistant Tuberculosis (MDR) Usually refers to a form of tuberculosis that is resistant to two or more of the primary drugs.

Occupational Safety and Health Administration (OSHA) The federal regulatory agency established by the Occupational Safety and Health Act of 1970; an agency within the U.S. Department of Labor.

Personal Protective Equipment (PPE) is specialized clothing or equipment worn by an employee for protection against a hazard. For the purposes of this research, PPE refers to any type of face mask, glove, or clothing that acts as a barrier between bloodborne and airborne infectious materials and the skin, mouth, nose, or eyes (mucous membranes).

Severe acute respiratory syndrome (SARS) A contagious and sometimes fatal respiratory illness caused by the SARS coronavirus.

Standard Precautions (SP) SP is the terminology used by CDC since 1997 to include protective measures for all potentially infectious exposures.

Universal Precautions (UP) UP is the term originally defined in 1988 as protection from BBP.

Universal/Standard Precautions (UP/SP) Is the term used in this paper which links the two terms for those who continue to use UP.

CHAPTER 1: INTRODUCTION

1.1 Problem statement

Infection control is a fundamental aspect of public health. The risks of infections associated with health care facilities have long been known. Many advances have been made in the identification of these risks and subsequent management of these risks in the healthcare setting. New technologies and safety processes have been deployed for many years to protect both patients and health care providers. However, in spite of advances, occupationally-acquired infections are still a significant problem for health care workers (HCW). The Centers for Disease Control and Prevention (CDC) issued guidelines for health care professionals over twenty years ago (CDC, 1987). Although the guidelines have been updated twice since 1987, compliance remains imperfect in many health care settings. This dissertation describes a study to identify potentially important risk factors for less than strict compliance regarding specific aspects of personal protective equipment and patient characteristics not previously addressed in the peer reviewed literature. Strict compliance is defined as self-reporting “always” to questions regarding compliance while less than strict refers to any response besides “always” or non-applicable. These factors not previously studied are identified in this research as novel predictive factors. The goal is to determine the association between these novel predictive factors, in addition to previously identified factors, and less than strict compliance with the CDC guidelines.

1.2 Importance of Compliance

The importance of compliance is shown by a review of the potential outcomes of low compliance. The CDC currently lists 28 infectious diseases that may be transmitted or acquired in healthcare settings (CDC, 2006). Infectious diseases can be categorized as those that are transmitted:

- by exposure to blood or body fluids (e.g., HIV/AIDS, hepatitis B and C);
- by exposure to airborne bioaerosol droplets from a cough, sneeze, or normal breathing (e.g. tuberculosis or influenza); or
- by exposure dermally, such as Methicillin-resistant Staphylococcus aureus (MRSA).

1.3 Terminology

While the traditional term for hospital acquired illness is nosocomial, the term healthcare-associated infections (HAI) will be used in this dissertation in accordance with the 2007 CDC Guidelines (Siegel et al., 2007). Just as patients are at risk for HAI, workers can also be exposed and therefore HCW are also at risk. Work related infections account for an unknown proportion of the high rate of illnesses experienced by this occupational group. Compliance is defined into two levels for the purposes of this research: strictly compliant and less than strictly compliant. Respondents were stratified into these groupings based on the survey questions on compliance. The method for determining level of compliance is detailed in section 3.5.1 of Chapter 3

Methods. One point that needs to be reiterated often is that nurses and other HCW cannot be compliant with CDC guidelines if the equipment and resources to do so are not available.

The CDC now uses the term standard precautions (SP) to describe protective measures for all potentially infectious exposures. However, the term universal precautions (UP), originally defined as protection from bloodborne pathogens (BBP), is still in wide usage by clinicians. The term UP was far from universal since it applied to only bloodborne pathogens. For this dissertation the two terms will be used together, abbreviated as UP/SP. In accordance with the 2007 guidance (Siegel et al., 2007), SP are directed not only at BBP but also at potentially infectious body fluids and respiratory exposures. UP/SP links the two terms for those who continue to use UP. UP/SP should not be considered static. As new information is developed regarding infectious exposures, the guidelines will continue to change as they have since 1987.

1.4 Research Objectives

Many studies have been conducted regarding compliance with UP/SP since the CDC first promulgated UP in 1987 (CDC, 1987). A review of the peer reviewed literature suggests the barriers to compliance with UP/SP are multifactoral. The literature reviewed identifies many risk factors for low compliance. Despite general recognition of the importance of compliance and three sets of guidance developed since 1987, compliance is variable in practice. This research employed primary data collection from members of the Massachusetts Nurses Association (MNA) through a web based survey of a sample of nurses, currently engaged in clinical care, to accomplish the following specific aims:

1. Characterize level of compliance with UP/SP in three categories: glove use; respiratory shield use; and face/eye shield use.

2. Evaluate the association of established and novel predictive factors with compliance in this population using multivariate logistic regression analysis. The novel predictive factors to be explored include detailed aspects of personal protective equipment availability and preference as well as demographic characteristics of the patient population served.

3. Develop policy recommendations for improved compliance with UP/SP among nurse clinicians.

This survey-based project was designed to provide a current estimation of the prevalence of compliance with UP/SP in a population of nurses engaged in clinical care. The influence of protective equipment preference and availability and demographic features of the patients on compliance in this population were explored. The specific null hypotheses tested include:

$H_0$1 Among MNA nurses surveyed, there is no association between compliance with UP/SP and workplace climate.

$H_0$2 Among MNA nurses surveyed, there is no association between compliance with UP/SP and availability of Personal Protective Equipment (PPE) in preferred materials, sizes, colors or other physical factors.

$H_0$3 Among MNA nurses surveyed, there is no association between compliance with UP/SP and patient characteristics of age, nurses' perception of risk, and English as a second language.

CHAPTER 2: LITERATURE REVIEW

2.1 Regulations and Guidelines Governing Standard Precautions/Universal Precautions

The CDC has a long history of promoting infection control. In particular, the CDC has issued three sets of standards and guidance regarding implementation of precautions to prevent transmission of infectious agents in health care settings beginning in 1987. The first UP guidance was issued in part as a response to the HIV/AIDS epidemic (CDC, 1987). This was followed in the mid-nineties by expanded SP guidance that still focused primarily on blood and body fluids (CDC, 1997). The 1997 guidelines for standard precaution procedures applied to: (1) blood, (2) all body fluids, secretions, and excretions except sweat, regardless of whether or not they contain visible blood, (3) non-intact skin, and (4) mucous membranes. In response to increased concerns about non-bloodborne illnesses, such as severe acute respiratory syndrome (SARS), multidrug resistant (MDR) tuberculosis, and the dermally transmitted MRSA, SP guidance was again updated in 2007 to include precautions involving Respiratory Hygiene/Cough Etiquette and safe injection practices (Siegel et al., 2007).

The Occupational Safety and Health Administration (OSHA) also has rules addressing workplace safety in health care settings. Among these is the Bloodborne Pathogens Standard (1910.1030(d)(1)) in which UP are addressed: **"**Universal precautions shall be observed to prevent contact with blood or other potentially infectious materials. Under circumstances in which differentiation between body fluid types is difficult or impossible, all body fluids shall be considered potentially infectious materials." OSHA further mandates in section 10.1030(d)(2)(i) that engineering and work practice controls be primary and PPE be used only if engineering and work practice controls are not sufficient. If respiratory PPE is to be used in a health care setting, the OSHA Respiratory Protection Standard section 1910.134(d)(1)(i) dictates that employers must "select and provide an appropriate respirator based on the respiratory hazard(s) to which the worker is exposed and workplace and user factors that affect respirator performance and reliability" (OSHA 1991, 2001).

Passage of the Needlestick Safety and Prevention Act (Public Law 106-430) in 2001 provided Congressional impetus to focus on engineering controls for sharps. This act required employers to establish safety plans with input from non-managerial employees at risk of exposure from sharps. OSHA's interpretation of the Act was to follow the guidance of the original standard that "Engineering and work practice controls shall be used to eliminate or minimize employee exposure. Where occupational exposure remains after institution of these controls, personal protective equipment shall also be used." The problem remains that because in most health care settings there is no feasible way to engineer out all possible exposures, the term *minimize* may be interpreted broadly (OSHA, 2001).

Hospitals are required to follow CDC recommendations under two separate entities. Formerly known as the Joint Commission on Accreditation of Healthcare Organizations (JCAHO), The Joint Commission is the nation's predominant standards-setting and accrediting body in health care. Approval from The Joint Commission is necessary for hospitals in most areas of the United States to maintain accreditation. The Joint Commission Requirement 7A for 2006 requires healthcare organizations comply with CDC hygiene guidelines. Under The Joint Commission requirements adherence to CDC regulations is a matter of patient safety. Worker safety requires that the hospitals comply with the OSHA regulations which are generally duplicative of the patient safety requirements. This Joint Commission requirement is a reinforcing factor which should be considered a positive influence on compliance and may make hospitals more likely to be compliant than other health care facilities. However, there is a need to be vigilant to ensure that this does not cause confusion rather than reinforcing good practices since one is aimed at patient safety and one at worker safety.

2.2 Modalities of Compliance

The major modalities of compliance with all of these standards and guidance include use of sharps with engineered sharps injury protection, appropriate use of gloves, respiratory shields, protective gowns, sharps disposal equipment, and other procedures to minimize the risk of transmission of bloodborne, body fluid or respiratory pathogens between HCW and patients and between patients and HCW. The governmental standards for compliance with these modalities

have been put into place based on risk assessments and risk classifications completed by CDC (CDC, 1987, CDC 1997, Siegel et al., 2007).

Health care systems deal with humans and not closed mechanical systems. There is always variability in human actions and reactions, and necessity for immediate actions regardless of whether or not the clinicians are in appropriate locations with engineering controls in place. Although the standard hierarchy of controls places PPE at the bottom, below more effective methods that include engineering, safe work practices, and administrative changes, compliance with PPE guidance is nonetheless essential.

The overall research cited in the literature review section shows substantial differences in the levels of appropriate PPE usage, making efforts to improve compliance important to both patient and worker safety. Appropriate usage is defined as using the correct type of PPE and using it in the appropriate circumstances. No questions were asked about use of PPE as it was designed to be used.

2.3 Compliance Variation

Reasons for low compliance reported in published studies have included limited availability of gloves, supplies and equipment, non-use by older mentors, and the perception that gloves interfered with fine manipulation during procedures (Wang et al., 2003). These same barriers have been reported in Canadian hospitals (Godin et al., 2000) and in US hospitals (Curry and Cole, 2001, Malone and Larson, 1996). Additional factors include occupation (e.g. nurses are

more compliant than physicians), risk-taking tendencies, commitment by the organization to worker safety, and hours worked. Risk-taking tendencies were measured using a scale of behaviors at both work and recreation. No specific occupations were identified as having more risk taking tendencies than any other (Gershon et al., 1995).

Working conditions are also a factor in low compliance. A 2003 review of nurses' working conditions and infectious diseases found that HAI rates were inversely related to both staffing levels of nurses and the proportion of full time staff versus contract nursing staff (Stone, 2004).

Several studies published since the early 1990's show a wide variation in compliance with UP/SP among nurses. A survey was sent to registered nurses, physicians, and medical technicians involved in direct patient care or specimen handling in three Midwest community hospital facilities. There were 3,223 surveys returned (63%) including 2,168 from registered nurses. Sixty-six percent of the nurses self-reported compliance for routinely wearing gloves during invasive procedures. The authors did not indicate what criteria they used to define *routinely*. Only 49% of the nurses responding reported that they always washed their hands after patient care. The survey also showed that almost 40% of the responding nurses had one or more exposures to blood via mucocutaneous or sharps injury in the previous three months. The authors indicated that the participants and non-participants were comparable with respect to demographics. They felt this factor and the adjusted response rate of 63% lessened the likelihood that a response bias was having an impact on these results.

A similar study among correctional facility HCW in Maryland, with a patient population assumed to be at high risk for TB, hepatitis and HIV, also showed a wide variation in self-reported compliance rates depending on the task. The HCW in the study were full time employees under the management of two medical contractors overseen by the Maryland Department of Public Safety and Correctional Services (DPSCS). Of the 350 full time HCW (HCW), 216 responded to the survey (62%). The authors indicate that a full time infection control practitioner was on staff with responsibility for all 28 correctional facilities in the state. The authors did not indicate whether the infection control practitioner was an employee of the contractors or the DPSCS. Self-reports by anonymous survey respondents indicated compliance with glove use to be 93.2% when drawing blood, but compliance fell to 86% for other uses of sharps. Use of disposable face masks and protective outer garments was below 50% (Gershon et al., 1999).

A study done at the Cook County Hospital in the early 1990's was intended to demonstrate whether glove use alone, or glove and gown use, was more effective in reducing vancomycin-resistant enterococci (VRE). Nurses in two units with 93 patients and 88 patients respectively were directly observed for compliance. In spite of knowing both that they were being observed and that the purpose of the study was to find methods to reduce VRE, nurses were only 79% compliant in glove and gown designated rooms and 62% compliant in glove only rooms (Slaughter et al., 1996).

Other studies showed variations in levels of compliance with glove use and respiratory protection. Ferguson et al. (2004) surveyed over 3,000 community hospital based HCW in the

Midwest. Their study included physicians, nurses and laboratory technicians. They found that only 54% of respondents self-reported 100% glove use compliance for venipuncture procedures, while Clarke et al (2002a) found that 87% of respondents self-reported 100% glove use compliance for venipuncture procedures. A study among correctional facility HCW revealed compliance rates of 82% for respiratory protection (Mitchell et al., 2005).

2.4 Potential Risks for Health Care Workers

The Bureau of Labor Statistics (BLS) 2008 data on recorded illnesses and injuries requiring time away from work indicates the rate of occupational injuries and illnesses requiring days away from work per 100 workers was 1.7 for general hospitals, 2.5 for nursing and residential care facilities and 1.4 for home health care. An injury or illness is considered by the Occupational Safety and Health Administration to be work-related if an event or exposure in the work environment either caused or contributed to the resulting condition or significantly aggravated a pre-existing condition (BLS, 2008). These BLS data reflect only the recorded cases representing time off of work. Since many illnesses do not result in time away from work these rates underestimate the true incidence of workplace illnesses and injuries. The Massachusetts Department of Health has data on sharps injuries but no overall illness and injuries data for HCW.

A study was recently completed using the National Occupational Mortality Surveillance data to investigate the potential occupational deaths among HCW due to bloodborne infections. This was a death certificate based study. The authors reviewed death certificate data from 1984 to

2004. The size of the database allowed stratification between male and female nurses as well as other HCW. They found that among male nurses there was increased mortality for HIV, HCV and other diseases potentially caused by bloodborne infections. Female nurses were only found to be at higher risk for HCV related deaths over the time span of the study (Luckhaupt and Calvert, 2008). One of the limitations of this study was that they were only able to use marital status as a surrogate variable for heterosexual orientation to control for non-occupational risky sexual behaviors.

These study results indicate that the risk of occupational exposure to infectious diseases for HCW is substantial. True incidence rates for most infections directly related to lack of health care worker compliance are not available. The CDC estimates HCW seroconversion rates for HIV to be 0.3% and for HCV to be 1.8% per exposure incident. Post-exposure prophylaxis for HIV may decrease the rates of seroconversion. The HBV seroconversion rate for non-vaccinated HCW is estimated to be between 6-30% per exposure incident (CDC, 2004). Seroconversion is defined in Webster's on-line medical dictionary as the development of detectable antibodies to the infection to which the health care worker was exposed. It is therefore a marker of exposure, but not necessarily of illness.

Prior studies have shown that the percentage of needlestick injuries that are not reported ranges from 27-69% and that exposures to mucosa are not reported up to 49% of the time (Alvarado-Ramy et al., 2003, Doebbeling et al., 2003, Gershon et al., 2000). The Duke University Health System (DUHS) has conducted an in-depth surveillance program of its HCW since 1997. The DUHS study is unique in that it tracks over 24,000 employees and has developed a job exposure

matrix that allows stratification for level of potential risk for exposure to blood or body fluids. They were able to access both a voluntary recording system and workers' compensation data. The authors found that 86% of the exposures were recorded in both systems, 12% were reported only to the workers' compensation system and 2% were only reported in the voluntary system. The authors indicated that although there was concordance between the two systems of reporting, underreporting was still a limitation in their study (Dement et al., 2004).

Other studies indicated that underrecording of both percutaneous injuries and exposure to body fluids is a limitation (Aiken et al., 1997, Beekman et al., 2001, Chen and Jenkins, 2007, Elder and Patterson, 2006, Gershon et al., 2005, Gershon et al., 2007a, Markkanen et al., 2007, Osborne, 2003). The true magnitude of the problem is believed to be underestimated in all studies and only the degree of underrecording is considered an unknown.

It is also difficult to quantify the actual risk due to the lack of a consistent denominator. Data from EPINet, a surveillance system of 41 hospitals, recorded incidence rates by number of occupied beds over a period of a year. This is also an imprecise measure since staffing levels per bed may vary from shift to shift and hospital to hospital. EPINet data for 2004 indicated rates of 33.18 percutaneous injuries per 100 occupied beds for teaching hospitals and 18.98 for nonteaching hospitals. In addition, this study showed rates of 9.76 exposures to blood and body fluids per 100 occupied beds in teaching hospitals and 6.3 in nonteaching hospitals in that same time period. These exposures included splashes onto the mucosa and/or lacerations.

The EPINet data show that nurses (RN and LPN) accounted for 40.6% of the percutaneous injuries and 50.7% of the exposures to blood and body fluids (Perry et al., 2007). While percutaneous injuries are usually defined as needlesticks, articles in the peer-reviewed literature are not always clear as to whether the authors mean only needlesticks or if other percutaneous injuries, (e.g. scalpel wounds,) are included. This lack of clarity may lead to a misclassification of some exposures.

Even defining what constitutes a full time nurse varies. Many hospitals provide full time pay and benefits for nurses willing to work two twelve hour shifts on week-ends and define these as full time. Others require a minimum of 40 hours and, others, something in between.

2.5 Interventions and Barriers

Studies have shown that UP/SP training and reinforcement of training reduce the incidences of HAI (Malone and Larson, 1996). Increased compliance with UP/SP would logically appear to lead to a decrease in HAI, and consequently several studies have sought to demonstrate this. Only two studies of the more than a dozen reviewed indicated that improved compliance with UP/SP did not reduce HAI (Aboelela et al., 2007, Slaughter et al., 1996). While those two did not show any decrease they did not indicate an increase in HAI.

There are a number of training materials and training programs available on the topic of UP/SP. For example, hospital employees in Virginia and Iowa were provided with video, lectures, computerized training, and didactic training (Beekman et al., 2001), while HCW in a surgical

intensive care unit were provided with self study modules (Coopersmith et al., 2002). Preliminary interviews for this project, conducted in spring 2005 (Kirkland and Levinson, 2005), indicated that while the information regarding UP/SP conveyed during training is relatively uniform, the methods of teaching, degree of review over a period of time and reinforcement of learning objectives are extremely variable. In all of the studies reviewed for this research that focused on improving compliance with UP/SP, changes in behavior required at least one or more of the following: convincing HCW of need for UP/SP, engaging peer groups, changing and/or enforcing institutional policies, modeling by senior staff, and input by management in providing appropriate supplies and supporting training efforts. Several studies reviewed these factors in depth (Aboelela et al., 2007, Curry and Cole, 2001, Wang et al., 2003).

One quasi-experimental study in China divided 106 nursing students into two groups. One group was provided with intense education with lecture and video which emphasized needlestick prevention. The comparison group was given brief oral instruction on the importance of HBV vaccine and the same written materials as the experimental group. The results showed that initial intense training increases knowledge of BBP and the need for UP/SP. The experimental group showed significant increase in handwashing and decrease in sharps injuries as compared to the comparison group both in self-report and observations conducted four months post intervention. However, the intervention did not affect glove use. The authors felt this was due to multiple factors including availability of gloves, management concerns about the cost benefit of gloves and behaviors modeled by senior staff (Wang et al., 2003).

A 1999 study in a surgical intensive care unit involved educational activities including self-study modules to decrease infection rates related to catheters. One of the chief measurable outcomes was improved compliance with handwashing. This intervention resulted in increased knowledge among nurses and an initial steep decline in infection rates in the first month following the intervention. However, infection rates then increased for the next two months, although the increase did not meet the pre-intervention rates of infection. This pattern continued for the entire study with rebounds in infection rates being followed by decreases. The authors did not offer theories as to why these rebounds occurred. The intervention did show an overall success over the eight months (Coopersmith et al., 2002). The question remains as to whether this overall decrease was maintained after the study ended.

