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Exploring Self-Reported Hand Hygiene among Registered Nurses in the Inpatient Hospital Setting using the Health Belief Model

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by

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Dedication

I would like to dedicate this dissertation to my family. Especially to my loving husband Bo Gillespie who has supported me through this entire journey. Thank you for listening to me cry, struggle, and succeed. I was very proud to have you by my side in the final oral defense. Thank you for helping me to understand that the hurdles that are crossed help make us who we are today, and it would not be worth doing if it was not hard. I would also like to dedicate this dissertation to my children Rocco Danger and Max Trouble, who were both born while I was attending the PhD program. Thank you for understanding all the hours when mommy had to close the door to study or write, and thank you for sneaking me all of those kisses.

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Exploring Self-Reported Hand Hygiene among Registered Nurses in the Inpatient Hospital Setting using the Health Belief Model

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Methicillin Resistant *Staphylococcus aureus* (MRSA) is the most commonly isolated multi-drug resistant organism in the hospital setting. MRSA can result in death among people who have no identified risk factors for infection. One-third of MRSA infections are cross-transmitted as Healthcare-Associated Infections (HAIs). It is well known that the single most effective means for decreasing the risk of HAIs is hand hygiene (HH), yet poor performance among registered nurses persists. The theoretical framework used to guide the study was the Health Belief Model (HBM). The purposes of the study were to: explore the RNs' self-reported HH performance rate; explore the RNs' knowledge related to MRSA; identify relationships between MRSA knowledge and HBM constructs; explore the RNs' barriers to HH performance; identify relationships between barriers and self-reported HH performance; explore relationships among HH behaviors and constructs in the HBM; explore predictors of 'overall HH' performance; and identify if certain demographic characteristics are related to MRSA knowledge, self-reported HH, and HBM constructs. A cross sectional descriptive study was conducted with a sample of RNs who were randomly selected. The questionnaire mailing, which included the survey, consent, and the return-stamped envelope were distributed to 684 RNs. Completed surveys (n=120) from RNs who met the sample inclusion criteria were

returned within four weeks. Self-reported HH were highest during times of increased perceived susceptibility for infection. In addition, nurses were more likely to overcome barriers to HH during 'moments' associated with the highest perceived susceptibility. Although MRSA knowledge did not correlate with 'overall HH' performance, there was a significant relationship identified with self-efficacy (r=.27, p<.01), which may influence HH behaviors. The most commonly identified barriers to HH performance were system factors (e.g. 'a high workload'). Self-efficacy and barriers represented 26% of the variability in the regression model when applying significant correlations among HBM constructs and 'overall HH.' The phenomenon of the RN's HH decision making is not completely understood. More research is needed to explain predictors for HH among registered nurses. This understanding will allow researchers to plan interventions aimed at increasing knowledge and understanding about perceived susceptibility, which may in turn improve self-efficacy behaviors for HH, which could decrease HAI rates.

Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction

INTRODUCTION

According to the Centers for Disease Control and Prevention's (CDC) Active Bacterial Core Surveillance Statistics (2008) 89,785 people developed invasive Methicillin-resistant *Staphylococcus aureus* (MRSA) infections and 15,249 died during a hospital stay related to MRSA. Fully, one-third of invasive MRSA was cross-transmitted in the hospital setting (Klevens et al., 2007). Although striking, these statistics do not capture the number of noninvasive nosocomial MRSA infections that were acquired annually within the inpatient hospital setting. Healthcare-associated infections (HAIs), also known as nosocomial infections, are infections transmitted to the patient (Pt) as a result of treatment within the hospital setting. Healthcare-associated infections related to MRSA were most commonly reported as clinical sepsis (CS), soft tissue infection (STI), surgical site infections (SSI), ventilator acquired pneumonia (VAP), blood stream infection (BSI) and central line associated blood stream infection (CLABSI). It has been well established that the single most effective means for preventing the risk for spreading HAIs to patients was performing hand hygiene (HH) (CDC, 2002; WHO, 2005). However, the literature supports that registered nurses (RN) were often non-compliant or ineffective with this behavioral practice (CDC, 2002; WHO, 2005).