A study conducted in 1998 by Larson et al., designed to improve frequency of hand washing and modeled after studies showing workplace safety climate to be a major factor in the long term success of interventions, the authors used a top down strategy to improve hand washing frequency in Neonatal Intensive Care Units (NICU) and in Medical Intensive Care Units (MICU). This intervention began with orientation and consultation with upper management on the best ways to implement such a program, followed by activities designed to educate staff on the importance of hand washing to infection control, but also to demonstrate the "buy-in" of senior management. The intervention was successful as measured by decrease in rates of VRE, although rates of MRSA did not decrease significantly (Larson et al., 2000).

2.6 Research Gaps

The goal of this research is to evaluate novel factors that may affect compliance with UP/SP. Several studies documented that compliance is affected by whether gloves are available (DeJoy et al., 2000, DeJoy et al., 2004, Ferguson et al., 2004, Godin et al., 2000, Gould and Ream, 1994, Gould et al., 1996) and others by whether gloves are used with no indication of whether or not gloves were available (Clarke et al., 2002, Doebbeling et al., 2003, Gershon et al., 1994, Gershon et al., 1995, Gershon et al., 1999, Gershon et al., 2000, Markkanen et al., 2007, Slaughter et al., 1996, Wang et al., 2003). However, none of the surveys reviewed to date have asked whether or not the gloves were available in the appropriate size, preferred material, color, or whether other seemingly extraneous factors such as the age of the patient affect compliance.

The DUHS surveillance study showed that pediatric departments had higher incidence of exposure to blood and body fluids than many other departments (Dement et al., 2004). While it is reasonable to assume that this higher incidence is due to the behavior of children in a health care setting, there are other possible explanations. Children are not routinely hospitalized unless very sick and may require more testing than an adult hospitalized for elective surgery or a chronic condition. Nurses may choose not to wear PPE to avoid adding to a child's stress level, because they feel children pose less of a threat of HAI, or for other reasons. Similar questions arise with regard to other patient populations such as older adults. A series of key informant interviews indicated that some nurses do not use PPE when otherwise advised with older patients. Reasons given included: not wishing to further isolate the older patients; the need for older patients to see the nurse's mouth to better understand what was said; that wearing PPE showed a lack of respect; and, that older patients were less at risk for HAI (Kirkland and Levinson 2005).

The novel factors of interest are: availability of various types of PPE including size, material, style and certain patient characteristics including age, English as a second language, and nurses' perception of risk. These factors were studied by evaluating responses from a random sample of members of the MNA to a survey.

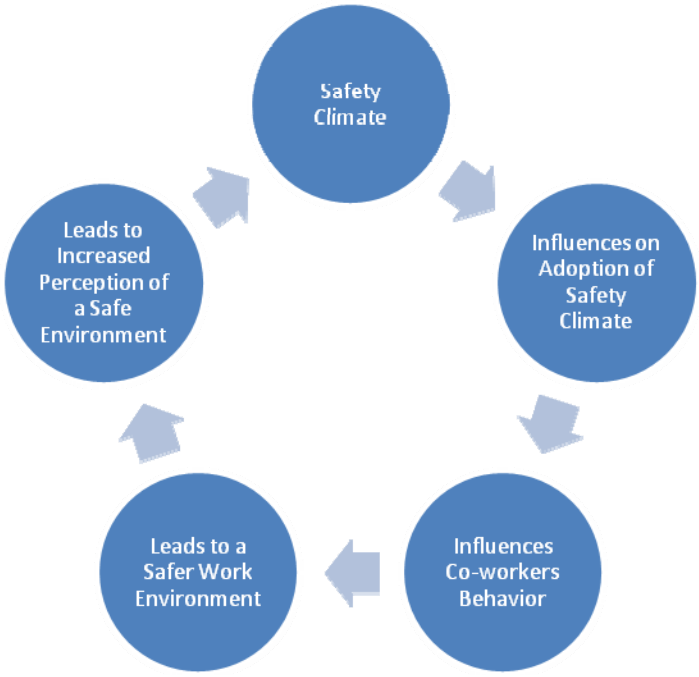
CHAPTER 3: METHODS

3.1. Theoretical Model

The historic context of workplace "safety climate" was defined by Dov Zohar in 1980 for industrial settings. According to this model, safety climate can be understood as the employees' perceptions of the organization's commitment to safety. The research conducted on how workplace climate affects compliance with UP/SP is very extensive, and indicates consistently that high compliance with any safety guideline is associated with a positive, reinforcing workplace climate (Anderson et al., 2000, DeJoy et al., 2000, Gershon et al., 1994, Gershon et al., 1995, Gershon, 1996, Gershon et al., 1999, Gershon et al., 2000, Gershon et al., 2004, Mitchell et al., 2005, Zohar, 1980, Zohar, 2002). Therefore, a basic assumption of this research will be that, unless the workplace safety climate is supportive of compliance, interventions will not increase compliance for any extended duration.

Gershon et al (2000) created a flow chart (Figure 3.1) that illustrates the influences of safety climate.

Figure 3.1 Influences of Safety Climate Flow Chart



This dissertation used a combination of the Zohar model of safety climate in industrial organizations and the primary aspects the PRECEDE model as adapted by DeJoy (DeJoy et al., 2000, DeJoy et al., 2004). Zohar's research identified eight components of safety climate. These are: (1) importance of training, (2) management attitudes, (3) effects of safety performance on promotion, (4) level of environmental risk, (5) effects of required work pace on safety, (6) status of safety officers in the organization, (7) effects of safe conduct on social status, e.g. do co-workers respect someone who insists on a safe environment; and (8) status of safety committee (Zohar, 1980). While the Zohar research was done within a manufacturing setting, it can be applied for use with health care professionals. Importance of training was measured in part by the amount of safety training provided and the timing of that training, (e.g., was safety training part of the orientation for new workers?). The health care setting equivalent of a safety officer is

more likely to be a person from the infection control department although some hospitals will have both. An infection control person is most likely to be responsible for surveillance for HAI and staff education on prevention of HAI.

PRECEDE stands for "*p*redisposing, *r*einforcing, and *e*nabling *c*onstructs in *e*ducational/ *e*cological *d*iagnosis and *e*valuation" (Green and Kreuter, 2005). The PRECEDE model was adapted by DeJoy to better fit the occupational model by incorporating workplace factors, including the concept of an "organizational climate" affecting participation and compliance (DeJoy et al., 2000, DeJoy et al., 2004). In the 4th edition of their classic text, Green and Kreuter acknowledge the DeJoy adaptation. The PRECEDE model is designed to work in tandem with the PROCEED model (*p*olicy, *r*egulatory, and *o*rganizational *c*onstructs in *e*ducational and *e*nvironmental *d*evelopment). PRECEDE is used to evaluate and determine what the problems are that need to be resolved and PROCEED to implement solutions (Green and Kreuter, 2005). Ideally, these two models would be part of a single process.

Research focusing on the health care field has been done using the PRECEDE model to illustrate factors leading to compliance with UP/SP and/or safety rules (Green and Kreuter, 2005, DeJoy et al., 2000, DeJoy et al., 2004). The three summary components used by PRECEDE and DeJoy – Predisposing, Enabling, and Reinforcing – incorporate Zohar's eight components with some overlap. They are briefly summarized as follows:

1. Predisposing factors: individual characteristics (knowledge, beliefs, attitudes, values). These factors are thought to provide motivation for compliance. DeJoy found that

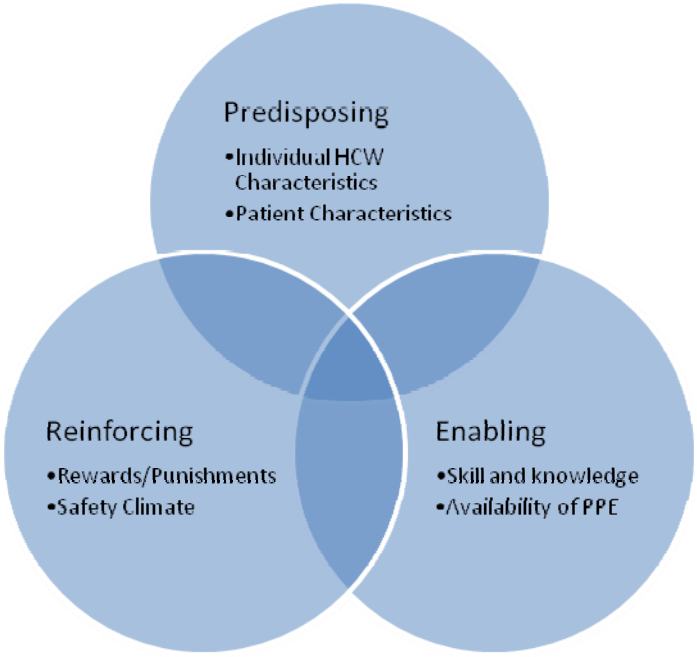
compliance is better among those better informed on modes of transmission, those with positive attitudes towards treating patients with AIDS, and those with fewer risk taking tendencies. Demographics of the surveyed population including age, years as a nurse, educational level, and practice setting are considered predisposing. In addition, for this study, patient characteristics including age, the nurses' perception of risk posed by the patient, and English as a second language are included as predisposing factors.

2. Enabling factors: aspects of system and environment that promote self protective actions. This section of DeJoy's model incorporates the following factors listed by Zohar: training, management attitudes, status of safety officer (in hospitals the equivalent would most likely be the infection control personnel), status of safety committee (this may overlap and/or conflict with the infection control committee) on issues such as safety product selection, work pace or workload (e.g. number of patients per nurse), severity of the conditions of the patients, and the availability of PPE. While not specifically mentioned by DeJoy, the workplace environment e.g. basic housekeeping, cleanliness, organization of space, also plays an important role as an enabling factor.

3. Reinforcing factors: rewards and/or punishments in consequence. This would include the Zohar factors of effects of safe conduct on promotion, and effects of safe conduct on social status.

While for the purposes of the research, these factors are listed separately, they actually fit a Venn diagram with overlapping areas (Figure 3.2).

Figure 3.2 Venn Diagram of Factors



Predisposing factors were investigated by looking at demographic characteristics of the nurses responding to the survey such as age, gender, years in the field, and education level. Attitudes were ascertained by questions on whether the use of UP/SP is practiced more or less with certain patients. Patient characteristics of age, English as a second language and nurses' perception of risk were included as predisposing factors. The published literature has not placed these in any of DeJoy's categories. While these could also be considered as enabling factors, the author has placed them here. Although risk taking behaviors are an identified predisposing factor in compliance with UP/SP (Gershon et al., 1995), they are not addressed in this research due to the need to limit the number of questions in the survey instrument.

Enabling factors were investigated primarily on the basis of the responses to questions regarding safety equipment and the reasons given for using or not using that equipment, including lack of availability, management support for use, and co-worker support. The specific environment was evaluated as an enabling factor in UP/SP compliance. Certain medical environments (e.g. emergency rooms and surgical units) seem to provide more opportunities for exposures to potential HAI than other settings because of their higher risk profile. Therefore, there may be more awareness of the need to comply with UP/SP in these areas, but all areas of the medical care facility have significant opportunities for HAI. Another environmental concern is the availability and attributes of the PPE needed to reduce risk. Attributes of PPE will include not only availability but size, materials, color and type/model.

Reinforcing factors were investigated primarily by looking at the safety climate of each workplace. Responses to survey questions in Section 4: *Safety Climate* regarding overall availability of safety equipment, support of co-workers as well as of management for compliance with safety measures, cleanliness of work area and other related factors served as indicators of reinforcing factors. One very important component in the safety climate is management attitudes, which includes rewards and punishments for not following UP/SP. As previously noted, there are overlaps in the factors within this model, and safety climate may also be considered a predisposing factor. For the purposes of this research, safety climate will be defined as reinforcing.

3.2 Study Design

3.2.1 Descriptive background

The study investigated factors related to PPE availability and patient characteristics not evaluated in prior studies which may influence compliance with UP/SP among nurses. A self-administered questionnaire addressing these issues as well as demographic information and workplace climate was employed; this survey was web-based to reduce costs. Postcards requesting participation were mailed to a random sample of registered nurses who are members of the MNA.

The questionnaire was divided into five sections: Demographics and Work Information, Safety Equipment, Compliance, Workplace Safety Climate and Exposure History. The Exposure History was completed only by those nurses who had had a blood/body fluid exposure within the past twelve months. The questions provided the information needed to characterize Predisposing Factors, Enabling Factors, and Reinforcing Factors. The study used portions of previously validated instruments which explored demographics and workplace climate issues (Anderson et al., 2000, DeJoy et al., 2000, Gershon et al., 1994, Gershon et al., 1995, Gershon 1996, Gershon et al., 1999, Gershon et al., 2000, Gershon et al., 2004, Mitchell et al., 2005). The study questions are based on interviews with expert consultants and one focus group, as described below.

A series of discussions with experts in the field was conducted to determine if other questions should be included or if the questions should be reworded. Initial discussions were held with Evelyn Bain, RN - Associate Director/ Coordinator Health & Safety, MNA; Stephanie Chalupka, EdD, APRN, BC, CNS; Robyn Gershon, DrPH, BSPH, MS - Columbia University; Marion

Gillen, RN, MPH, PhD; Bonnie Rogers, DrPH, RN - University of North Carolina; Jacqueline Agnew, DrPH, RN - Johns Hopkins University; Kathleen McPhaul, PhD, MPH, RN - University of Maryland School of Nursing; Linda McCauley, PhD, RN - University of Pennsylvania; and, Priscah Mujuru, DrPH, COHN-S.

The proposed survey instrument was sent to the nine experts named above, anticipating that at least five would complete the process. Eight of the nine responded with comments regarding which questions are relevant, which should be dropped, and which should be reworded. A review of their responses was conducted in February 2009, the survey revised based on the comments received and a revised survey sent out for a second round of review. There was no significant disagreement and a third round of review was not deemed necessary. This process resulted in both the addition of new questions and the deletion of others. The original survey was designed to be completed in approximately 30-40 minutes. Following the interviews and suggestions of the expert consultants, this time was reduced to 20-25 minutes.

George Washington University (GWU) Institutional Review Board (IRB) approval was sought for the resulting survey as well as for the focus group described below. MNA does not have an IRB and agreed to abide by the decision of the GWU IRB.

The survey instrument received IRB approval on May 5, 2009. A final review of the questionnaire was completed by conducting a pilot test and follow-up focus group made up of the members of the MNA Congress on Health and Safety (MNA Congress). The MNA Congress is made up of an elected body of 12 members of MNA. The focus group was held on May 13,

2009 at the MNA Congress's monthly meeting at the MNA headquarters in Canton, MA. Others who have previously served on the MNA Congress and/or who are interested in health and safety issues also participated in the focus group. The focus group included thirteen MNA members including eleven nurses and two health and safety personnel. All signed IRB releases for participation and received $5 Dunkin Donuts gift certificates as a thank you for participation.

The focus group was recorded, but not transcribed. Comments were received on the survey instrument: whether the questionnaire was understandable; if the questions were clear, the amount of time required to fill out the form; and whether they felt that the number of questions was too onerous for good response. The focus group resulted in minimal modifications to the survey. The modified survey was again submitted to the GWU IRB and approval was received on May 22, 2009.

The initial plan was to conduct a pilot test of the survey at the educational seminars held by MNA: one on May 14-15, 2009 and one on June 4, 2009. This was determined to be unworkable due to both the short time frame between the focus group and the first meeting as well as the economic restrictions that resulted in the survey being an on-line survey only. Instead, the author attended the May 14-15, 2009 educational seminar and distributed a one page IRB approved description of the project. MNA Congress personnel also distributed the description at the June 4, 2009 meeting and an announcement about the survey was included in the June MNA Newsletter (Appendix I).

3.3 Study Population

According to the Massachusetts Department of Labor, there were over 78,000 registered nurses in the state in 2007. With assistance from the MNA leadership, the study population was recruited from the membership of the MNA. The current membership of the MNA is approximately 23,000 registered nurses, most of whom are currently working full or part-time.

This project was approved by the MNA leadership subject to review of the survey instrument. They wrote a letter of support and advertised that support in the MNA newsletter as well as in response to any inquiries. MNA staff created address labels for the random sample. Addressing and mailing the postcards requesting participation was completed under the supervision of Celeste Monforton, DrPH, MPH, at the Department of Environmental and Occupational Health at GWU.

3.3.1 Sampling Description

The sample was drawn from the MNA's existing mailing label database of members. The danielsoper.com "A-priori Sample Size Calculator for Multiple Regression" was used to calculate the sample size. The calculations used a two sided p value of 0.05, a statistical power of 0.8 and the anticipated multiple regression of eight dependent variables, including four measures of compliance with PPE (gloves, respiratory shields, eye shields and overall compliance) as well as compliance with four patient subgroups (pediatric (under age 18), older patients (age 65+), English as a second language, and perceived as low risk). Separate models were planned for each type of PPE.

Sample size was calculated to facilitate the originally planned multivariate analyses. The calculations were completed using the Cohen standard for effect sizes (f^2) of small (.02), medium (.15) and large (.35). The effect size for multiple regression is defined as $f^2 = R^2/1\text{-}R^2$ where R^2 is the squared multiple correlation. This measure (rather than a measure based on the expected difference and standard deviation of the two groups) was used as a guide for estimating sample size since the planned analysis included multivariate analyses. In actuality, however, due to the small response rate, the multivariate analyses were not conducted. Instead, chi-square, Student t-test, univariate analyses, and simple correlation analyses were carried out.

An assumption was made by the author that between 15-25% of the nurses surveyed would be in the low compliance category and approximately the same percentage would be in the high compliance category. Based on these calculations and assumptions, an estimated sample size of 3,020 to 5,285 nurses was calculated for small effect size, 432 to 756 for medium effect size and 208 to 364 for large effect size. While the ideal situation would be to have a large enough sample to analyze the survey for a small effect, budget limitations dictated that a medium effect size was the best that this research would have the power to detect. Thus, a sample of 750 participants was sought.

Table 3.1 Sample Size Calculations

Alpha Level (p)	0.05	0.05	0.05
# Predictors	8	8	8
Effect Size (f2)	0.02	0.15	0.35
Statistical Power Level	0.80	0.80	0.80
Assuming 25% low Compliance	3,020	432	208
Assuming 15% low Compliance	5,285	756	364

In order to achieve approximately 750 responses, additional factors were considered. The MNA could not stratify the membership by the proposed eligibility criteria in section 3.3.2. This meant that an allowance needed to be made for a number of respondents not meeting the eligibility criteria. In addition, a recent study regarding survey response was conducted by researchers at the University of Massachusetts-Lowell which showed that a similar and possibly overlapping population of nurses in Massachusetts had a 29.5% response rate to the survey (Cifuentes et al., 2008).

Given the 23,000 members of MNA and the support provided by the MNA Health and Safety staff, it was expected that with the sample of 2,300 and a 30% response rate there would be approximately 690 responses. As will be discussed fully in *Chapter 4: Results,* the actual response was far less than anticipated.

Nurses were sampled using a systematic nth name selection technique. To establish the initial survey population labels were created using each 10^{th} address based on the above calculated sample size. MNA created three sets of duplicate labels to allow for reminder postcards to be mailed. Twenty Macy gift certificates worth $25 each were provided by the author as an incentive to completion. This lottery was approved by the IRB.

MNA has an "opt out" option for members when the association is asked for mailing labels. This means that members who have opted out will not have their addresses included in any mailing label request. The request for the 10% random sample therefore yielded only 1,523 usable names and addresses with approximately 800 names selected not yielding addresses. Postcards were

mailed on June 19, 2009 with reminder postcards sent on July 7, 2009 and July 21, 2009. Only 57 MNA members responded by completing the survey.

This was deemed an insufficient number for any preliminary analysis and therefore a second request was submitted for a 5% random sample of MNA members. The smaller sample size was selected based on both the costs of a second mailing and the very low response rate for the first mailing. Nurses were again sampled using a systematic nth name selection technique however; this time the sampling was begun on name three in the MNA database to avoid duplication. Due to the previously described opt-out option for MNA members, this sample of the approximately 23,000 members yielded 763 names and addresses with approximately 300 names selected not yielding addresses. Postcards were mailed on August 12, 2009 with reminder postcards sent on August 26, 2009 and September 9, 2009. As of September 22, 2009, only 84 total survey responses had been received. This included the 57 from the initial set of mailings and 27 two weeks after the mailing of the final reminder post card of second set of mailings. There is no way of determining if the last 27 responses were all from the second set of mailings or if some were simply late responders to the initial set of mailings. On September 30, 2009 the random survey responses were considered complete. Four of the 84 responding chose not to complete the survey leaving a random sample of 80 completed responses.

On October 9, 2009 the MNA Division of Health and Safety posted an announcement in the on-line version of the Massachusetts Nurse and on the MNA web site to solicit responses from the general membership. This action was taken to provide additional response yield although it changed the sample methodology to a convenience sample. The announcement remained on the

MNA web site until November 23, 2009 after which time the author ended data collection due to lack of response. An additional 37 responses were received in response to this announcement. However, 11 people checked "Yes" on the informed consent page, but did not complete the survey leaving 26 completed responses to the convenience sample. A total of 106 responses are analyzed.

3.3.2 Eligibility Criteria

The initial eligibility criteria for the study population included the following:

- Member of MNA
- Currently working at least 24 hours per week or self identifying as employed full time.
- Working as a nurse in a clinical setting and/or supervising nurses in clinical settings including non-acute care facilities.

Those not eligible included:

- Those nurses not working full time as defined above.
- Those working in administrative or non-clinical settings e.g. in case management, administration only, teaching only.

The above criteria were reviewed by both the expert consultants and the focus group held in May 2009 and were deemed appropriate. As will be explained in section 4.1.2, due to the limited response rate, all nurses working in clinical situations with *hands-on* patient responsibilities were included in the final analyses. Responses to questions in *Section 1: Demographics and Work*

Information were used to determine eligibility based on these criteria. All nurses responding were assumed to be members of MNA since postcards were only mailed to current members. However, while the request for responses in October and November was only published on the MNA website, there is a possibility that some of the 37 respondents to the convenience sample may not be MNA members.

3.4 Methods for Data Collection

Postcards were sent to MNA members as described above in 3.3. The postcards included a brief message that provided assurance that the data would not be identifiable and would only be analyzed in the aggregate.

Figure 3.3 Postcard Invitation to Random Sample of MNA Members

This postcard is to invite you to participate in a survey "Barriers to Using Universal/Standard Precautions." This survey is conducted by Katherine Kirkland, MPH of the George Washington University (GWU) and supported by the ***Massachusetts Nurses Association****. To participate, please go online at www.aoec.org/mna. The survey should take about 20 minutes to complete. All responses are anonymous and are strictly voluntary. When you finish the survey, you will be prompted to send an e-mail to a GWU faculty member with your name and address to be entered in a drawing for one of twenty $25 Macy's gift cards. Ms. Kirkland will not be given your name or address nor will it be recorded with your response.*

Survey Monkey was used to establish a secure on-line survey. The nurses were only given the option of responding via an on-line survey instrument. A consent form approved by the IRB was

the nurse's first step in completing the on-line survey. If the participant did not indicate willingness to have responses analyzed, s/he was not able to complete the survey. Only upon completion of the on-line survey did a final page provide nurses with the option to submit their name and address for one of the twenty chances to win a Macy's gift certificate. This information was sent to Dr. Monforton who was approved by both MNA and the GWU IRB to conduct the drawing.

Survey responses were self-reported. The health care worker population adherence to UP/SP has been studied through both observation and self-reporting. These studies have found that self-reporting for use of UP/SP is a reliable measurement tool (Gould and Ream, 1993, Gould et al., 1996, Mitchell et al., 2005). Even with known observation, compliance rates were not optimal. Levin (1995) reviewed over thirty studies using observed compliance, self-reported compliance or both. These studies showed that observed compliance was consistent with self-report; in many cases the observed compliance was higher than the self-reported compliance among the same groups. Self-report has also been used in the non-health care field with similar results (Zohar, 1980, Bot et al., 2004).

3.5 Measures

This survey determined the current level of compliance with UP/SP and obtained the perspective of working nurses regarding the barriers and beliefs surrounding compliance. Existing survey instruments validated in 1995, 2000 and 2002 (Gershon et al., 1995, Gershon et al., 2000, Gershon et al., 2004) were used as the basis for this study's questionnaire. The first analysis

describes the nurses responding based on the factors in Section 1: *Demographics and Work Information* of the questionnaire. The questions within the demographics section of the survey (Questions 1-20) were taken from previously validated surveys (Gershon et al., 1995, Gershon et al., 2000, Gershon et al., 2004). The final survey with distributions is found in Appendix II.

Not all questions from these prior studies were asked of this study population. Questions were retained to enable comparisons of this study population with nurses previously studied as far as: a) demographics, b) self-reported compliance, c) general availability of gloves, masks, and gowns, and d) training in UP/SP.

While existing validated surveys provided many of the questions, additional questions were asked regarding other factors such as glove size, material, and color; what sort of safety precautions nurses believe to be appropriate regardless of CDC Guidelines; nurses' personal preferences for safety practices; and patient population characteristics such as age and language. Patient's age was categorized into four possible responses: pediatric (under 18); mid-range (ages 19-64), older (over 65) and cannot remember. Language was defined as English as a second language.

A complete pilot test by the researcher of the new questions was not financially feasible. Instead, the new questions were evaluated by the focus group consisting of members of the MNA Congress as well as by individuals with expertise in the area of compliance – specifically nursing compliance.

3.5.1 Compliance

The primary indicator of interest was the self-reported level of compliance with UP/SP. A measure of overall compliance was constructed based on the questions in *Section 3: Compliance*. This section consisted of the previously validated scale developed by Robyn Gershon in 1998 and refined in 2002 (personal correspondence 2008). The low response rate precluded statistical comparison to prior study populations. A frequency table was developed to ascertain percentages of compliance for each question. In addition, each response was assigned a numeric value from 1-5 (those responding "not applicable to my job" were not included) so that a mean score could be calculated across all questions.

Three dependent variables were developed and utilized in the descriptive analyses. These included one variable for each PPE of concern: gloves, eye protection, and respiratory shields. This was necessary since a nurse may be highly compliant with glove use, but minimally compliant with eye protection.

The initial classification for each of the three variables was based on responses to questions 46, 47 and 48 in *Section 3: Compliance* of the survey. These questions ask how often nurses utilize the specific PPE. Consistencies of these responses about compliance with specific PPE were reviewed using the responses in *Section 2: Safety Equipment* for each of the categories of PPE.

Measures of compliance when treating specific patient subgroups were also considered in the analysis: pediatric (under age 18), older patients (age 65+), English as a second language, and

perceived as low risk. Additional analyses were conducted to explore associations between compliance and the major demographic and workplace safety climate variables listed in Table 3.2. The major demographic variables analyzed for associations were age, years nursing, education degree, and time spent in UP/SP training. The workplace safety climate questions were analyzed for association between compliance and workplace safety based on the mean scores for all 21 questions (Questions 59-79). Dichotomous analyses were completed for workplace safety climate scores using categories based on three divisions of the workplace safety scores: All respondents above and below the mean score (3.62), the top quartile (≥ 3.95 and above) versus bottom quartile (≤ 3.14), and the top 10% (≥ 4.52) and bottom 10% (≤ 2.86).

3.5.2 Workplace Safety Climate and Other Independent Variables

Workplace safety climate was measured using twenty one questions. Each response was scored using a five point scale developed by developed by Dr. Gershon, with the highest scores indicating the highest degree of workplace safety climate. One question was reverse scaled to provide some assurance that the respondents were reading the questions carefully. This question was recoded for analysis. Responses to all 21 questions were averaged for each respondent. Following the analysis methods used by Gershon et al. (2007b), the results were dichotomized with scores of ≤ 2.5 considered weak/poor and > 2.5 considered strong/moderate workplace safety climate. All but one nurse met these criteria for strong/moderate workplace climate and additional analyses were completed comparing within all the respondents at differing values of workplace safety climate.

Independent variables were examined for their association with recorded compliance. The questionnaire was organized into sections to collect data on both the dependent variables and the independent variables. The independent variables are identified as to where they fit within the PRECEDE model. Those which are also the novel variables of interest to the hypothesis are in italics.

The fifth section of the survey was Exposure History. It was limited to those respondents reporting a blood or body fluid exposure in the prior 12 months. It is not shown here due to the limited number of responses.

Table 3.2 Major Variables Considered in Analysis

Section 1: Demographics

Question	Variable Name/Category	How Measured	Factor
Q2	Gender	Female, Male	Predisposing
Q3	Age	Years, Continuous	Predisposing
Q4	Race	White, Black/African American, American Indian or Alaska Native, Asian, Native Hawaiian or other Pacific Islander, None of the Above	Predisposing
Q6	Educational level	Diploma, Associate Degree, Bachelor of Science, Masters or higher	Predisposing
Q8	Years as nurse	Years, Continuous	Predisposing
Q12	Practice setting	Acute care, Home health care/community health, Community, Outpatient clinic, Government institution (e.g. correctional institution, mental health facility), Surgical Center/ambulatory surgery center, other	Predisposing
Q18	Training in UP/SP	None, 15 minutes, 30 minutes, 1 hour, 2 or more hours	Enabling

Section 2: Safety Equipment

Question	Variable Name/Category	How Measured	Factor
	Gloves		
Q21, 23, 25, 27, 29	Availability	Personally available to me, Sometimes available to me, Not available to me, Not applicable to my job.	Enabling
Q22, 24, 26, 28, 30	Use	Always, Often, Sometimes, Rarely, Never	Enabling
Q33	Reasons for low use	I don't have time, My patients are uncomfortable when I wear gloves, I don't like the gloves available to me	Enabling
Q34	Reasons for low use	They don't stretch well enough, The color doesn't allow good visualization between my hands and the patient's skin, My hands get irritated/I develop rashes, They make my hands sweat, I can't feel sensation well enough to do my tasks, Other	Enabling
	Eye Shield		
Q36	Availability	Personally available to me, Sometimes available to me, Not available to me, Not applicable to my job.	Enabling
Q37	Use	Always, Often, Sometimes, Rarely, Never	Enabling
Q39	Reasons for low use	I can't see well enough to do my tasks, They are uncomfortable, They are unnecessary for me because I wear glasses, It makes my patients uncomfortable, I've never been splashed in the eyes, Other	Enabling
	Respiratory shield		
Q40	Availability	Personally available to me, Sometimes available to me, Not available to me, Not applicable to my job.	Enabling
Q41	Use	Always, Often, Sometimes, Rarely, Never	Enabling
Q43	Reasons for low use	They are too difficult/time consuming to tie, It makes communicating with patients too difficult, They are uncomfortable to work in for more than a few minutes, My older patients have difficulty understanding me when I wear one, It isolates my patients, My patients feel I am afraid of them, Other	Enabling

Section 3: Compliance

Question	Variable Name/Category	How Measured	Factor
Q46[1]	Gloves	Never, Rarely, Sometimes, Often, Always, Not applicable	Dependent
Q47[1]	Eye protection	Never, Rarely, Sometimes, Often, Always, Not applicable	Dependent
Q48[1]	Respiratory Protection	Never, Rarely, Sometimes, Often, Always, Not applicable	Dependent
Q58	*Patient Characteristics*		
	Pediatric (under 18)	Much more compliant, More Compliant, Same, Less compliant, Much less compliant	Predisposing
	Older patient (65+)	Much more compliant, More Compliant, Same, Less compliant, Much less compliant	Predisposing
	English as a second language	Much more compliant, More Compliant, Same, Less compliant, Much less compliant	Predisposing
	"Low Risk" for infections	Much more compliant, More Compliant, Same, Less compliant, Much less compliant	Predisposing

[1] Collapsed in analysis to strictly compliant (always) or less than strictly compliant

Section 4: Workplace Safety Climate

Question	Variable Name/Category	How Measured	Factor
Q59, 60, 61, 65, 66, 68, 76	Management Support-Level of management support for UP/SP	Strongly disagree, Disagree, Neither agree nor disagree, Agree, Strongly agree	Reinforcing
Q62, 63,	Job Hindrances-Time available, workload, Job satisfaction	Strongly disagree, Disagree, Neither agree nor disagree, Agree, Strongly agree	Reinforcing
Q72, 77, 78	PPE-Availability, selection	Strongly disagree, Disagree, Neither agree nor disagree, Agree, Strongly agree	Reinforcing
Q64, 74, 75	Conflict/Communication-Co-worker attitudes, support, communication	Strongly disagree, Disagree, Neither agree nor disagree, Agree, Strongly agree	Reinforcing
Q67, 68, 69,	Feedback/Training-Supervisor instruction, training, documentation of practices	Strongly disagree, Disagree, Neither agree nor disagree, Agree, Strongly agree	Reinforcing
Q70, 71, 73, 79	Cleanliness/Orderliness-Staffing, cleanliness of work stations, space	Strongly disagree, Disagree, Neither agree nor disagree, Agree, Strongly agree	Reinforcing

3.5.3 Decision Tree for Inconsistent or Unanticipated Responses

It was expected that there would be instances of inconsistent responses or unanticipated response patterns. The initial plan to create a decision tree was not implemented as the small number of responses allowed for descriptive discussion of each inconsistent or unanticipated response.

3.6 Survey Evaluation Process

Because the final study sample consisted of participants recruited through two different methods (the randomly selection from the MNA mailing list and the convenience sample through the MNA website), the initial analysis step was to compare the demographic characteristics of these two portions of the sample. These analyses were run using either Student's t-test for continuous variables or chi-square for categorical variables. A Fisher's exact test was completed for categorical values with less than 5 responses in an analyzed cell. While no direct comparison can be completed of the responding nurses to non-responding nurses, a comparison was made of the responding nurses to the 2008 HRSA national survey. There is no publically available demographic information regarding the membership of MNA.

Overall answers to *Section 3: Compliance* were compared to prior populations cited in the literature. These analyses help determine if the MNA study population differs from populations studied by DeJoy, Gershon and others. Any substantive differences were noted.

Section 2: Safety Equipment included questions regarding general availability for each of the three PPE of concern; gloves (Questions 21, 23, 25, 27, and 29), eye shields (Question 36), and

respiratory shields (Question 40). Given the requirements of both The Joint Commission and OSHA, the answers to these questions should be that PPE are typically available. If any or all were not typically available, compliance is not possible and those respondents were not included in the compliance analyses. Evaluation of consistency of responses was completed by comparing the responses to the compliance questions to responses to a series of free form questions (Questions 33, 39, and 43) where respondents could provide reasons for not complying. This is fully discussed in Section 4.2.

3.7 Evaluation of Factors Associated with Low Compliance

Analyses compared demographic and workplace safety climate factors by level of compliance for the three types of PPE under study. This included analysis for individual predictive factors of low compliance using t test for continuous variables (e.g. age, years in nursing). The correlation between years of nursing and age was examined using Pearson's correlation coefficient. A chi-square analysis for proportions evaluated the possible associations of education and type of nursing with compliance for the three types of PPE. Planned multivariate analyses were not completed due to the sample size, however, univariate analyses were completed for training time and age.

The patient characteristics that are hypothesized to be potential predictors of compliance – age, English as a second language, and nurses' perception of risk – were evaluated in this stage of the analysis. English as a second language may be an influence on nurse's perception of risk or an

obstacle to good oral communication. These are identified in the survey in *Section 5: Exposure History*, *Section 2: Safety Equipment* and *Section 3: Compliance*.

3.8 Descriptive Analyses of Nurses Reporting History of Exposures

Additional descriptive analyses characterized nurses who reported having had an exposure in the past twelve months compared to those who had not.

CHAPTER 4: RESULTS

As noted in section 3.6, unless otherwise specified, analyses employed either Student's t-test for continuous variables or chi-square for categorical variables. A Fisher's exact test was completed for all categorical values with less than 5 responses in an analyzed cell.

4.1 Descriptive Analysis

4.1.1 Respondents and Final Population

The responses downloaded from Survey Monkey showed that 121 nurses entered the Survey Monkey site. Of those, only two responded no to the consent form and did not continue the survey. An additional thirteen potential responders did not fully complete the survey and no results were captured by the software. One hundred six (106) nurses completed the survey sufficiently for their responses to be recorded by the software.

The survey responses were initially divided into the random survey and convenience sample respondents. The first analysis compared the responses from the random sample and the convenience sample to determine if there was a notable difference in the proportion between those who initiated the survey but did not complete it (Table 4.1).

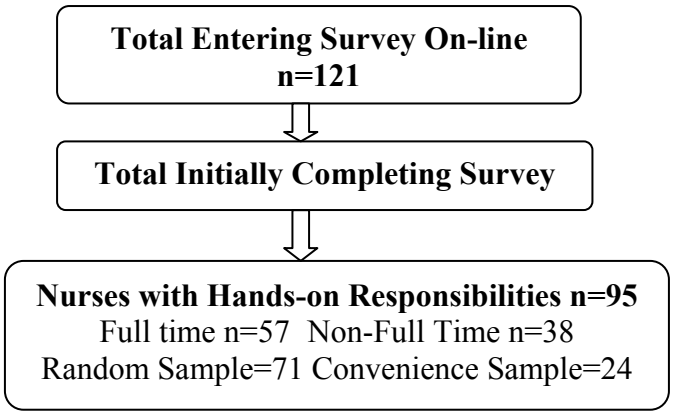
Table 4.1 Comparison of Responses by Survey Type (N=121)

	Random Sample	Convenience Sample
Total Surveys Begun	84	37
Not Completed	5	10
Percent Completion	94%	73%

Completion rates were significantly lower (p=0.0023) in the convenience sample (73%) compared to the random sample (94%). Reasons for this difference in survey completion rate are unknown. The introduction to the survey via post card (Figure 3.3) did not differ from the introduction on the MNA web site. Text for both is found in Appendix III.

The next step was to determine which of the 106 responses could be included in the analysis of hypotheses of concern (Figure 4.1). Five respondents indicated they did not have hands-on patient contact and therefore were ineligible for further analysis. Due to a programming problem on Survey Monkey, six respondents were able to skip all or most of the questions regarding compliance and workplace safety climate. Because the hypotheses of this dissertation requires these factors, analyses were completed with the 95 respondents who indicated their current responsibilities included hands-on patient care and who completed the sections on compliance and workplace safety climate entirely.

Figure 4.1 Flow Chart of Survey Responses



4.1.2 Demographics

Table 4.2 displays the analysis of the demographics of the two populations, random and convenience. The average age differed significantly between the two groups (p=0.04).The average age was 44.0 for random sample respondents and 49.5 for convenience sample respondents. There were also discernable differences in educational level with more diploma and associate degree nurses, fewer patients cared for per day, and more years of nursing in the convenience sample. These were determined to not be substantively different and both sample populations were combined for further analyses. One school nurse indicated the entire school enrollment (400) as number of patients cared for per day. This response was deleted from analysis.

Table 4.2 Demographics of MNA Nurses Responding by Sampling Method

	Random Sample (N=71)		Convenience Sample (N=24)	
	No.	%	No.	%
Gender				
Female	68	96%	23	96%
Male	3	4%	1	4%
Mean Age (SD) Ŧ	44.0 (11.9)		49.5 (11.0)	
Race/Ethnicity				
White	68	96%	23	96%
Black	1	1%	0	0%
Asian	2	2%	1	4%
Hispanic				
Yes	2	2%	0	0%
No	68	96%	24	100%
Unknown	1	1%	0	0%
License				
RN	67	94%	22	92%
NP	4	6%	2	8%
Degree				
Diploma	8	11%	3	12%
Associate	11	12%	5	21%
Bachelor	43	61%	11	46%
Masters or higher	9	13%	5	21%
Years Nursing (SD)	17.9 (13.0)		23.4 (10.2)	
Hours per Week (SD)	33.5 (9.4)		31.8 (12.5)	
Full time	42	60%	15	63%
Non-full Time	29	40%	9	37%
Patients per day*	8.6 (SD 9.9)		5.6 (SD 5.2)	

*Excludes one school nurse response

Ŧ $p < 0.05$

The initial proposal for this research stated that only full time nurses with hands on patient care responsibilities would be included in the final analyses. However, this would have substantially decreased the already small sample; therefore, a second decision was necessary regarding whether or not to include both the full and non-full time nurses. Full time nurses were compared with non-full time nurses to determine whether there were significant demographic differences (Table 4.3). The full time nurses with patient contact had statistically fewer years of nursing

(Pooled p=0.04) with 16.8 years average hands-on care versus 22.4 years for all other nurses. The t-test showed relatively equal variances for both. Full time nurses were statistically more likely (p=0.02) to work a permanent day shift than other nurses. They worked more hours (p<0.0001) but were statistically no more likely than part-time nurses to work overtime (p=0.56). There was a discernable difference in educational degrees with a higher percentage of full time nurses having associate degrees and fewer with Bachelor's degrees (p=0.24) As indicated in Table 4.3, the other major demographic indicators are relatively similar between the two groups.