Healthcare-associated infections have recently become a non-reimbursable expense, which has significant financial impact for the healthcare institutions. Cost of infections related to the MRSA bacterium have ranged from $27,000 (Abramson & Sexton, 1999) to $40,000 (Engemann et al., 2003) per event, which was dependent on the site of infection. It has been estimated that a 200-bed hospital incurs roughly $1.8 million annually in expenses directly related to MRSA infections from ineffective HH

performance (Cummings et al., 2010). Ineffective HH performance could lead to HAIs, which in turn could negatively influence length of stay and mortality in patients infected with MRSA. Abramson and Saxon (1999) compared MRSA infections to Methicillin-susceptible *Staphylococcus aureus* (MSSA) infections and reported a three-fold increase in length of stay for MRSA infections. Another study compared the cost of SSIs associated with patients that recently underwent surgery. In this study, Engemann et al. (2003) described that the cost associated with a MRSA SSI was roughly $40,000 more when compared with control subjects. Methicillin-resistant *Staphylococcus aureus* SSI were also associated with increased length of stay and a higher 90-day mortality rate (Engemann et al., 2003). Furthermore, Hanberger et al. (2011) reported a 50% higher mortality rate in patients admitted with MRSA infections to the intensive care unit.

Nosocomial MRSA infections are linked with behaviors that are modifiable. Examples of modifiable behaviors include HH performance and compliance with infection control policies (Larson et al., 2000; Pittet et al., 2000). For these reasons, nosocomial infections will have become a non-reimbursable expense by Centers for Medicare and Medicaid Services (CMS). In the future, nosocomial infections rates also will be reportable to the public and patients will have access to this information when choosing a hospital to provide their care. The Joint Commission on Accreditation of Healthcare Organizations (2012) published National Patient Safety Goals (NPSG) that emphasizes the importance for hospitals to continue to improve healthcare for the public. National Patient Safety Goal 07.01.01 focused on HAIs, which are known to pose a significant patient safety issue. Specifically, the focus of this NPSG was to promote HH within an inpatient hospital setting with the prevention goal to decrease cross-transmission of pathogens and to decrease HAIs. This goal requires hospitals to implement HH programs based on the CDC or World Health Organization (WHO)

guidelines. Additionally, the commission requires hospitals to set goals for improving compliance and to demonstrate improvement with HH performance. National Patient Safety Goal 07.03.01 focused specifically on multi-drug resistant organisms (MDRO) in the inpatient hospital setting (i.e. MRSA). This goal required hospitals to implement evidence based practice strategies that assist in preventing HAIs that are related to MDROs. The commission recognized that MDROs negatively influence patient care, pose a significant financial burden, and increase morbidity and mortality among patients (Abramson & Saxon, 1999; Cummings et al., 2010; Engemann et al., 2003; Hanberger et al., 2011).

A potential area to explore when examining methods to decrease HAIs is evaluating the RN as a potential vector for cross-transmission of organisms. Currently, there is a limited body of evidence that has examined RNs as carriers of MRSA, but what has been demonstrated in the science was that healthcare providers (HCP) carry MRSA and RNs carry it more often than any other HCP (Amorim et al., 2009; Elie-Turenne et al., 2010; Johnston et al., 2007; Scarnato et al., 2003; Sufflotto et al., 2008). Differentiation among specific MRSA carrier types was discussed in the literature. Cookson et al. (1989) was among the first to study this phenomenon. The researchers differentiated among nurses that *transiently* or *persistently* carried MRSA by screening them at multiple time-points. *Transient* carriage was far more common and was correlated with HAIs. Furthermore, Cookson et al. (2011) later explain that MRSA screening, and specifically differentiation of *transient* MRSA carriers types, may serve as a proxy for auditing hygiene practices. Unfortunately, the phenomenon of the nurse as a MRSA carrier is not completely understood. What is known is that HH plays an integral role in decreasing the risk of *transiently* carrying MRSA, which in turn decreases the likelihood of spreading this bacterium within the inpatient hospital setting (Cookson et

al., 1989; Cookson et al., 2011; Stone et al., 2007). Consequences of RNs *transiently* carrying MRSA include single patient cross-transmission (Cookson et al., 1989), endemic outbreaks of MRSA within hospitals (Thompson et al., 1982), nurses bringing MRSA home to their families (Mitsuda et al., 1999), nurses infecting themselves, and possibly cross-transmitting MRSA to the community (Elie-Tourenne et al., 2010).