Table 4.3 Demographics of Nurses: Non-Full Time and Full Time

	Non-Full Time Respondents (N= 38)		Full Time Nurses (N=57)	
	No.	%	No.	%
Gender				
Female	37	98%	54	93%
Male	1	2%	3	7%
Mean Age (SD)	47.1 (11.3)		44.3 (12.3)	
Race/Ethnicity				
White	36	95%	55	96%
Black	1	2%	0	0%
Asian	1	2%	2	4%
Hispanic				
Yes	1	2%	1	2%
No	36	95%	56	98%
Unknown	1	2%	0	0%
License				
RN	38	93%	54	95%
NP	3	7%	3	5%
Degree				
Diploma	4	11%	7	12%
Associate	3	8%	13	23%
Bachelor	24	63%	30	53%
Masters or higher	7	18%	7	12%
Years Nursing (SD) ₸	22.7 (11.3)		17.0 (13.9)	
Hours per Week (SD) ₸	26.9 (8.2)		37.1 (9.4)	
Patients per day (SD)*	7.7 (6.2)		8.0 (10.6)	

*Excludes one school nurse

₸ $p < 0.05$

Due to the lack of statistically significant differences in most demographic characteristics as well as the limited number of respondents, a determination was made to include all respondents with current hands-on patient care responsibilities who had fully completed the survey (n=95). Including both also improves the diversity of the overall sample and provides a broader spectrum of the workforce.

Finally, the MNA population chosen for analysis was compared to a national sample of registered nurses. National data were available from the Health Resources and Services Administration (HRSA) report, *The Registered Nurse Population: Findings from the 2008 National Sample Survey of Registered Nurses* (HRSA, 2008). The 2008 HRSA study sample was determined by randomly selecting individual RNs from each state's listing of licensed RNs, with the sampling rate differing across states. HRSA's report is based on completed surveys (a response rate of 62.4 percent). The information here is extrapolated from those findings. The findings are weighted on a number of factors with age being one. The HRSA report states that it may underrepresent younger nurses. It should be noted that the report gives results as percentages which do not always add up to 100%. However, even with these caveats, the data provide a basis for comparison between the MNA nurses surveyed and the national nursing population. Table 4.4 compares the 95 MNA respondents to the national population of registered nurses.

Table 4.4 Demographics of MNA Nurses and HRSA Survey

	MNA Respondents (N=95)	HRSA 2008 Survey (N=33,549)
Gender		
Female	96%	94%
Male	4%	6%
Median Age	47	46
Race/Ethnicity		
White	96%	83%
Black	1%	5%
Asian	3%	5%
Hispanic	2%	4%
Degree		
Diploma	12%	14%
Associate	17%	36%
Bachelor	57%	37%
Masters or higher	15%	13%

The MNA respondents were similar to the national HRSA sample but there are differences worth noting. Age and gender are close to the HRSA national survey but MNA nurses were more likely to have a Bachelor's degree or higher (72%) versus either the national average (50%) or the HRSA estimate for Massachusetts (57.2%). The MNA nurses were also more likely to be white and non-Hispanic than the HRSA sample. According to the U.S. Census this racial trend is true of Massachusetts in general, as compared to the overall U.S. population (http://quickfacts.census.gov/qfd/states/25000.html).

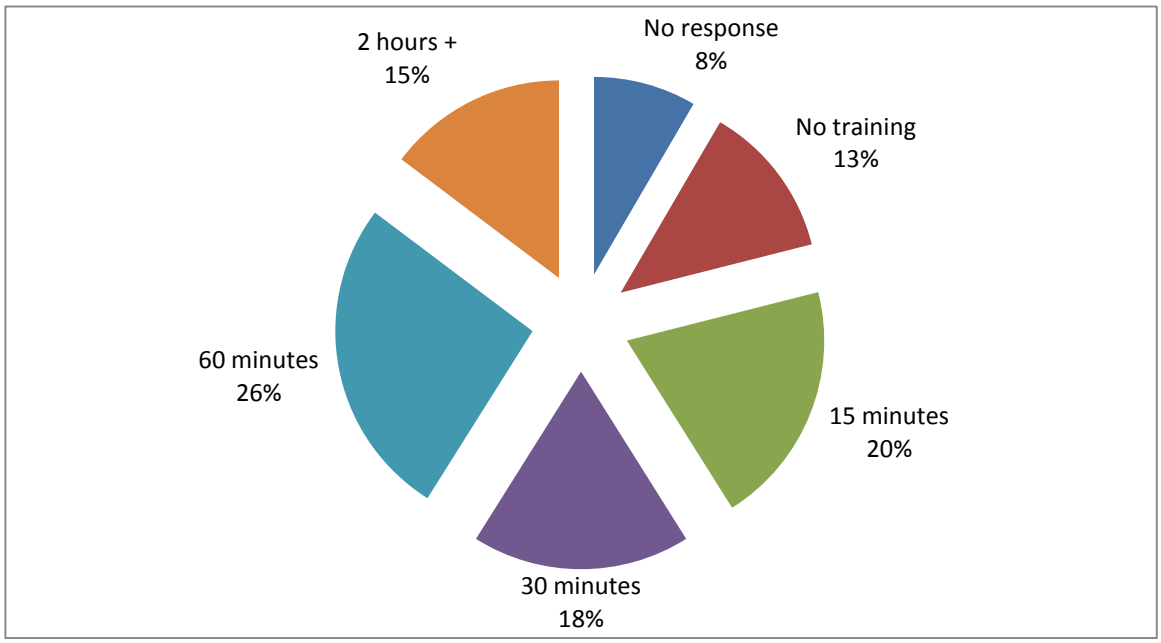
The final population for study (n=95) listed 109 work settings. The question allowed for more than one setting due to the nature of nursing assignments. All 95 nurses responded with at least one work setting, including: 61 who work in acute care, 5 in home health care, 2 in community

care, 10 in out-patient clinics, 4 in governmental facilities, 4 in surgical centers and 23 in other settings. The other settings included: outpatient psychiatric units, schools, nursing homes, radiology/special procedures, an emergency center, nursery and a cardiac step-down unit. While the last four could be in an acute care hospital, they were self identified as other.

4.1.3 Training on UP/SP

Question 18 in the demographics section of the survey asked: *In the past 12 months, how much time would you say you received in training on UP/SP or other infection control?* Among the 87 nurses responding to this question, training on UP/SP was not rigorously reinforced (Figure 4.2). In the previous year, 48 (55%) respondents received 30 minutes or less training in UP/SP or infection control. Twelve respondents (14%) indicated they had received no training in UP/SP or infection control the previous year, while nineteen (21%) received 15 minutes of training and seventeen (20%) received 30 minutes. Of the remaining thirty seven nurses, twenty five received an hour of training and fourteen received two hours or more of training. Eight respondents did not answer the question and may skew these figures. However, even if all eight nurses not responding to this question received an hour or more of training, it would still indicate that just over half (50.5%) of the nurses received less than one hour of training.

Figure 4.2 Training in UP/SP (n=95)



4.2 Availability of PPE and Compliance

Three types of PPE were investigated in this survey: gloves, eye shields and respiratory shields. The availability of and compliance with PPE varied with type; therefore analyses are specific to each type of PPE. One of the points repeatedly made to the author during discussions with various members of MNA was that a nurse couldn't be compliant with UP/SP if the PPE wasn't available. To ensure this was a valid point, a frequency analysis was completed for the five nurses who did not always have access to respiratory shields and the 18 who did not always have access to eye shields. Only one respondent answered *always*; this individual's response was the same for both use of eye shields and respiratory shields. That same respondent did not provide any justifications for Questions 39 or 43. All further compliance analyses were therefore run only for those respondents who indicated that the type of PPE was personally available.

Questions asked in the availability and use section (Questions 21-43) were unique and developed specifically for this study. Almost all of the questions within the compliance section of the survey (Questions 44-57) were taken from previously validated surveys (Gershon et al., 1995, Gershon et al., 2000, Gershon et al., 2004). These sections of the survey included closed choice questions as well as open ended questions to obtain additional information.

One additional question (Question 58) was added regarding compliance based on patient characteristics. This question was added to address the null hypothesis: $H_0 3$ *Among MNA nurses surveyed there is no association between compliance with UP/SP and patient characteristics of age, nurses' perception of risk and English as a second language*.
While Questions 44-58 were intended to be the primary measure of compliance, responses to Questions 21-43 were also used to explore variability in responses.

4.2.1 Glove Availability

Gloves were reported to be universally available. All respondents (n=95) *always* had access to at least one type of disposable glove. Table 4.5 illustrates the availability of the five types of gloves.

Table 4.5 Glove Availability by Type (n=95)

	Personally Available	Sometimes Available	Not Available	Not Applicable to my job
Q21-Latex	57%	11%	32%	1%
Q23-Latex Free	93%	3%	4%	0%
Q25-Powder Free	85%	9%	5%	0%
Q27-Synthetic	52%	14%	26%	8%
Q29-Latex and Powder Free	86%	9%	4%	0%

Four (4%) respondents indicated that latex free gloves were not available and an additional three (3%) respondents indicated they were not always available. Further analysis showed that there was inconsistency in these replies. Each of those seven respondents indicated that either synthetic gloves or latex and powder free gloves (or both) were always available. Synthetic gloves (most frequently nitrile) were the least available with only 49 (52%) respondents saying they were always available and an additional 13 (14%) saying they were sometimes available. One (1%) said that latex gloves were not applicable to her job. Eight (8%) said synthetic gloves were not applicable to their jobs. However, all of these respondents indicated they used non-latex gloves at least sometimes. The responses therefore pertain to only gloves specified as "synthetic" and not to all non-latex gloves. Nineteen (20%) nurses indicated gloves were not always available in their size including one (1%) who said gloves were rarely available in the correct size. Forty-five (47%) of the nurses indicated that they had double gloved on occasion. Sixty-one (64%) of the nurses preferred gloves that were both latex free and powder free. Of those 61 nurses, 54 (88%) always had them available, another six (10%) had them available sometimes and one (1%) never had them available.

- Question 34: *You stated that you don't like the gloves available to you. Please check all the reasons that apply.*

Question 34 was asked to clarify why nurses did not like the gloves available to them. It was intended only for those nurses who responded that they did not always use gloves when available. Of those, 28 (29%) of the 95 nurses provided reasons why they didn't like the gloves available. Since multiple answers were allowed there were 41 answers provided so the following are listed without percentages. Five nurses felt the available gloves did not stretch well enough, five felt their hands got irritated wearing gloves, seven felt they made their hands sweat and twelve felt they could not feel sensation well enough to do their tasks. None of the nurses indicated the color of the glove was a barrier. An additional twelve free form responses included: the gloves cut off circulation, gloves not needed, size availability, latex gloves adhering stubbornly to tape, fit, latex allergy, and prefer latex.

4.2.2 Glove Compliance

Several questions in the survey addressed compliance with glove use. The first set of questions asked about compliance with five types of gloves if they were personally available to the respondents. Questions related to use of each type of glove were only asked of those who responded that the type of glove was *always* available. While this precluded usage information for those who sometimes had that type of glove available, if gloves are not always available, then the nurse cannot always use them. As previously illustrated in Table 4.5, not all types of gloves are available to all nurses. However, all nurses had one or more types of gloves available and availability of gloves was not a significant factor in compliance.

Table 4.6 illustrates compliance responses only from those nurses who reported each specific type of glove to be available.

Table 4.6 Glove Compliance by Specific Type of Glove

Glove Type	Always	Often	Sometimes	Rarely	Never	Other
Q22-Latex (n=54)	30%	30%	5%	13%	22%	0%
Q24-Latex Free (n=88)	61%	17%	10%	3%	6%	2%
Q26-Powder Free (n=81)	67%	21%	6%	2%	2%	1%
Q28-Synthetic (n=49)	43%	24%	18%	10%	4%	0%
Q30-Latex and Powder Free (n=82)	65%	23%	6%	2%	4%	0%

n=# nurses with specific PPE always available

The next set of compliance questions evaluated overall compliance.

- Question 33: *If gloves that are suitable to you are available and you still don't always use them, why not?*
- Question 46: *When at work I: Wear disposable gloves whenever there is a possibility of exposure to blood or other body fluids.*

Question 46 was a previously validated compliance question. Of the 95 nurses, 78 (82%) responded they *always* used gloves when there was a possibility of exposure, 16 (17%) responded *often* and one (1%) responded *sometimes*. Responses to Question 33 giving reasons for not using gloves indicate that not all the responses to Question 46 may be accurate. Thirty-four (36%) of the 95 nurses responded to Question 33. Twenty-four (25%) nurses replied they did not always have time to wear gloves, six (6%) indicated that wearing gloves made the patients uncomfortable, and four (4%) responded that they didn't like the gloves available to them. Twenty-two (28%) of the nurses who had responded always in Question 46 gave responses

to Question 33. Table 4.7 illustrates the impact of potential misclassification, moving frequency of use for those nurses from always to sometimes.

Table 4.7 Examination of Possible Misclassification in Compliance Responses: Gloves Overall (N=95)

	Always	Often	Sometimes	Rarely	Never	Other
Q46-Overall Compliance	78 (82%)	16 (17%)	1 (1%)	0	0	0
Q46-Adjusted by Q33-Reasons for Not Complying	56 (59%)	38 (40%)	1 (1%)	0	0	0

Q33: If gloves that are suitable to you are available and you still don't always use them, why not?

Q46: When at work I: Wear disposable gloves whenever there is a possibility of exposure to blood or other body fluids.

Table 4.8 shows the one novel predictor that was significantly associated with strict compliance was availability of gloves in the appropriate size (p=0.04). Of the 19 nurses who indicated that gloves were not always available in their size, 12 (63%) were strictly compliant based on their responses to Question 46. When the analysis was run with Question 46 adjusted by Question 33, the percentage strictly compliant was 37% among the 19 who indicated that gloves were not always available in their size. Three of the respondents gave size as the reason they didn't always use the gloves available to them in the free form response to Question 34.

Table 4.8 Compliance Responses Related to Glove Size Availability (N=95)

	Percent Strictly Compliant by Glove Size Availability				
	Glove available in correct size		Glove not available in correct size		p-value
	No.	%	No.	%	
Q46 Glove compliance	76	87%	19	63%	0.04∓
Q46 Glove compliance Adjusted by Q33 Reasons for Not Complying	76	64%	19	37%	0.04∓

∓ Statistically Significant

Q33: If gloves that are suitable to you are available and you still don't always use them, why not?

Q46: When at work I: Wear disposable gloves whenever there is a possibility of exposure to blood or other body fluids.

4.2.3 Eye Shield Availability

Question 36 elicited responses as to whether or not personal splash guards/eye shields (eye shields) were always available. Seventy seven (81%) nurses indicated they were personally available, ten (11%) said they were sometimes personally available and five (5%) said they were not available. Three (3%) said they were not applicable to their job. Of the seventy seven who indicated eye shields were always available, only six (8%) responded to Question 37 "if available then I use" that they used them *always*, nine (12%) used them *often*, twenty four (31%) used them *sometimes*, thirty one (40%) used them *rarely*, and five (6%) indicated they *never* used them. Eight (8%) stated they did not wear eye shields because they normally wore glasses. This question was basically repeated in the Compliance section of the survey by Question 47 that they "Wear protective eye shields whenever there is a possibility of splash or splatter to my eyes."

Sixty eight (72%) responded to Question 38 regarding what type of shield was used when they did use one. Twenty nine (43%) used full face splash guards, fifteen 22%) used half face splash guards, twelve (18%) used an eye shield, and twelve (18%) used safety glasses. Eight nurses (8%) stated they did not wear shields because they normally wore glasses.

4.2.4 Eye Shield Compliance

Question 37: *You stated that Personal Splash Guards/Eye Shields are typically available in your workplace. How often do you use?*

- Question 39: *If you don't use a personal splash shield when there is a potential for splash to your eyes, please indicate why not.*
- Question 47: *When at work I: Wear protective eye shields whenever there is a possibility of splash or splatter to my eyes....*

Differences were also noted in responses to the questions regarding compliance with eye shields, particularly between Question 39 which allowed free form narrative responses and Questions 37 and 47 which limited response. Seventy seven nurses responded to all three questions. In response to Question 47, 40 (52%) nurses responded they *always* wore eye shields when there was a chance of splash to the mouth or eyes, 22 (29%) said they *often* did and five (6%) said they *sometimes* did. However, in response to Question 37 in the *Availability and Use of PPE* section only six (8%) stated that they *always* wore eye shields. Among the 18 (19%) respondents who did not always have eye shields personally available, only one (1%) responded *always* to Question 47. That respondent indicated that eye shields were *sometimes* available. Another three (3%) responded *not applicable to my job*.

While some of this difference can be attributed to the differing questions, when further narrative detail was elicited in Question 39, six (15%) of the nurses who responded *always* to Question 47 gave reasons for not always using eye shields. The responses were mixed and indicate that these nurses may not use eye shields even when there is a chance of splash or splatter. To illustrate the impact of this potential misclassification, any respondent answering always to Question 47 who provided one or more reasons for not wearing a shield was moved from *always* to *often* in the row labeled Q47 Adjusted by Q39 (Table 4.9).

Table 4.9 Examination of Possible Misclassification in Compliance Responses: Eye Shields (n=77)

	Always	Often	Sometimes	Rarely	Never	Other
Q37	6 (8%)	9 (12%)	24 (31%)	31 (40%)	3 (4%)	4 (5%)
Q47	40 (52%)	22 (29%)	5 (6%)	7 (9%)	2 (3%)	1 (1%)
Q47 Adjusted by Q39	34 (44%)	28 (36%)	5 (6%)	7 (9%)	2 (3%)	1 (1%)

n=# nurses with specific PPE always available

Q37: You stated that Personal Splash Guards/Eye Shields are typically available in your workplace. How often do you use?

Q39: If you don't use a personal splash shield when there is a potential for splash to your eyes, please indicate why not.

Q47: When at work I: Wear protective eye shields whenever there is a possibility of splash or splatter to my eyes....

Forty five (47%) respondents gave reasons why they did not use eye shields even when there was a potential for splash to their eyes. Twelve (27%) of the 45 responding gave two or more reasons. Nine (20%) felt they could not see well enough to do their tasks, six (13%) felt shields were uncomfortable, eight (18%) felt they were unnecessary because they wore glasses, two (4%) did not wear shields because they made patients uncomfortable, four (9%) because they had never been splashed and 21 (27%) said *other*. Those responding *other* provided a narrative explanation for Question 39: *If you don't use a personal splash shield when there is a potential*

for splash to your eyes, please indicate why not. Four (5%) nurses contradicted the response to Question 36 by stating that shields weren't always available. Two (3%) stated shields were not always easy to find and three (4%) stated they would have to leave the room to get them. Three (4%) nurses specifically mentioned time. The lack of availability within patient rooms was addressed succinctly by one nurse's comment, "No time and it is a pain to carry stethoscope and eye glasses and everything else on me at all times."

The narrative responses in Question 39 further indicate that the responses to Question 47 may not reflect the actual practice of nurses. In addition to those noted above, reasons for not always using shields even when there was the possibility of splash included that "they fogged up", "not in the habit", "I always cover my eyes", "cumbersome", "don't work well with glasses", and "not usually in splash situations."

4.2.5 Respiratory Shield Availability

Respiratory shield availability was second only to gloves. Ninety (95%) of the respondents said respiratory shields were personally available, three nurses (3%) stated they were *sometimes* available and two nurses (2%) responded with *other*. Of the ninety who said they were personally available 14 (24%) used them *always*, 23 (39%) *often*, 31 (53%) *sometimes*, 17 (29%) *rarely* and 5 (8%) *never* in response to Question 41. When asked what kind of respiratory shield was most often used, twenty five (28%) used flat double tie, twenty two (24%) used flat elastic, nineteen (21%) used cone with elastic, twenty (22%) used N95 and one (1%) used a powered air purifying respirator (PAPR).

4.2.6 Respiratory Shield Compliance

- Question 41: *You stated that respiratory protection/oral protection are typically available in your workspace. How often do you use them?* Question 43: *If you don't use respiratory masks/shields when there is a potential for infection please indicate why not:*
- *Question 48: When at work I: Wear a face mask whenever there is a possibility of splash or splatter to my mouth.*

There were differences noted in responses to questions regarding compliance with respiratory shields between the availability and use section and the compliance section of the survey. For Question 48 responses, forty one respondents indicated they used respiratory shields *always*, twenty seven *often*, six *sometimes*, nine *rarely* and two *never*. Among the five (5%) who responded that respiratory shields were not *always personally available*, only one (1%) responded *always* to Question 48. This was the same respondent who responded *always* to Question 47 regarding eye shield use in spite of not always having eye shields available.

When further detail was elicited in Question 43, twelve respondents gave reasons for not always using respiratory shields. While some of this difference can be attributed to the differing questions, these responses, as with those for gloves and eye shields, indicate that actual practice may vary depending on circumstances. To illustrate this difference, any respondent answering always to Question 48 who provided one or more reasons for not wearing a respiratory shield was moved from *always* in Table 4.10 to *often* as shown in the row labeled Q48 Adjusted by Q43.

Table 4.10 Examination of Possible Misclassification in Compliance Responses: Respiratory Shields (n=90)

	Always	Often	Sometimes	Rarely	Never	Other
Q41	14 (16%)	23 (26%)	31 (34%)	17 (19%)	5 (6%)	0
Q48	41 (46%)	27 (30%)	6 (7%)	9 (10%)	2 (2%)	5 (6%)
Q48 Adjusted by Q43	33 (37%)	35 (39%)	6 (7%)	9 (10%)	2 (2%)	5 (6%)

n=# nurses with specific PPE always available

Q41: You stated that respiratory protection/oral protection are typically available in your workspace. How often do you use them?

Q43: If you don't use respiratory masks/shields when there is a potential for infection please indicate why not:

Q48: When at work I: Wear a face mask whenever there is a possibility of splash or splatter to my mouth.

Twenty one (23%) respondents gave reasons why they did not always use masks. Of those eight (10%) had responded to Question 48 that they *always* used respiratory shields and two (2%) of those had responded *always* to both Questions 41and 48. Eight (38%) of the twenty-one respondents to Question 43 gave two or more reasons. The most common reason for not using respiratory shields was that it made communicating with the patient more difficult. Ten nurses (11%) indicated this as a reason for not using respiratory shields including two (2%) who also said their elderly patients had difficulty understanding them when they wore masks. Six (7%) nurses indicated they found respiratory shields too uncomfortable to wear for more than a few minutes and five (6%) found them too difficult or time consuming to tie on. Although the question used the term “tie” only one of the five respondents had indicated in Question 42 using a flat double tie mask.

Three of the five who responded in Question 37 that they never used respiratory shields explained why in Question 43. Two stated they were not needed in their tasks although they had previously responded that they had hands-on patient contact and did not check that response for

other PPE. One respondent did not use a mask due to "budget constraints." This response was echoed by another nurse who used respiratory shields often but "our unit ran out." One response was "not allowed in policy and procedures." Other reasons given for not using shields included that they are claustrophobic and itchy. Two responses indicate that respiratory shields are not readily available in rooms. The first was "do not have time to find them" and the second was that in an emergency a nurse did not "stop to get one first."

4.3 Analysis of Associations of Various Factors with Compliance

4.3.1 Compliance and Nurse Demographic Factors

As indicated in Table 3.2, gender, age, race, educational level, years as nurse, and practice setting are considered predisposing factors for compliance. Strict compliance is defined as always compliant with specific PPE as self reported. Associations with compliance were examined for all predisposing factors except race and gender. Race and gender were excluded because the population was 96% white females. There were no notable differences in strict compliance based on practice setting.

While the analysis by educational degree showed no statistically significant differences, it is interesting to review. Those nurses with a diploma degree appear to be far less compliant with glove use than others but even when analyzed against the other three levels of degree combined, this difference was not statistically significant. The small numbers of nurses in each category makes any comparative analysis unsatisfactory. As Table 4.11 illustrates, there are no consistent associations between degree and compliance across the three types of PPE. One interesting

finding is that nurses with Master's degrees or higher are more consistent in their responses as to whether or not they use PPE, with only two responses under glove compliance being adjusted for reasons for not complying and no adjustments for either eye shield or respiratory shield compliance.

Table 4.11 Compliance by Educational Degree

	Percent Strictly Compliant by Degree				
	Diploma	Associate Degree	Bachelors Degree	Master's or Higher	p-value
Q46 Glove compliance	64% (n=11)	94% (n=16)	81% (n=54)	86% (n=14)	0.27
Q46 Glove compliance Adjusted by Q33 Reasons for Not Complying	36% (n=11)	69% (n=16)	57% (n=54)	71% (n=14)	0.30
Q47 Eye Shield Compliance	56% (n=9)	56% (n=16)	48% (n=42)	60% (n=10)	0.88
Q47 Eye shield compliance adjusted by Q39 Reasons for Not Complying	44% (n=9)	44% (n=16)	40% (n=42)	60% (n=10)	0.76
Q48 Respiratory Shield Compliance	60% (n=10)	57% (n=14)	38% (n=52)	50% (n=14)	0.50
Q48 Respiratory shield compliance adjusted by Q43 Reasons for Not Complying	50% (n=10)	50% (n=14)	27% (n=52)	50% (n=14)	0.15

Ŧ Statistically significant

n=# nurses in educational category with specific PPE always available

Compliance differed markedly by age, as shown in Table 4.12. For gloves, eye shields, and respiratory shields, strictly compliant nurses were, on average, four to eight years older than the less than strictly compliant nurses. These associations held for both adjusted and non-adjusted measures of compliance. Differences in mean age were statistically significant for eye and respiratory protection, and marginally statistically significant ($p = 0.07$) for glove use.

Table 4.12 Nurses' Age by Compliance Response

	Strictly Compliant- Mean age (SD)	Less than Strictly Compliant- Mean Age (SD)	p-value
Q46 Glove compliance x Q3 (n=95)	46.4 (11.3)	41.0 (10.1)	0.07
Q46 Glove compliance x Q33 Adjusted by Q33 Reasons for Not Complying (n= 95)	47.2 (11.0)	42.9 (11.3)	0.07
Q47 Eye Shield Compliance x Q33 (n=77)	49.3 (10.3)	41.1 (11.3)	0.001 Ŧ
Q47 Eye shield compliance x Q3 adjusted by Q39 Reasons for Not Complying (n=77)	50.1 (9.8)	41.7 (11.4)	0.001 Ŧ
Q48 Respiratory Shield Compliance x Q3 (n=90)	49.2 (9.7)	42.1 (11.7)	0.003 Ŧ
Q48 Respiratory shield compliance x Q3 adjusted by Q43 Reasons for Not Complying (n=90)	49.6 (10.3)	42.8 (11.3)	0.006 Ŧ

Ŧ Statistically significant

n=# nurses with specific PPE always available

Like compliance based on age, compliance based on years of nursing did not differ significantly for all categories of PPE. It only differed significantly for adjusted and non-adjusted compliance for eye shields (Table 4.13) and the unadjusted compliance with respiratory shields is close to significance (p=0.06). However, while the statistical significance is minimal, all the associations go in the same direction and are consistent with findings by age. The strictly compliant nurses averaged 3-7 more years of nursing than the less than strictly compliant nurses.

Table 4.13 Years Nursing by Compliance

	Strictly Compliant- Mean years nursing (SD)	Less than Strictly Compliant -Mean years nursing (SD)	p-value
Q46 Glove compliance (n=95)	20.2 (13.1)	14.9 (13.1)	0.13
Q46 Glove compliance Adjusted by Q33 Reasons for Not Complying (n= 95)	20.5 (13.6)	17.5 (12.4)	0.27
Q47 Eye Shield Compliance (n=77)	21.9 (14.5)	14.9 (11.5)	0.02 ₸
Q47 Eye shield compliance adjusted by Q39 Reasons for Not Complying (n=77)	22.1 (14.6)	15.7 (12.0)	0.04 ₸
Q48 Respiratory Shield Compliance (n=90)	21.9 (13.9)	16.6 (12.2)	0.06
Q48 Respiratory shield compliance adjusted by Q43 Reasons for Not Complying (n=90)	21.2 (14.6)	17.7 (12.3)	0.22

₸ Statistically significant

n=# nurses with specific PPE always available

A correlation analysis of age versus years of nursing was completed using a Pearson correlation coefficient. It showed a correlation factor of r = 0.84 with p= <0.0001. Because of the high correlation between these variables, it was not possible to estimate the independent effects of each of these factors.

4.3.2 Compliance and Patient Characteristics

Question 58 in the survey asked the nurses to rate their PPE compliance with four patient groups: pediatric patients defined as “under 18”, older patients defined as “over 65”, patients for whom English is a second language and patients they considered a “low risk” for infectious disease.

Over 20% of the respondents indicated that their compliance differed based on patient characteristics as shown in Table 4.14. These responses most often indicated increased compliance for all four patient categories. However, 13 (14%) of the respondents were less likely to comply with UP/SP with pediatric patients. Ten (11%) respondents also rated themselves as less compliant with patients perceived to be "low risk." Only one respondent reported decreased compliance with both pediatric and low risk populations, indicating that respondents recognized a difference between pediatric patients and low risk patients.

Table 4.14 Compliance Responses by Patient Characteristics (n=95)

	Much More Compliant	More Compliant	Same	Less Compliant	Much Less Compliant
Pediatric Patients (under 18)	12 (13%)	7 (7%)	63 (66%)	12 (12%)	1 (1%)
Older Adult (65+)	11 (12%)	15 (16%)	66 (69%)	3 (3%)	0
English as a Second Language	12 (13%)	9 (9%)	73 (79%)	1 (1%)	0
Perceived Low Risk	8 (8%)	9 (9%)	68 (72%)	10 (11%)	0

4.4 Workplace Safety Climate

Following the analysis methods used by Gershon et al. (2007b), responses to the workplace safety climate section (Questions 59-79) were analyzed to determine which met the criteria for good workplace safety climate in accordance with that protocol. Workplace safety climate results were dichotomized with scores of ≤ 2.5 considered weak/poor and > 2.5 considered strong/moderate workplace safety climate. Only one nurse described an environment that did not meet the criteria for strong/moderate workplace safety climate, with a score of 2.38. Initial analyses of compliance showed no discernable differences between that nurse and the others and

given the small number in the analysis pool; the responses were therefore included with the rest. (The responses from that nurse were *always* for Question 46 on glove use, *often* for Question 47 on eye shield use and *always* for Question 48 on respiratory shield use.)

Because all the respondents met the criteria for a moderate to strong workplace safety climate, the methodology for evaluating its association with compliance needed to be revised. Robyn Gershon, DrPH was consulted (personal communication November 29, 2010). After discussions with Dr. Gershon a decision was made to analyze safety climate score using additional divisions of the workplace safety scores. Dichotomous analyses were completed for workplace safety climate scores using categories based on the following:

- All respondents above and below the mean score (3.62)
- the top quartile (≥ 3.95 and above) versus bottom quartile (≤ 3.14)
- the top 10% (≥ 4.52) and bottom 10% (≤ 2.86)

Associations between compliance and safety climate were conducted based on responses to Questions 46, 47 or 48 among those respondents who had previously indicated that the specific type of PPE (gloves, eye shield, and respiratory shield) was always available. Only in unadjusted respiratory compliance were any significant differences found. The analysis comparing compliance for the top quartile to the bottom quartile of workplace safety climate demonstrates this finding (Table 4.15). The results of the other two analyses may be found in Appendix IV.

Table 4.15 Proportion of Nurses Strictly Complying in Highest and Lowest Quartiles of Workplace Safety Climate

	Lowest Quartile		Highest Quartile		
	No.	%	No.	%	p-value
Q46-Glove Compliance	20	80%	25	92%	0.24
Q46-Adjusted by Q33-Reasons for Not Complying	20	55%	25	80%	0.07
Q47 Eye Shield Compliance	19	42%	20	70%	0.08
Q47 Adjusted by Q39 Reasons for Not Complying	19	42%	20	55%	0.42
Q48 Respiratory Shield Compliance	19	37%	24	71%	0.03Ŧ
Q48 Adjusted by Q43 Reasons for Not Complying	19	26%	24	54%	0.07

Ŧ Statistically significant

n=# in highest and lowest 25% of workplace safety climate with specific PPE always available

As shown in Table 4.15, a consistent pattern of higher prevalence of compliance among nurses with higher workplace safety climate scores was seen when comparing the highest to the lowest quartiles of climate scores. The unadjusted respiratory shield compliance outcome differed significantly by workplace safety climate (p=0.03). Both the adjusted respiratory shield compliance and the adjusted glove compliance outcomes had p values close to significance (p=0.07).

The association between PPE compliance and UP/SP training (Question 18) was also evaluated. The responses to Question 18 were dichotomized: 30 minutes or less training versus one hour or more. These two training time categories were compared to both adjusted and unadjusted compliance with the three types of PPE. While the only statistically significant result was for the unadjusted respiratory shield compliance (Table 4.16) there is some evidence of an association between longer training time and compliance with both eye shields and respiratory shields.

Glove compliance appears almost totally unrelated to training time. Unadjusted glove use compliance is high for either level of training time. The adjusted percentages of glove use compliance are notably lower for both levels of training time.

Table 4.16 Proportion of Nurses Strictly Compliant by Training Time

	Training 0-30 minutes	Training 1 Hour plus	p-value*
Q46 Glove compliance (n=87)	83%	82%	0.87
Q46 Glove compliance adjusted by Q33 Reasons for Not Complying (n=87)	60%	54%	0.54
Q47 Eye shield compliance (n=71)	47%	61%	0.26
Q47 Eye shield compliance adjusted by Q39 Reasons for Not Complying (n=71)	39%	52%	0.31
Q48 Respiratory shield compliance (n=80)	36%	63%	0.02 ₸
Q48 Respiratory shield compliance adjusted by Q43 Reasons for Not Complying (n=80)	34%	43%	0.42

₸ Statistically significant

n=# nurses with specific PPE always available and who indicated training time

Another analysis compared mean responses to each of the twenty-one questions in the workplace safety climate portion of the survey by the two levels of training time: 30 minutes or less versus one hour or more. The twenty one were divided into six subgroups as presented in Table 3.2:

- Management support - level of management support for UP/SP (Q59, 60, 61, 65, 66, 68, 76);
- Job hindrances - time available, workload, job satisfaction (Q62, 63);
- PPE - availability, selection (Q72, 77, 78);
- Conflict/communication - co-worker attitudes, support, communication (Q64, 74, 75);

- Feedback/Training - supervisor instruction, training, documentation of practices (Q67, 68, 69); and
- Cleanliness/Orderliness - staffing, cleanliness of work stations, space (Q70, 71, 73, 79).

While not all the comparisons showed statistically significant differences, only one question did not provide a positive association between longer training time and a higher workplace safety climate score; Question 75: *The members of my unit support one another*. The results for all three questions in this section (Conflict/communication) are shown in Table 4.17.

Table 4.17 Mean Scores for Conflict/Communication Workplace Climate Questions Dichotomized by UP/SP Training Time (n=87)

Question	30 Minutes or Less UP/SP Training (n=48)	One hour or more UP/SP Training (n=39)	p-value
64. I usually follow Standard Precautions	4.24	4.33	0.32
74. There is minimal conflict within my department	2.7	3.05	0.09
75. The members of my unit support one another	3.41	3.38	0.81

Table 4.18 illustrates the results for the specific management support questions from the workplace safety climate portion of the survey, by training time. The mean values of the workplace safety climate management support responses for those nurses reporting 30 minutes or less of UP/SP training are consistently and significantly lower for each question.

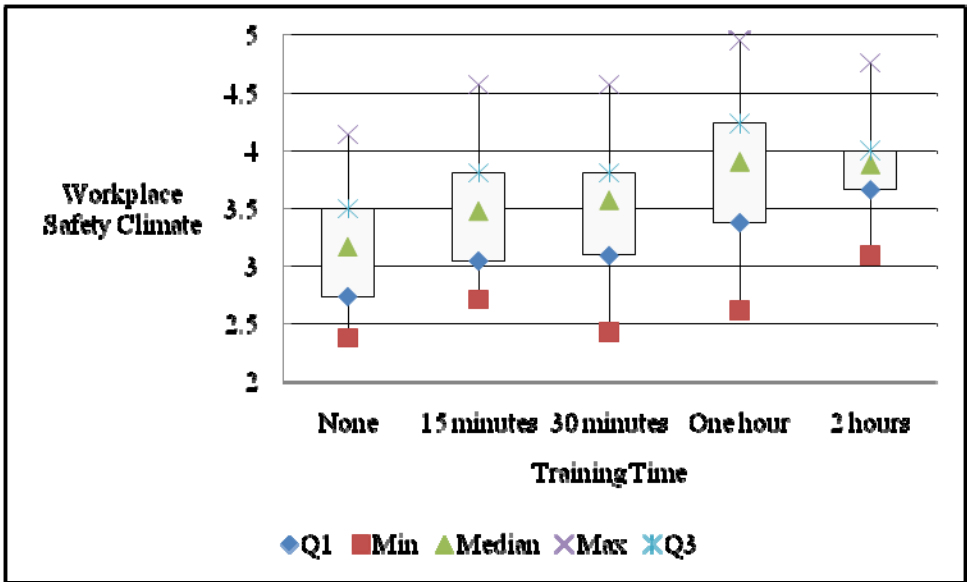
Table 4.18 Mean Scores for Management Support Workplace Climate Questions by UP/SP Training Time (n=87)

Question	30 Minutes or Less UP/SP Training (n=48)	One hour or more UP/SP Training (n=39)	Pooled p-value
59. The protection of workers from occupational exposures to HIV/HBV/HCV is a high priority with management where I work	4.00	4.33	0.045 Ŧ
60. On my unit, all reasonable steps are taken to minimize hazardous job tasks and procedures	3.75	4.13	0.03 Ŧ
61. On my unit, employees are encouraged to become involved in safety and health matters	3.71	4.05	0.049 Ŧ
65. On my unit, unsafe work practices are corrected by supervisors	2.94	3.69	0.001 Ŧ
66. My nurse manager often discusses safe work practices	2.81	3.67	0.001 Ŧ
68. Employees are taught to recognize potential health hazards at work	3.65	4.31	0.001 Ŧ
76. On my unit, there is open communication between nurse management and staff	2.94	3.49	0.02 Ŧ

Ŧ Statistically significant

Because many of the individual workplace safety climate variable responses showed significant differences by training time, an additional analysis was conducted to see if there was a correlation between overall workplace climate score and training provided in UP/SP. Training time was converted from ordinal to numeric data points with no training converted to 0, fifteen minutes to 1, thirty minutes to 2, one hour to 4 and two hours or more to 8. A box-plot depicting the distribution of workplace climate scores by training time is shown in Figure 4-3. The median workplace safety climate scores increase with increasing training time and the Pearson correlation coefficient is correlated $r=0.42$ and $p<0.0005$

Figure 4.3 Box Plot of Overall Workplace Safety Climate Score by UP/SP Training Time



4.5 Exposure History

The final section of the survey asked about exposures to body fluids within the past twelve months (Questions 80-98). Most of the questions were previously validated (Gershon et al., 1995, Gershon et al., 2000, Gershon et al., 2004) with additional questions about patient characteristics added for each possible exposure.

Seven nurses had experienced percutaneous sharps injuries. Of the seven, only four were wearing gloves. Four were also using a safety device and all stated they had been trained on its use. None were double gloved at the time of injury. Four of the injuries occurred while the nurse was providing routine care.

Ten nurses experienced splashes to the eyes or mouth. An additional four indicated they couldn't remember if they had experienced such an exposure. Nine of those exposed were not wearing

respiratory shields and eight of those were also not wearing an eye shield. The remaining exposed nurse skipped the question regarding eye shields. Eight of the exposures occurred while providing routine care as opposed to an emergency situation where time may be a factor. One nurse, having been spit in the eyes, admitted to not anticipating it could happen.

Five nurses had experienced blood or body fluid contacts with open wounds on their skin. One additional nurse couldn't remember whether there had been such an exposure. Of the five known to have been exposed, three were wearing gloves, one was wearing a respiratory shield and one was wearing an eye shield. Three of the exposures occurred while providing routine care.

No correlation is apparent between exposures and patient characteristics. The near 100% recall of patient age for nurses who had an exposure to body fluids or percutaneous sharps injury may reflect usual patient responsibilities. The survey also asked the nurses to indicate the perceived causes of their exposures. The choices provided included; Caused through actions of a co-worker, Device not being used for intended purpose, Equipment design flaw, Equipment failure, Patient caused, Other and Don't remember. Patients were perceived by the respondents as a major contributing factor to percutaneous injuries and splash exposures. No further detail was requested so it is unknown if patients were combative, simply uncooperative or possibly just moved the wrong way.

CHAPTER 5: DISCUSSION

5.1 Introduction

The focus of this dissertation was barriers to strict compliance with UP/SP. This research proposed novel factors that were hypothesized to be potentially important, specifically: availability of various types of PPE including size, material, style; and certain patient characteristics including pediatric patients, older patients, patients who spoke English as a second language, and patients whom nurses perceived to be low risk. Other factors, including demographic and work characteristics, workplace safety climate and prior exposures, were investigated as enabling, reinforcing or predisposing in accordance with prior studies.

The factors affecting compliance with UP/SP that were either statistically significant or indicative of effects warranting further investigation were: patient characteristics, availability of gloves in the appropriate size, age of nurses, years nursing, workplace safety climate, and time in annual UP/SP training. Of these, only patient characteristics and availability of gloves in the appropriate sizes were proposed novel predictors. That compliance varied based on patient characteristics is of particular interest. As noted in Table 4.14, over 20% of the respondents responded that their compliance differed based on patient characteristics. Availability of specific types and styles of PPE were the predictors of initial interest. Of the three types of PPE investigated for usage, only gloves were reported to be 100% available by the study participants and that availability came with caveats relating to size and type of glove. Eye shields were only

81% available and respiratory shields were 95% available. Based on descriptive results, overall availability also appears to be an important issue to be addressed.

The other findings of this research, although studied previously, are still important to consider with respect to implications for public health policy. The limited amount of training time for UP/SP for many of the MNA nurses was an unanticipated finding with 55% of the MNA respondents indicating they received 30 minutes or less in UP/SP training in the previous 12 months. The other findings are consistent with prior studies cited in Chapter 2. An important, but not surprising finding, was that strict compliance with UP/SP for any PPE studied was considerably less than 100% among the MNA respondents even when PPE was available. There was a strong association for older nurses and those with more years of nursing experience to be significantly more compliant with SP/UP for all three types of PPE (Tables 4.11 and 4.12). A correlation analysis indicated that age and years of nursing experience were closely correlated ($r=0.84$) and so should be considered together. Higher workplace safety climate scores were associated not only with an increase in strict compliance with PPE but also with an increase in annual training time in UP/SP.

There are some strong and consistent associations but due to the small sample size, it is not advisable to place too much weight on the statistically significance of the findings. The following sections discuss these findings within the context of the proposed models as well as within a policy context. This chapter also includes a discussion of the strengths and limitations of this research.

5. 2 Models

The conceptual framework for this research was based on the summary components, Predisposing, Enabling, and Reinforcing used in the PRECEDE model (Kreuter and Green 2005) as adapted by DeJoy (DeJoy et al., 2000, DeJoy et al., 2005). These incorporated Zohar's eight components of 1) importance of training 2) management attitudes, 3) effects of safety performance on promotion, 4) level of environmental risk, 5) effects of required work pace on safety, 6) status of safety officers in the organization, 7) effects of safe conduct on social status e.g. do co-workers respect someone who insists on a safe environment, and 8) status of safety committee (Zohar, 1980).

5.2.1 Predisposing factors: Individual and patient characteristics

The initial model included age, years nursing, educational level and practice setting as previously studied predisposing components, and patient characteristics as the novel predictors considered as predisposing components. The levels of strict compliance among MNA respondents are supported by other studies. This study found that only about 60% of nurses strictly complied with glove precautions (when adjusted for reasons for not wearing gloves). Other studies have found strict compliance to range from 44% to 82% (Doebbeling et al., 2003, Fergusen et al., 2004, Gershon et al., 2000). Adjusted compliance with eye shields and respiratory shields in this study were low at 44% and 37% respectively; this compares with at least one other study showing eye shield compliance at 41% and respiratory shields at 36% (Gershon et al., 2000).

One of the more interesting findings of this research and the research in the literature review is the variability in compliance by age and years of nursing experience. The findings in this research that older nurses with more years nursing were consistently more likely to be strictly compliant are supported by prior studies (Gershon et al., 1995, Gershon et al., 2007b, Dement et al., 2004). However, another study showed less compliance with increased age and experience (Gershon et al., 1999) and yet others showed no significant difference (Stone and Gershon, 2006, Stone et al., 2007, Anderson et al., 2000).

The associations between nurse's education and compliance were variable. As seen in Table 4.11, diploma nurses were substantially but non-significantly less likely to be strictly compliant with gloves. However, education was not consistently associated with eye shield and respiratory shield compliance. Those nurses with a Master's degree or higher were not appreciably more or less strictly compliant than other nurses but they were noticeably less likely to provide a justification for not strictly complying. None of the nurses with Master's degree or higher gave any justification for not strictly complying with either eye shields or respiratory shields and the difference between adjusted and unadjusted glove usage is only two responses. This may just be an anomaly due to the small sample size but one that is worth further research

To investigate one aspect of compliance that had not been previously studied this research added an additional factor to the predisposing component of the model: whether patient characteristics influenced compliance. Question 58 asked "How would you rate your universal/standard precaution compliance for each of the following groups: Pediatric patients (under 18), Older adults (over age 65), Patients for whom English is a second language, and Patients you consider

a *low risk* for infectious disease." If UP/SP were being strictly followed, the results should show each patient population to be treated the same. Instead, the respondents differed in their compliance. This difference was bi-directional; with some respondents indicating they were *more* compliant and some that they were *less* compliant with UP/SP for specific patient subgroups. This would suggest that nurses are making personal and clinical risk assessments based on patient characteristics. Table 4.14 illustrates this difference with 20% of the respondents being *much more* or *more* compliant with pediatric patients and 14% being *less* or *much less* compliant. Similar results are seen for low risk patients with 18% of nurses being *much more* or *more* compliant and 11% being *less* compliant. However, for the remaining two populations of interest – older patients (age 65+) and those for whom English is a second language – when the compliance varied it was predominantly in the direction of greater compliance. Since there was no previously validated survey to use for these variables, the question to be addressed is whether these results are real or are they the result of the respondents giving the researcher what they think is the right answer? Another possible question would be whether additional education increases confidence that the HCW can ascertain whether their patient is low risk.

The original DeJoy model also included knowledge, beliefs, attitudes, values. While these were not specifically addressed in the survey, they may be influences. Adherence to UP/SP is not supposed to be open to individual assessment but it would appear that many nurses do it. The very nature of hands-on nursing in all health care settings demands a certain amount of instant risk assessment. A logical series of data inputs would be: what PPE is needed, what is available

and how can it be accessed? A risk assessment includes "a series of data gathering, evaluation and synthesis steps that produce new information to support risk management decision making" (Embrey et al., 2002). Another component of risk assessment is the human factor: the emotional component of risk assessment or "risk as feelings" with the emotional aspect involved (Slovic et al., 2004). Risk assessment in the health care setting includes not only the rationally-based decision processes but also the emotionally-based decision processes. This latter is traditionally considered a major part of nursing.

The survey did not define what aspects of a patient constitute low risk but discussions with key nursing experts and the MNA focus group included the following: known HIV/hepatitis status, willingness and ability of the patient to comply with medical instructions, lack of obvious signs of infection or visible blood, and overall demeanor. The older patients may meet the low risk criteria, but nurses may also perceive a greater need to protect them from hospital-acquired infections because they are sicker than average. This could explain the higher percentage of increased compliance for this subgroup; however, the explanation may just as easily be that older patients are a more highly educated patient population who are more demanding. Since pediatric patients were defined as under age 18, they may or may not be able to meet the low risk criteria of understanding and complying with medical direction depending upon where they fall in the age spectrum from 0-18 years. Also dependent on where they fall in that age spectrum is the likelihood they have had the HBV vaccine (Mast et al, 2005). Patients for whom English is a second language may not be able or willing to share their HIV/Hepatitis status and language barriers would impair the ability to understand and comply with medical directions.

These results suggest the following directions for future research on predisposing factors:

- What are the reasons nurses would respond that they would be more compliant with these patient populations?
- Why were they both more and less compliant with pediatric patients?
- What factors are considered in determining whether a patient is "low risk"?

5.2.2 Enabling factors: Aspects of the system that promote self protective actions

The initial model included training in UP/SP and availability of PPE as enabling components. Skill and knowledge of UP/SP should be good among the participating MNA nurses. They are members of a union with a strong health and safety department. The MNA nurses responding to the survey had a higher percentage of Bachelor's or above than nurses in the 2008 HRSA national survey (72% versus 50%). Moreover all MNA respondents, with one exception, work in settings that meet the criteria set forth by earlier research for a moderate/strong workplace safety climate. It was therefore an unexpected finding that 51% of the respondents received 30 minutes or less training in UP/SP or infection control the previous year.

The need for reinforcement of training is emphasized by the work of DeJoy, Zohar and others (Siegel et al., 2007, McCoy et al., 2001). Based on their findings, the lack of UP/SP training for MNA nurses was hypothesized to be a factor in less than strict compliance rates, but the results were inconclusive regarding such a role. Table 4.16 illustrates the associations found between training time and compliance. Strict compliance with eye shields and respiratory shields showed

a positive association with longer training but strict compliance with glove usage did not. Regardless of the amount of training time, the unadjusted proportion of strictly compliant respondents for gloves was above 80%. One possible reason for this difference may be that hand sanitation messages are reinforced in most health care facilities. While these messages may focus on handwashing rather than glove usage, they are constantly encountered not only in health care facilities but also in restaurants, grocery stores and other commercial establishments. While not formal training, the public health message is being reinforced. Strict compliance with eye shield and respiratory shield usage are both lower than strict compliance with glove usage but strict compliance with both these types of PPE demonstrates a positive association with longer training. Compliance drops dramatically when the adjusted measure is examined, but does not differ substantially by training time. The question to be answered is whether these results are due to training time, training content or some other factor.

An analysis of work settings among those with training for 30 minutes or less showed that 69% of the nurses with limited training identified at least one of their work settings as an acute care facility. Among the 48 nurses with limited training time, 77% reported working in settings with greater than 50 employees. The lack of UP/SP training was not expected. One comparison is with the studies conducted in 1996 and 1997 of health care facilities in Iowa and Virginia (Beekman et al., McCoy et al., 2001). All 149 of the facilities surveyed indicated they provided annual UP/SP training. Key informant interviews conducted in 2005 (Kirkland and Levinson) indicated this was also the norm for the INOVA hospital system in Virginia. This raises the question of whether Massachusetts health care facilities are markedly different from those in

earlier studies or whether other issues have overshadowed training. One possible explanation is that financial constraints in the current economic climate have reduced training budgets.

While the current CDC guidelines do not specify the amount of training time, the training requirements would seem to indicate more than 30 minutes would be required to meet the guidelines: *II.A. Provide job- or task-specific education and training on preventing transmission of infectious agents associated with healthcare during orientation to the healthcare facility; update information periodically during ongoing education programs. Target all healthcare personnel for education and training, including but not limited to medical, nursing, clinical technicians, laboratory staff; property service (housekeeping), laundry, maintenance and dietary workers; students, contract staff and volunteers. Document competency initially and repeatedly, as appropriate, for the specific staff positions* (Siegel et al., 2007).

As shown in sections 4.2.1, 4.2.3 and 4.2.5 the availability of all types of PPE was high but only for gloves was it 100%. Although technically available, the reality is that even for gloves, there were other barriers to strict compliance for many of the nurses surveyed. The primary barrier was that 25% of the nurses felt they didn't always have time to use gloves. This explanation for less than strict compliance has been mentioned in previous studies (Fergusen et al., 2004, Gammon et al. 2008).

Of primary importance to this research was the finding that although gloves were 100% available, for 20% of the respondents gloves were not always available in an appropriate size. As noted in Table 4.8, this novel predictor was significantly associated with strict compliance

(p=0.04). While only 20% of the already small sample indicated this was a concern, it supports the opinions expressed in the 2005 focus group (Kirkland and Levenson, 2005) and by discussions held with experts in the field while developing the survey questions for this research.

Several respondents felt that wearing gloves made patients feel uncomfortable. While this was proposed as a novel predictor, the small response precludes a precise estimation of the association with less than strict compliance. Seven of the 95 nurses indicated latex free gloves were either not available or only sometimes available. Further analysis showed these may have been response errors, as all but one of the seven indicated in other questions that they *always* had access to either synthetic gloves or powder free/latex free gloves. Regardless, given the prevalence of latex allergies and the potentially serious effects on both HCW and patients, it is worth following up in subsequent surveys to ensure that all HCW have ready access to latex free gloves.

The major barrier to using eye shields was lack of availability. Only 81% of the respondents indicated that they were always available. The second most common barrier was not seeing well enough to complete tasks, mentioned by 14% of the nurses who always had them personally available. Many of the other comments reflect the same concerns as with glove usage. Several respondents indicated eye shields were personally uncomfortable.

The primary reason for not using respiratory shields, cited by 11% of respondents, was that they interfere with communication. The other reasons cited were similar to gloves and eye shields including discomfort when wearing and working in them.

As previously noted for several factors, the low response rate precluded finding statistically significant associations between availability of PPE as described in the hypothesis (preferred materials, colors or other physical factors) and strict compliance except for availability in appropriate size. While the associations did not reach statistical significance, the anecdotal comments indicate that these factors may influence compliance.

5.2.3 Reinforcing factors: Rewards and/or punishments and workplace safety climate

The 21 workplace safety climate questions were modeled as the primary reinforcing factors. As previously reported, responses from all but one of the 95 nurses were consistent with a strong/moderate workplace safety climate. As seen in Table 4.15, there were consistent associations between workplace safety climate scores and strict compliance. There were also consistent positive associations between management support workplace safety climate scores and longer training time in UP/SP as seen in Table 4.18. Only Question 75 regarding co-worker support did not show a positive association between these two factors. Coupled with the consistent associations between higher workplace safety climate scores and strict compliance with UP/SP this study supports prior work indicating workplace safety climate is an important factor in occupational health and safety (Anderson et al., 2000, DeJoy et al., 2000, Gershon et al., 1994, Gershon et al., 1995, Gershon, 1996, Gershon et al., 1999, Gershon et al., 2000, Gershon et al., 2004, Mitchell et al., 2005, Zohar, 1980, Zohar, 2002).

5.3 Strengths and Limitations

The primary limitations to this study are due to the low response rate and subsequent small sample size and possible selection bias. Other limitations include generalizability of the study sample to other populations, and limitations of the study instrument.

There were 2,286 postcards sent directly to MNA members as part of the random sample process with each addressee receiving an additional two postcards as reminders over a period of five weeks. While there was an assumption that most of the addresses were valid, use of postcards rather than letters prevented any count of returned mail. The survey was also advertised on the MNA web site for over two months with an announcement in the MNA News. Despite these efforts, only 95 usable surveys were available for analysis. This small sample size meant the analysis could not include secondary or sub-group analyses such as by type of nursing assignment or by whether nurses had had exposures to blood or body fluids in the past 12 months.

The small response to the survey also prevented definitive analyses of the null hypotheses of this proposal. Although numerous analyses produced consistent results showing associations, these were bivariate rather than multivariate analyses, and the results cannot be definitively interpreted. However, results do suggest that further research based on these hypotheses is warranted. These null hypotheses were:

$H_0 1$ *Among MNA nurses surveyed there is no association between compliance with UP/SP and workplace safety climate.*

$H_0$2 *Among MNA nurses surveyed there is no association between compliance with UP/SP and availability of PPE in preferred materials, sizes, colors or other physical factors.*

$H_0$3 *Among MNA nurses surveyed there is no association between compliance with UP/SP and patient characteristics of age, nurses' perception of risk and English as a second language.*

Of particular concern is whether respondent self-selection may have introduced selection bias. There was no way to analyze differences between the population responding to the survey and the non-responders. This potential selection bias can be a special case of confounding especially since nurses with either strong positive or negative feelings towards their employers and workplace safety climate may be more likely to complete the survey. All the respondents, with one exception, had a moderate/strong workplace safety climate. This unexpected lack of representation across the workplace safety climate spectrum could reflect a difference between respondents and non-respondents. However, limiting the pool of potential respondents to MNA members may also be a factor here. It is not possible to determine whether the predominantly strong or moderate workplace safety climate reflects the unionized status of the study population, or whether it reflects self selection of the nurses who chose to complete the survey. Without knowing any information about the non-responders, it is difficult to determine whether this or other possible response biases may have affected the results.

Generalizability was also assessed by comparing data on participating nurses to national HRSA survey data. The MNA respondents, although small in number, are not atypical of other studies. The MNA respondents were similar in many respects to the 2008 HRSA survey respondents as shown in Table 3.2. The MNA respondents were markedly different in education level when

compared to HRSA survey but since education level did not appear to be a major factor in compliance it should not be considered a limitation.

Union membership may influence the generalizability of the research results. MNA nurses are 100% unionized whereas the health care labor sector nationally is less than 20% unionized according to the Bureau of Labor Statistics (http://www.bls.gov/news.release/union2.t03.htm). The national percentage is not broken down by SOC code and includes all health care practitioners and technical occupations. It therefore is not totally accurate for nurses, but it does provide a snapshot of one major difference between the study population and nurses overall that could affect the outcomes of research.

The survey instrument itself proved to be a limitation in some ways. Possible information bias was introduced with the novel predictors and newly developed questions for the survey. The need to combine previously validated questions and the new questions developed to identify novel predictive factors created a fairly lengthy survey of 99 questions. This may have contributed to the number of nurses beginning but not completing the survey.

The survey instrument was tested in focus group and by sources outside of MNA. Despite these efforts, there were still questions that could have been misinterpreted. Some of the misinterpretations resulted in outliers which were subsequently omitted from the analysis. This was done for the nurse whose response indicated an average workday of 36 hours and the school nurse who listed a patient load of 400 patients per day. Some misinterpretations could not be adjusted for, as with Question 28: *You stated that synthetic gloves are available in your*

workplace. How often do you use them? The question originally used the term nitrile but during the focus group session, it was advised that this be changed to synthetic. Eight nurses responded that nitrile gloves were not applicable to their job although nitrile gloves are in common use and can be considered as latex free. Discussions with several of the nurse experts in the field consulted at the beginning of this research indicate that the responses may be due to the interpretation that synthetic gloves are something other than nitrile but this cannot be verified.

Some questions were deliberately designed to require interpretation. One example is found in *Section 2: Safety Equipment*. It would have been more precise to ask a range of percent time availability for PPE rather than asking whether PPE is "typically" available; however, this would have required more effort on the part of the responding nurse to mentally calculate percentages. The "typically" wording may have lead to exposure misclassification.

There were also programming problems with the online survey instrument. Questions were skipped that should not have been permitted to be skipped; questions were asked of every respondent that were only to be asked of those who had provided a specific response to a prior question; and, there was no way for someone to start the survey, save it and return to complete it at a later time. Random misclassification of information in a study tends to decrease the sensitivity of a study which may have precluded statistically significant findings for factors that may truly be associated with the outcome.

The fact that the responses are only a snapshot of cross-sectional information is a potential informational bias. Individual compliance may differ over time due to a variety of factors

including but not limited to: blood or body fluid exposure of oneself or a co-worker, changes in management, safety fairs, change of PPE supplier, etc. Whether this is a major concern with this particular survey is unknown.

The limitations stem from some of the same factors that provide strengths. The unionized nurses of MNA have health and safety policies written into their contracts and access to a number of health and safety programs through the MNA's continuing education. Their membership may not be representative of nurses in other non-union settings but if the tenets of their union are followed, theirs should be safer workplaces with more assurances for PPE availability and higher levels of workplace safety climate.

In addition to the strength of the MNA health and safety programs, Massachusetts has historically had both a strong recording system in place for occupational injuries and illnesses and strong support for workplace health and safety within the Massachusetts Department of Public Health. While the impacts of the novel predictive factors being studied may be modest, the identification of those factors in Massachusetts among the union nurses of MNA may actually be an underestimation of the problems with PPE compliance faced by other nurses.

5.4 Policy Implications of this Research and Public Health Recommendations

The goal of this research was to evaluate novel predictors of compliance with UP/SP that might aid in increasing compliance levels. These included availability of various types of PPE including size, material, style; and certain patient characteristics including pediatric patients,

older patients, patients who spoke English as a second language, and patients whom nurses perceived to be low risk. Other factors, including demographic and work characteristics, compliance, workplace safety climate and prior exposures, were investigated as enabling, reinforcing or predisposing in accordance with prior studies. While this study focuses on the experience of nurses in clinical practice, the findings may assist other types of clinical health professionals working to improve compliance with UP/SP. Identification of these issues is an essential first step toward resolving them and improving compliance.

Due to the low response rate additional, confirmatory research is needed. However, the positive associations are indicative that these factors should be incorporated not only into future research but also – if these results are confirmed – into training and policy decisions. The responsibilities for implementing the following recommendations will fall to different entities.

5.4.1 Recommendations for future research

The first recommendation would be to conduct follow-up research with adequate response rate to ensure representativeness and adequate sample size for statistical validity. Future research should include a strong effort to recruit nurses with both a broad range of both ages and years of experience so that these two factors are not closely correlated if possible. As previously noted in section 4.1.2, the HRSA survey has a caveat that it may under represent younger nurses. Not only must this potential problem be addressed but an effort should be made to also include others who have become nurses as older adults. Future studies should also involve nurses from different ethnicities and countries of origin.

Although there was insufficient statistical power in this research to make any definitive conclusions, there were sufficient associations to warrant further investigation. The survey showed associations with two of the proposed novel factors: glove size and patient characteristics. The availability of gloves in the appropriate size was positively associated with higher levels of strict compliance. Patient characteristics did not show a clear association with strict compliance, but instead nurses varied in strict compliance for the different categories of patients as seen in Table 4.14. Prior to conducting any new surveys, it is recommended that a series of focus groups be held to more clearly identify issues that are possible barriers; e.g., size was a factor associated with strict compliance but color was not. Other questions that should be addressed in a series of focus groups would be whether there are there other patient characteristics besides age, risk perception and English spoken as a second language that may affect compliance. Other issues to be addressed in focus groups could include whether or not there is a perceived lack of availability for non-latex gloves, and whether or not there are differences in strict compliance based on educational level.

The differing responses to the questions regarding compliance with limited response options and those allowing for free form responses show a need for a survey with both quantitative and qualitative questions. The need for this was demonstrated serendipitously: due to a programming problem, respondents who had indicated they *always* used PPE were asked to give reasons why they were not always strictly compliant. The justifications in the free form section provided a good deal of information that would otherwise have been lost.

5.4.2 Training Issues

The research results indicate that there may be a need for focus on aspects of training beyond which PPE to use and how and when to use it. The responses regarding compliance with the four different categories of patient characteristics demonstrate that the nurses responding to this survey appear to conduct a personal risk assessment of their patients before determining how strictly compliant with UP/SP they will be. Assuming this analysis is supported by further research this should be addressed directly in training. Nurses may or may not be making conscious decisions to vary compliance by patient characteristics; addressing this issue in training may enhance overall PPE compliance regardless of patients' perceived risk potential. The question to be addressed by nursing education experts is how to address this issue. It may require involving nurses in risk assessment/risk management education. One possibility is to use theory-based risk perception research to address these issues in training. Another possible approach would be to teach UP/SP in relation to the ethics of preventing HAI exposure to both patients and HCW.

5.4.3 Responsibilities and Implementation of Recommendations

Nurses want to be compliant with UP/SP but they need all the tools possible to do so. Nurses cannot be compliant if the equipment is not available. Based on the responses, overall availability of PPE and its immediate availability in rooms when needed is still a concern for many HCW. As indicated in the responses to this survey, while PPE is usually available, it is not always *readily* available. Having PPE in appropriate sizes and materials is a management

decision. Because HCW are dealing with humans and not closed systems, engineering and administrative controls cannot resolve the issue of healthcare acquired infections. Therefore PPE is essential. Since PPE must be used, it needs to be both available and as "user friendly" as possible. Under OSHA regulations management is responsible for providing PPE and therefore must also bear the primary responsibility for the convenient availability of PPE. This idea is endorsed by a recent Institute of Medicine (IOM) report that includes a recommendation that there be "widespread and convenient availability of appropriate PPE devices…" (Institute of Medicine, 2011).

Management must also be supportive of the use of PPE. As seen in Table 4.15, strict compliance is positively associated with higher workplace safety climate scores. One response that would have invited further investigation had the survey not been anonymous was that use of respiratory shields "was not allowed in policy and procedures." That nurse worked in an out-patient clinic and indicated that 80% of the day was spent in direct patient care with an average of 60 patients per day.

Ease of use, ability to see, and ability to communicate clearly were also listed as concerns regarding various PPE. Health care facility management should also be educated on the cost-benefit of easier to use and more accessible PPE. Information from the National Personal Protective Technology Laboratory should proactively be made available to all health care facilities by NIOSH. Some of these concerns could be addressed by additional information and education on types of PPE already available.

It is the responsibility of the managers of health care facilities to provide adequate training opportunities. One major policy recommendation is that training in UP/SP must be not only mandatory (OSHA 1910.1030(g)(2)(i)), but that there be enforcement by management and staff to ensure that it actually occurs. While the published literature does not always show that increased training increases compliance, there is agreement that there is a need for training and reinforcement of that training since a lack of training will obviously do nothing for compliance. (Zohar 1980, DeJoy et al., 2000, DeJoy et al., 2004, Green and Kreuter, 2005, Siegel et al., 2007, McCoy et al., 2001). Tables 4.16, 4.17 and 4.18 all show a positive correlation with longer training time and higher workplace safety scores.

There is also a governmental responsibility with regard to health and safety rules. Both the OSHA standard and the CDC guidance documents share a common deficit. Extensive evaluation post-adoption of mandatory government standards or voluntary governmental guidance documents has not been done. It is not just UP/SP rules that have not been evaluated; many federal regulations have not. While many in government want to know the cost/benefit from a strictly economic sense, any evaluation of government standards or guidance documents needs to also take into consideration the human costs in stress, guilt from not complying, illness, etc. A thorough literature search produced no peer reviewed articles evaluating the BBP standard itself for effectiveness or its impact on the overall health of HCW. This is not surprising since it is challenging to measure illnesses, the ultimate outcome of interest. In many ways, illness surveillance has not improved much since Viscusi provided an evaluation of the cotton dust standard (U.S. Congress, *Hidden Tragedy*, 2008).. "In the textile industry as in other industries, the illness data do not exist in a long and continuous time series. Moreover, byssinosis cases,

representing illnesses rather than accidents are notoriously under- reported" (Viscusi, 1985). BLS data for days lost due to illness uses five very broad categories, skin diseases or disorders, poisonings, respiratory illnesses, hearing loss, and all other illnesses. Even ignoring the problem that occupational illness and injury are underreported (U.S. Congress, *Hidden Tragedy*, 2008), analyzing the three logical categories, skin diseases, respiratory illnesses and all other illnesses to determine which reported illnesses might be related to the BBP standard is a daunting task. It will undoubtedly require governmental resources to produce a valid evaluation of the BBP standard.

Another issue that needs to be addressed by governmental agencies to increase UP/SP compliance is to ensure that all public health recommendations focus on the health and safety of both patients and HCW. Compliance can be viewed as either to protect the patient from HAI, or to protect the health care worker from HAI, or both. The 2007 CDC Guidance stressed both but the 2010 Health Infection Control Practices Advisory Committee (HICPAC) guidance stresses patient safety only (Siegel et al., 2007, Umsheld et al., 2010). The HICPAC guidance never mentions the word worker and only mentions the terms nurse or physician in describing who is on the committee. This should be changed in all future recommendations. In the field of health care, worker safety is patient safety.

References

Aboelela SW, Stone PW, Larson EL. Effectiveness of bundled behavioural interventions to control healthcare-associated infections: a systematic review of the literature. J Hosp Infect. 2007 Jun;66(2):101-8

Aiken LH, Sloane DM, Klocinski JL. Hospital nurses' occupational exposure to blood: prospective, retrospective, and institutional reports. Am J Public Health. 1997 Jan;87(1):103-7.

Alvarado-Ramy F, Beltrami EM, Short LJ, Srivastava PU, Henry K, Mendelson M, Gerberding JL, Delclos GL, Campbell S, Solomon R, Fahrner R, Culver DH, Bell D, Cardo DM, Chamberland ME. A comprehensive approach to percutaneous injury prevention during phlebotomy: results of a multicenter study, 1993–1995. Infect Control Hosp Epidemiol 2003;24:97–104

Anderson E, McGovern PM, Kochevar L, Vesley D, Gershon R. Testing the reliability and validity of a measure of safety climate. J Healthc Qual 2000 Mar Apr;22(2):19-24

Beekmann SE, Vaughn TE, McCoy KD, Ferguson KJ, Torner JC, Woolson RF, Doebbeling BN. Hospital bloodborne pathogens programs: program characteristics and blood and body fluid exposure rates. Infect Control Hosp Epidemiol. 2001 Feb;22(2):73-82.

Bot SDM, Terwee CB, van der Windt D, Feleus A, Bierma-Zeinstra SM, Knol DL, Bouter JM, Dekker J. *Internal consistency and validity of a new physical workload Questionnaire*, Occup Environ Med 2004;61:980–986.

BLS. Bureau of Labor Statistics. OSHA recordable case rates - latest incidence rates, by industry, for nonfatal work-related injuries and illnesses. U.S. Department of Labor. http://www.bls.gov/iif/oshwc/osh/os/ostb2071.pdf (last accessed 9/21/2010)

CDC. Recommendations for the prevention of HIV transmission in health care settings. MMWR Morb Mortal Wkly Rep 1987 (Suppl no 2S).

CDC. Guideline for Isolation Precautions in Hospitals. MMWR Jan 3 1997:46 (no RR)

CDC. 2006. Infectious Diseases in Healthcare Settings May 22, 2006 http://www.cdc.gov/ncidod/dhqp/id.html

CDC. 2004. Workbook for Designing, Implementing, and Evaluating a Sharps Injury Prevention Program February 12, 2004 http://www.cdc.gov/sharpssafety/toc.html

Chen GX, Jenkins EL. Potential work-related exposures to bloodborne pathogens by industry and occupation in the United States part II: a telephone interview study. 2007 Am J Ind Med 2007. 50:285-292

Cifuentes M, Boyer J, Gore R, d'Errico A, Scollin P, Tessler J, Lerner D, Kriebel D, Punnett L, Slatin C; PHASE in Healthcare Research Team. Job strain predicts survey response in healthcare industry workers. Am J Ind Med. 2008 Apr;51(4):281-9.

Clarke SP, Rockett JL, Sloane DM, Aiken LH. Organizational climate, staffing and safety equipment as predictors of needlestick injuries and near-misses in hospital nurses. 2002a Am J Infect Control. 2002 Jun;30(4):207-16.

Commonwealth of Massachusetts, Office of Health and Human Services
Statistics on numbers of nurses in 2009
http://www.mass.gov/?pageID=eohhs2subtopic&L=7&L0=Home&L1=Provider&L2=Certification%2c+Licensure%2c+and+Registration&L3=Occupational+and+Professional&L4=Nursing&L5=Licensing&L6=Statistics+About+Licensees&sid=Eeohhs2 (accessed on January 29, 2011)

Commonwealth of Massachusetts Occupational Injuries and Illnesses as compiled by The Massachusetts Division of Occupational Safety and the U.S. Department of Labor
http://www.mass.gov/?pageID=eohhs2subtopic&L=4&L0=Home&L1=Consumer&L2=Community+Health+and+Safety&L3=Workplace+Health+and+Safety&sid=Eeohhs2 (accessed on January 29, 2011)

Coopersmith, CM, Rebmann TL, Zack JE, Ward MR, Corcoran RM, Schallom ME, Sona CD, Buchman TG, Boyle WA, Polish LB, Fraser VJ. Effect of an education program on decreasing catheter-related bloodstream infections in the surgical intensive care unit. Crit Care Med. 2002 Jan;30(1):59-64.

Curry VJ, Cole M. Applying social and behavioral theory as a template in containing and confining VRE. Crit Care Nurs Q. 2001 Aug;24(2):13-9.

DeJoy DM, Searcy CA, Murphy LR, Gershon RR. Abstract Behavioral-diagnostic analysis of compliance with universal precautions among nurses. J Occup Healt Psychol. 2000 Jan;5(1):127-41.

DeJoy DM, Gershon RR, Shaffer BS. Safety climate: Assessing management and organizational influences on safety. Professional Safety July 2004 ***www.asse.org***

Dement JM, Epling C, Østbyte T, Pompeii LA, Hunt DL. Blood and body fluid exposure risks among health care workers: Results from the Duke health and safety surveillance system. Am J Ind Med 2004 46:637-648

Doebbeling BN, Vaughn TE, McCoy KD, Beekmann SE, Woolson RF, Ferguson KJ, Torner JC. Percutaneous injury, blood exposure, and adherence to standard precautions: are hospital-based health care providers still at risk? Clin Infect Dis. 2003 Oct 15;37(8):1006-13. Epub 2003 Sep 24.

Elder A, Paterson C. Sharps injuries in UK health care: a review of injury rates, viral transmission and potential efficacy of safety devices. Occ Med 2006 56:566-574

Embrey, MA, Parkin, RT, Balbus JM. Handbook of CCL Microbes in Drinking Water. Amer Water Works Assn. 2002 p.9

Ferguson KJ, Waitzkin H, Beekmann SE, Doebbeling BN. Critical incidents of nonadherence with standard precautions guidelines among community hospital-based health care workers. J Gen Intern Med. 2004 Jul;19(7):726-31.

Gammon J, Morgan-Samuel H, Gould D. A review of the evidence for suboptimal compliance of healthcare practitioners to standard/universal infection control precautions. J Clin Nurs. 2008 Jan;17(2):157-67

Gershon RR, Curbow B, Kelen G, Celantano D, Lears K, Vlahov D. Correlates of attitudes concerning human immunodeficiency virus and acquired immunodeficiency syndrome among hospital workers. Am J Infect Control. 1994 Oct;22(5):293-9.

Gershon RR, Vlahov D, Felknor SA, Vesley D, Johnson PC, Delclos GL, Murphy LR. Compliance with universal precautions among health care workers at three regional hospitals. Am J Infect Control. 1995 Aug;23(4):225-36.

Gershon R. Facilitator report: bloodborne pathogens exposure among health care workers. Am J Ind Med. 1996 Apr;29(4):418-20.

Gershon RR, Karkashian CD, Vlahov D, Kummer L, Kasting C, Green-McKenzie J, Escamilla-Cejudo JA, Kendig N, Swetz A, Martin L. Compliance with universal precautions in correctional health care facilities. JOEM. 1999:41(3);181-189

Gershon RR, Karkashian CD Grosch JW, Murphy LR, Escamilla-Cejudo A, Flanagan PA, Bernacki E, Kasting C, Martin L. Hospital safety climate and its relationship with safe work practices and workplace exposure incidents. Am J Infect Control. 2000;28:211-221

Gershon RR, Stone PW, Bakken S, Larson E. Measurement of organizational culture and climate in healthcare J Nurs Admin. 2004 Jan:34(1);33-40

Gershon RR, Mitchell C, Sherman MF, Vlahov D, Lears MK, Felknor S, Lubelczyk RA. Hepatitis B vaccination in correctional health care workers. Am J Infect Control 2005 33(9) 510-518

a Gershon RR, Sherman M, Mitchell C, Vlahov D, Erwin MJ, Lears MK, Fleknor S, Lubelczyk MJ. Prevalence and risk factors for bloodborne pathogen exposure and infection in correctional healthcare workers. Infect Control Hosp Epidemiol. 2007;28(1); 24-30

b Gershon RR, Qureshi KA, Pogorzelska M, Rosen J, Gebbie KM, Brandt-Rauf PW, Sherman MF. Non-hospital based registered nurses and the risk of bloodborne pathogen exposure. Ind Health. 2007 Oct;45(5):695-704.

Godin G, Naccache H, Morel S, Ebacher MF. Determinants of nurses' adherence to universal precautions for venipunctures. Am J Infect Control. 2000 Oct;28(5):359-64.

Gould D, Ream E. Assessing nurses' hand decontamination performance. Nurs Times. 1993 Jun 23-29;89(25):47-50.

Gould D, Wilson-Barnett J, Ream E. Nurses' infection-control practice: hand decontamination, the use of gloves and sharp instruments. Int J Nurs Stud. 1996 Apr;33(2):143-60.

Green LW, Kreuter MW, Deeds SG, Partridge KB, Bartlett E. Health education planning: a diagnostic approach. Palo Alto, California, Mayfield Publishing, 1980

Green LW, Kreuter MW. Health Program Planning: An Educational and Ecological Approach. 4th Edition. New York. McGraw-Hill 2005

HRSA 2008 Health Resources and Services Administration, Department of Health and Human Services, The Registered Nurse Population: Findings from the 2008 National Sample Survey of Registered Nurses**.** http://bhpr.hrsa.gov/healthworkforce/rnsurvey/2008/nssrn2008.pdf (Accessed December 27, 2010)

Kirkland KH, Levinson A. Dirty Little Secrets in Health Care: A Choice by Health Care Professionals (Paper: PubH 343-Qualitative Research Methods. George Washington University School of Public Health and Health Services, 2005).

Larson EL, Early E, Cloonan P, Sugrue S, Parides M. An organizational climate intervention associated with increased handwashing and decreased nosocomial infections. Behav Med. 2000 Spring;26(1):14-22.

Levin PF. Improving compliance with universal precautions effectiveness of interventions. AAOHN Journal. 1995 43(7);362-370

Luckhaupt SE, Calvert GM. Deaths due to bloodborne infections and their sequelae among health-care workers. Am J Ind Med. 2008 Nov;51:812-824

Malone N, Larson E. Factors associated with a significant reduction in hospital-wide infection rates. Am J Infect Control. 1996 Jun;24(3):180-5.

Markkanen P, Quinn M, Galligan C, Chalupka S, Davis L, Laramie A. There's no place like home: a qualitative study of the working conditions of home health care providers. J Occup Environ Med. 2007 Mar;49(3):327-37.

Mast EE, Margolis HS, Fiore AE, Brink EW, Goldstein ST, Wang SA, Moyer LA, Bell BP, Alter MJ. A Comprehensive Immunization Strategy to Eliminate Transmission of Hepatitis B Virus Infection in the United States: Recommendations of the Advisory Committee on Immunization Practices (ACIP) Part 1: Immunization of Infants, Children, and Adolescents. MMWR, 2005 Dec. 23; 55(RR16); 1-23

Mitchell CS, Gershon RR, Lears MK, Vlahov D, Felknor S, Lubelczyk RA, Sherman MF, Comstock GW. Risk of tuberculosis in correctional healthcare workers. J Occup Environ Med. 2005 Jun;47(6):580-6.

NIOSH www.cdc.gov/niosh/sharps2.html

OSHA. 1991. 29 CFR Part 1910.1030. Occupational Exposure to Bloodborne Pathogens; Final Rule, Federal Register/Vol. 56, No. 235/December 6, 1991.

OSHA. 2001. 29 CFR Part 1910.1030. Occupational Exposure to Bloodborne Pathogens; Needlesticks and Other Sharps Injuries; Final Rule, Federal Register/Vol. 66, No. 12/January 18, 2001.

Osborne S. Perceptions that influence occupational exposure reporting. AORN J. 2003 Aug;78(2):262-72.

Perry J, Parker G, Jagger J. EPINet Report: 2004 Percutaneous injury rates. International Worker Health Care Center. Aug. 2007 http://www.healthsystem.virginia.edu/internet/epinet/epinet-2004-rates.pdf

Public Law 106-430. Needlestick Safety and Prevention Act. http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=106_cong_public_laws&docid=f:publ430.106

Siegel JD, Rhinehart E, Jackson M, Chiarello L, and the Healthcare Infection Control Practices Advisory Committee, 2007 Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings, June 2007 *http://www.cdc.gov/ncidod/dhqp/pdf/isolation2007.pdf*

Slaughter S, Hayden MK, Nathan C, Hu TC, Rice T, Voorhis JV, Matushek M, Franklin C, Weinstein RA. A comparison of the effect of universal use of gloves and gowns with that of glove use alone on acquisition of vancomycin-resistant enterococci in a medical intensive care unit. 1996 Ann Intern Med 125(6);448-456

Slovic P, Funucane ML, Peters E, MacGregor DG. Risk as analysis and risk as feelings: some thoughts about affect, reason, risk and rationality. 2004 Risk Analysis 24(2)

Stone PW. Clarke S. Cimiotti J. Correa-de-Araujo R. Nurses' Working Conditions: Implications for Infectious Disease. Journal of Emerging Infectious Diseases. Vol. 10 No. 11. 2004.

Stone PW, Gershon RR. Nurse work environments and occupational safety in intensive care units. Policy Politics and Nursing Practice. 2006 7(4);240-247

Stone PW, Du Y, Gershon RR. Organizational climate and occupational health outcomes in hospital nurses. J Occup Environ Med. 2007 Jan;49(1):50-8.

Umscheid CA, Agarwal RK, Brennan PJ. Updating the Guideline Methodology of the Healthcare Infection Control Practices Advisory Committee (HICPAC), 2010. http://www.cdc.gov/hicpac/pdf/guidelines/2009-10-29HICPAC_GuidelineMethodsFINAL.pdf (Last accessed December 20, 2010)

U.S. Congress. House of Representatives. Committee On Education And Labor. Hidden Tragedy: Underreporting of Workplace Injuries and Illnesses. 110th Congress, 2nd Session. Washington: GPO 2008. http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=110_house_hearings&docid=f:42881.pdf (last accessed March 14, 2011)

Wang H, Fennie K, He G, Burgess J, Williams A B. A training programme for prevention of occupational exposure to bloodborne pathogens: impact on knowledge, behaviour and incidence of needle stick injuries among student nurses in Changsha, People's Republic of China Burgess, J Advanced Nursing, 2003 (41)2:187-194

Zohar D. Safety climate in industrial organizations: theoretical and applied implications. J Appl Psychol. 1980 Feb;65(1):96-102.

Zohar D. Modifying supervisory practices to improve subunit safety: a leadership-based intervention model. J Appl Psychol. 2002 87(1):156-163.

Appendices

MNA Assistance Requested for Research on Universal/Standard Precautions

The MNA Congress on Health and Safety is interested in projects to help improve the health and safety of our members. One way we work to improve health and safety is to assist in research projects we feel further goal. We have therefore agreed to assist in recruitment for a project on barriers to universal precautions/standard precautions.

The goal of the proposed research is to evaluate novel factors that may affect compliance with UP/SP. The basic premise of this research is that nurses want to be compliant with UP/SP but they need the tools to do so.

Standard precautions are a set of precautions that the Centers for Disease Control and Prevention has called for in order to minimize the risk that health care workers will catch an infection for a patient or spread infections among patients. They extend beyond the universal precautions that were developed in the 1980's specifically to protect from blood-borne pathogens.

The study is being conducted by Katherine Kirkland as part of her doctoral dissertation at George Washington University. Kirkland works full-time at the Association of Occupational and Environmental Clinics and also serves an adjunct assistant professor in the Department of Public Health Nursing University of North Carolina.

Postcards will be mailed to a random sample of MNA members asking them to complete an online survey which should take about 20 minutes to complete. All responses will be both anonymous and voluntary. When completed, you may send an e-mail to a GWU faculty member to be entered in a drawing for one of 20 $25 Macy's gift cards. Kirkland will not be given your information nor will it be recorded with your response.

If you receive a post card, please complete the survey. For further information contact Katherine Kirkland at kkirkland@aoec.or or at 703-861-6177.

Appendix II: Kirkland Survey with Distributions n=95 unless otherwise specified

Section 1: Demographics

Q1	Agreement to participate	Yes	No	Completed survey	Eligible			
	n=121	119	2	106	95			
Q2	What is your gender?	Female	Male					
		91	4					
Q3	How old are you? (# years)	Mean	SD	Min	Max	Median		
		46.26	11.27	23	66	47		
Q4	How would you describe your race?	White	Black or African American	American Indian or Alaska Native	Asian	Native Hawaiian or other Pacific Islander	None of above	
		91	1	0	3	0	0	
Q5	Are you of Hispanic or Latino(a) origin?	Yes	No					Unknown
		2	92					1
Q6	What is your highest educational degree?	Diploma	AS	BS	Masters or Higher			
		11	16	54	14			
Q7	What is your professional license (check all that apply)	RN	NP	Other	free form	17 with additional certifications		
		89	6					
Q8	How many years have you worked as a nurse?	(# years)	SD	Min	Max			
		19.27	13.17	1	42			
Q9	Do you currently have "hands-on" patient contact?	Yes	No					
		95	0					
Q10	How many years have you had "hands-on" patient contact?	(# years)						
		18.74	12.7	1	42			

Q11	What is your current employment status? Select only one (1)	FT	PT	Temp	Retired			
		57	31	7				
Q12	What is your current work setting? May select more than one(1)	Acute care	Home health care/community health	Community	Out-patient clinic	Government Institution (e.g. correctional institution, mental health facility	Surgical center/ ambulatory surgery center	Other
	n=109	61	5	2	10	4	4	23
Q13	How many hours do you typically work each day? N=94							
	Did not include response of 36	9.7	1.99	5	13			
Q14	How many hours do you typically work each week including overtime?							
		33.03	10.21	0	65			
Q15	Is over-time mandatory for you?	Yes	No	N/A				
		14	81					
Q16	Describe your present work shift	Permanent day	Permanent night	Permanent evening	Flex-time day/evening	Rotating	Part-time	
		45	23	8	4	7	8	
Q17	Fill in the approximate percentage of time per week you spend in direct patient care	Mean %	SD	Min	Max			
		63.81	33.24	5	100			
Q18	In the past 12 months, how much time would you say you received in training on UP/SP or other infection control?	None	15 minutes	30 minutes	1 hour	2 or more hours		Don't know
		12	19	17	25	14		8

Q19	Approximately how many clinicians (nurses, physicians, PA's etc) work at your facility?	<10	10--50	51-1000	>1000			Don't know
	n=81	5	7	36	33			14
Q20	In general, how many patients are you personally responsible for (i.e. provide care to) in a typical work day? (fill in N/A if not applicable)	Mean	SD	Min	Max			N/A
	Did not include school nurse response of 400	7.87	9.04	0	60			
	Section 2: Safety Equipment							
Q21	Are the following PPE typically available in your workplace? Latex Gloves	Personally Available to me	Sometimes Available to me	Not Available to me	Not applicable to my job			
		54	10	30	1			
Q22	You stated that latex gloves are available in your workplace. How often do you use them?	Always	Often	Sometimes	Rarely	Never		
	n=54	16	16	3	7	12		
Q23	Are the following PPE typically available in your workplace? Latex Free gloves	Personally Available to me	Sometimes Available to me	Not Available to me	Not applicable to my job			
		88	3	4	0			
Q24	You stated that latex free gloves are available in your workplace. How often do you use them?	Always	Often	Sometimes	Rarely	Never		
	n=88	54	15	9	3	5		2
Q25	Are the following PPE typically available in your workplace? Powder Free Gloves	Personally Available to me	Sometimes Available to me	Not Available to me	Not applicable to my job			
		81	9	5	0			

Q26	You stated that powder free gloves are available in your workplace. How often do you use them?	Always	Often	Sometimes	Rarely	Never		
	n=81	54	17	5	2	2		1
Q27	Are the following PPE typically available in your workplace? Synthetic gloves	Personally Available to me	Sometimes Available to me	Not Available to me	Not applicable to my job			
		49	13	25	8			
Q28	You stated that synthetic gloves are available in your workplace. How often do you use them?	Always	Often	Sometimes	Rarely	Never		
	n=49	21	12	9	5	2		
Q29	Are the following PPE typically available in your workplace? Gloves that are both powder free and latex free	Personally Available to me	Sometimes Available to me	Not Available to me				Not applicable to my job
		82	9	4	0			
Q30	You stated that gloves that are both powder free and latex free are available in your workplace. How often do you use them?	Always	Often	Sometimes	Rarely	Never		
	n=82	53	19	5	2	3		
Q31	My personal preference in gloves is:	Latex	Latex free	Powder free	Synthetic	Both latex and powder free		Not applicable to my job
		6	14	5	9	61		
Q32	Gloves are available in my size	Always	Often	Sometimes	Rarely	Never		
		76	15	3	1	0		0

Q33	If gloves that are suitable to you are available and you still don't always use them why not? Check all that apply	I don't have time	Patient uncomfort-able	I don't like the gloves available to me				
	n=76	24	6	4				
Q34	You stated that you don't like the gloves available to you. Please check all reasons that apply:	They don't stretch well enough	The color doesn't allow good visualization between my hands and the patient's skin	My hands get irritated/I develop rashes	They make my hands sweat	I can't feel sensation well enough to do my tasks	Error-question does not apply	Other
	n=53	5	0	3	2	8	23	12
Q34g	Other reason (please describe)							
Q35	Do you ever wear double gloves	Yes	No					
		45	50					
Q36	Are the following PPE typically available in your workplace? Personal Splash Guards/Eye Shields	Personally Available to me	Sometimes Available to me	Not Available to me	Not applicable to my job			
		77	10	5	3			
Q37	You stated that Personal Splash Guards/Eye Shields are typically available in your workplace. How often do you use?	Always	Often	Sometimes	Rarely	Never		
	n=77	6	9	24	31	3		4
Q38	If you use Personal Splash Shields for your face indicate which type	Full face	Half Face	Eye Shield	Safety glasses			Other
	n=81	31	19	15	14			2

Q39	If you don't use a personal splash shield when there is a potential for splash to your eyes, please indicate why not (check all that apply)?	I can't see well enough to do my tasks	They are uncomfortable	They are unnecessary for me because I wear glasses	It makes my patients uncomfortable	I've never been splashed in the eyes	Error-question does not apply	Other
		11	6	9	2	5		8
Q39A	Other reason (please describe)							
Q40	Are the following PPE typically available in your workplace? Respiratory protection/oral protection	Personally Available to me	Sometimes Available to me	Not Available to me	Not applicable to my job			
		90	3	0	0			2
Q41	You stated that respiratory protection/oral protection are typically available in your workspace. How often do you use them?	Always	Often	Sometimes	Rarely	Never		
	N=90	14	23	31	17	5		
Q42	If you use respiratory protection/oral protection, what kind do you use most often?	Flat double tie	Flat with elastic	Cone with elastic	N95 or higher	PAPR (Powered Air Purifying Respirator)		Other
		25	22	19	20	1		8
Q43	If you don't use respiratory masks/shields when there is a potential for infection please indicate why not (check all that apply):	They are too difficult/time consuming to tie	It makes communicating with patients too difficult	They are uncomfortable to work in for more than a few minutes	My older patients have difficulty understanding me when I wear one	It isolates my patients	My patients feel I'm afraid of them	Other
	N=27	5	10	6	2	1	1	2
Q43a	If you don't use respiratory masks/shields when there is a potential for infection please indicate why not (free form):							

Section 3: Compliance

Q44	When at work I: Wash my hands after removing my disposable gloves	Never	Rarely	Sometimes	Often	Always		N/A
		0	1	7	28	59		
Q45	When at work I: Wear a disposable outer garment that is resistant to blood and bodily fluids whenever there is a chance of soiling my clothes	Never	Rarely	Sometimes	Often	Always		N/A
		4	13	10	26	36		6
Q46	When at work I: Wear disposable gloves whenever there is a possibility of exposure to blood or other body fluids	Never	Rarely	Sometimes	Often	Always		N/A
		0	0	1	16	78		
Q47	When at work I: Wear protective eye shields whenever there is a possibility of splash or splatter to my eyes	Never	Rarely	Sometimes	Often	Always		N/A
		3	12	8	26	42		4
Q48	When at work I: Wear a face mask whenever there is a possibility of splash or splatter to my mouth	Never	Rarely	Sometimes	Often	Always		N/A
		2	11	6	28	42		6
Q49	When at work I: Promptly wipe up all potentially contaminated spills using a disinfectant	Never	Rarely	Sometimes	Often	Always		N/A
		0	3	5	15	65		7
Q50	When at work I: Never eat or drink while working in an area where there is a possibility of becoming contaminated with blood or body fluids	Never	Rarely	Sometimes	Often	Always		N/A
		8	3	6	7	68		3

Q51	When at work I: Take special caution when using scalpels or other sharp objects	Never	Rarely	Sometimes	Often	Always		N/A
		0	0	0	4	85		6
Q52	Never recap needles that have been contaminated with blood	Never	Rarely	Sometimes	Often	Always		N/A
		11	1	2	5	75		1
Q53	When at work I: Never unscrew needles from Vacutainers that have been used to draw patient's blood	Never	Rarely	Sometimes	Often	Always		N/A
		8	0	0	5	60		22
Q54	When at work I: Wear gloves while drawing patient's blood	Never	Rarely	Sometimes	Often	Always		N/A
		0	0	1	9	61		24
Q55	When at work I: Dispose of sharp objects into a sharps container	Never	Rarely	Sometimes	Often	Always		N/A
		0	0	0	3	91		1
Q56	When at work I: Dispose of all potentially contaminated materials into a red (and/or labeled) bag for disposal as biomedical waste	Never	Rarely	Sometimes	Often	Always		N/A
		0	0	0	14	76	2	3
Q57	When at work I: Treat all materials that have been in contact with patient's saliva as if they were infectious	Never	Rarely	Sometimes	Often	Always		N/A
		0	4	12	21	54		4
Q58P	How would you rate your universal/standard precaution compliance for each of the following groups: Pediatric patients (under 18)	Much more compliant	More compliant	Same	Less compliant	Much less compliant		
		12	7	63	12	1		

Q58A	How would you rate your universal/standard precaution compliance for each of the following groups: Older adults (over age 65)	Much more compliant	More compliant	Same	Less compliant	Much less compliant		
		11	15	66	3	0		
Q58E	How would you rate your universal/standard precaution compliance for each of the following groups: Patients for whom English is a second language	Much more compliant	More compliant	Same	Less compliant	Much less compliant		
		12	9	73	1	0		
Q58L	How would you rate your universal/standard precaution compliance for each of the following groups: Patients you consider a "low risk" for infectious disease	Much more compliant	More compliant	Same	Less compliant	Much less compliant		
		8	9	68	10	0		
	Section 4: Workplace Safety Climate							
Q59	The protection of workers from occupational exposures to HIV/HBV/HCV is a high priority with management where I work	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree		
		0	2	16	40	37		
Q60	On my unit, all reasonable steps are taken to minimize hazardous job tasks and procedures	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree		
		0	7	14	50	24		
Q61	On my unit, employees are encouraged to become involved in safety and health matters	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree		
		0	6	20	50	19		

Q62	My job duties often interfere with my being able to follow Standard Precautions	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree		
		33	26	19	14	3		
Q63	I have enough time in my work to always follow Standard Precautions	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree		
		5	19	13	46	12		
Q64	I usually follow Standard Precautions	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree		
		0	0	3	47	45		
Q65	On my unit, unsafe work practices are corrected by supervisors	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree		
		4	18	31	29	13		
Q66	My nurse manager often discusses safe work practices	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree		
		8	20	20	36	11		
Q67	I have had the opportunity to be properly trained to use safe needles devices so I can protect myself from exposures	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree		
		1	4	6	54	30		
Q68	Employees are taught to recognize potential health hazards at work	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree		
		2	7	10	54	22		
Q69	At my worksite, a copy of the hospital/company safety manual is available	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree		
		0	1	10	46	38		
Q70	My work area is kept clean	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree		
		2	11	14	55	13		

Q71	My work area is adequately staffed	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree		
		6	25	20	37	7		
Q72	I am provided with all necessary equipment to comply with SP/UP	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree		
		0	7	13	53	22		
Q73	My work area is not crowded	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree		
		15	22	19	35	4		
Q74	There is minimal conflict within my department	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree		
		9	16	29	39	2		
Q75	The members of my unit support one another	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree		
		1	8	23	55	8		
Q76	On my unit, there is open communication between nurse management and staff	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree		
		8	18	26	34	9		
Q77	A product review board monitors new safety products as they become available	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree		
		5	10	30	39	11		
Q78	Nurses who provide patient care are involved in safety product selection	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree		
		9	27	30	28	1		
Q79	Overall, I am satisfied with the working conditions of my job	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree		
		1	15	19	45	15		

	Section 5: Exposure History							
Q80	In the past 12 months, have you EXPERIENCED any level of severity of the following types of exposures: Percutaneous Injuries	Yes	No					Don't remember
		7	88					
Q81A	Were you wearing gloves at the time?	Yes	No					Don't remember
	n=7	4	3					
Q81B	Were you wearing double gloves at the time of your exposure?	Yes	No					Don't remember
	n=7	0	7					
Q81C	Were you using a safety device at the time of your exposure?	Yes	No					Don't remember
	n=7	4	3					
Q82	If yes: did you receive training on how to use the device?	Yes	No					Don't remember
	n=7	6	1					
Q83	Please check the type of patient care you were providing?	Routine care	Emergency care	other				Don't remember
	n=7	4	2	1				
Q84	Patient Characteristics: Was the patient	Older (over 65)	Pediatric (-18)	Mid-range age				
	n=7	3	0	4				
Q85E	Did the patient speak English as a second language?	Yes	No					Don't remember
	n=7	2	4					1
Q85-L	Did you consider the patient a "low risk" for infectious disease?	Yes	No					Don't remember
	n=7	2	4					1

Q85C	Do you know the infection status of the patient (e.g. HIV, HCV, TB)	Yes	No					Don't remember
	n=7	5	1					1
Q86	Please indicate factors that contributed to your most recent exposure (please check all that apply)	Caused through actions of a co-worker	Device not being used for intended purpose	Equipment Failure	Recapping Needle	Needle left in linens, trash, or other unusual location	No sharps container available	
	n=7	1	1	2	3	0	0	2
Q86 (continued)	Please indicate factors that contributed to your most recent exposure (please check all that apply)	No safety needle or device	Overfilled sharps container	Patient Caused				Other
		0	0					
Q87	In the past 12 months, have you EXPERIENCED any level of severity of the following types of exposures: Splashes to eyes or mouth	Yes	No					Don't remember
		10	81					4
Q88a	If Experienced: In relation to your most recent splashes to eyes or mouth: Were you wearing a face mask at the time?	Yes						Don't remember
	n=10	0	9					1
Q88b	If Experienced: In relation to your most recent splashes to eyes or mouth: Were you wearing an eye shield at the time?	Yes	No					Don't remember
	N=10	0	8					1
Q89	Please check the type of patient care you were providing?	Routine care	Emergency care	other				Don't remember
	N=10	8	1					1

Q90	Patient Characteristics: Was the patient	Older (over 65)	Pediatric (-18)	Mid-range age				Don't remember
	N=10	2	1	6				1
Q91E	Did the patient speak English as a second language?	Yes	No					Don't remember
	N=10	1	5					4
Q91L	Did you consider the patient a "low risk" for infectious disease?	Yes	No					Don't remember
	N=10							
Q91C	Do you know the infection status of the patient (e.g. HIV, HCV, TB)	Yes	No					Don't remember
	N=10	5	3					2
Q92	Please indicate factors that contributed to your most recent exposure (please check all that apply)	Caused through actions of a co-worker	Device not being used for intended purpose	Equipment design flaw	Equipment failure	Patient caused	Other	Don't remember
	N=10	5	4	1				
Q93	In the past 12 months, have you EXPERIENCED any level of severity of the following types of exposures: Blood or body fluid contacts with open wounds on your skin	Yes	No					
		5	89					1
Q94a	If Experienced: In relation to your most recent blood or body fluid contact: Were you wearing gloves at the time?	Yes	No					Don't remember
	n=5	3	1					1
Q94b	If Experienced: In relation to your most recent blood or body fluid contact: Were you wearing a face mask at the time?	Yes	No					Don't remember
	n=5	1	3					1

Q94c	If Experienced: In relation to your most recent blood or body fluid contact: Were you wearing an eye shield at the time?	Yes	No					Don't remember
	n=5	1	3					1
Q95	Please check the type of patient care you were providing?	Routine care	Emergency care	other				Don't remember
	n=5	3	2					
Q96	Patient Characteristics: Was the patient	Older (over 65)	Pediatric (-18)	Mid-range age				Don't remember
	n=5	1	1	2				1
Q97E	Did the patient speak English as a second language?	Yes	No					Don't remember
	n=5	0	2					3
Q97L	Did you consider the patient a "low risk" for infectious disease?	Yes	No					Don't remember
	n=5	1	2					2
Q97C	Do you know the infection status of the patient (e.g. HIV/HCV/HBV)	Yes	No					Don't remember
	n=5	1	3					1
Q98	Please indicate factors that contributed to your most recent exposure (please check all that apply)	Caused through actions of a co-worker	Device not being used for intended purpose	Equipment design flaw	Equipment failure	Patient caused	Other	Don't remember
	n=5	4	0					1
Q99	In the past 12 months, have you EXPERIENCED any level of severity of the following types of exposures: Tested positive for exposure to MRSA	Yes	No					Don't remember
		7	85					1

This postcard is to invite you to participate in a survey "Barriers to Using Universal/Standard Precautions." This survey is conducted by Katherine Kirkland, MPH of the George Washington University (GWU) and supported by the ***Massachusetts Nurses Association****. To participate, please go online at www.aoec.org/mna. The survey should take about 20 minutes to complete. All responses are anonymous and are strictly voluntary. When you finish the survey, you will be prompted to send an e-mail to a GWU faculty member with your name and address to be entered in a drawing for one of twenty $25 Macy's gift cards. Ms. Kirkland will not be given your name or address nor will it be recorded with your response.*

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Appendix IV:
Proportion of Nurses Strictly Complying in Various Percentages of Workplace Safety Climate

	Lower 50%		Upper 50%			Lowest 10%		Highest 10%		
	No.	%	No.	%	p-value	No.	%	No.	%	p-value
Q46-Glove Compliance	41	83%	54	81%	0.86	11	100%	11	91%	1.00
Q46-Adjusted by Q33-Reasons for Not Complying	46	61%	49	57%	0.71	11	64%	11	91%	0.31
Q47 Eye Shield Compliance	35	51%	42	52%	0.93	8	38%	10	80%	0.14
Q47 Adjusted by Q39 Reasons for Not Complying	41	44%	36	44%	0.96	8	38%	10	60%	0.63
Q48 Respiratory Shield Compliance	54	51%	51	39%	0.17	10	30%	11	82%	0.03Ŧ
Q48 Adjusted by Q43 Reasons for Not Complying	44	41%	46	33%	0.41	10	20%	11	55%	0.18

Ŧ Statistically significant

Appendix