It is widely accepted that effective HH performance is correlated with lower HAI rates (Larson et al., 2000; Pittet et al., 2000). Although the value of HH has saturated the literature, many studies continue to reflect poor compliance rates among RNs. The WHO reports that RNs were only 40% compliant with this behavior (WHO, 2005). Pittet et al. (1999) completed one of the largest HH studies with 2,834 observations of HH opportunities and noted 48% compliance among RNs. Mertz et al. (2011) completed an observational study and evaluated 13 inpatient hospitals and documented a 31.2% performance rate. Because performance rates remain poor, it is important to understand barriers, knowledge, and attitudes towards HH behaviors. Correlating these concepts with self-reported HH behaviors may give insight into this phenomenon, which may assist researchers in developing interventions aimed at increasing the RNs' understanding of perceived susceptibility.

There is a relationship between positive MRSA carrier status and ineffective HH behaviors (CDC, 2002; WHO, 2005), but there were significant limitations in the literature that evaluated prevalence rates of nurses who carry MRSA. Because of conflicting data about carrier status, it was difficult to draw conclusions related to this phenomenon. This conflicting data likely contributed to the RNs' perceived susceptibility (perceived risk) and perceived severity of transmitting pathogens and may explain inconsistent HH behaviors among RNs. Some studies describe that carrier status did not affect HAIs, while other more comprehensive studies defined carrier patterns and

implications of the carrier status (Cookson et al., 1989). Additionally, some studies link the nurse carrier of MRSA with cross-transmission to patients, while others explain that carrier status did not significantly affect infection rates (Johnston et al., 2007).

Currently, the state of the science related to nurse carriers of MRSA is unknown. What is known is that nurses are a primary care giver at the patient bedside and they are also known to be both *persistent* and *transient* carriers of MRSA (Cookson et al., 1989). In addition, *transient* carriage of MRSA has been directly linked with ineffective HH performance (Cookson et al., 1989). Implications drawn from the literature about nurse carriers of MRSA include the possibility of cross-transmission to patients, themselves, their families, and their community (Elie-Turenne et al., 2010). In studies that compared prevalence statistics by discipline, nurses carried MRSA more often than any other HCP (Amorim et al., 2009; Elie-Turenne et al., 2010; Johnston et al., 2007; Scarnato et al., 2003; Sufflotto et al., 2008). For these reasons it is important to examine the phenomenon of self-reported HH, knowledge about MRSA, barriers to HH performance and attitudes toward infection control. In addition, it would be valuable to identify possible relationships among concepts and predictor variables that may help explain the RNs' self-reported HH behaviors. These constructs will be explored with the Health Belief Model (HBM).

PURPOSE

Methicillin-resistant *Staphylococcus aureus* is one of the most commonly identified MDROs, which has been isolated in the inpatient hospital setting. For this reason, this study focused specifically on this MDRO. Because RNs are a primary caregiver at the patient bedside, they are known to be *transient* carriers of MRSA, and are

known to carry MRSA more often than any other HCP, this study focused specifically on the discipline of nursing.

The purposes of the study were to:

- Explore the RNs' self-reported HH performance rate;
- Explore the RNs' knowledge related to MRSA;
- Identify relationships between MRSA knowledge and HBM Constructs;
- Explore the RNs' barriers to HH performance;
- Identify relationships between barriers and self-reported HH performance;
- Explore relationships among HH behaviors and constructs in the HBM;
- Explore predictors of 'overall HH' performance;
- Identify if certain demographic characteristics are related to MRSA knowledge, self-reported HH, and HBM constructs

BACKGROUND AND SIGNIFICANCE

Methicillin-resistant *Staphylococcus aureus* is a multi-drug resistant gram-positive cocci bacterium found in clusters at the microbial level. Drug resistance to *Staphylococcus aureus* (*S.aureus*) has been noted since Penicillin was invented, but the distinction of MRSA was first documented in the 1960's, specifically with the use of the Methicillin antibiotic (Barrett et al., 1968). Historically, this virulent organism was named 'Methicillin-resistant *Staphylococcus aureus*,' but in current practice the Methicillin antibiotic is not used. Interestingly, to keep with tradition, laboratory reports still indicate Methicillin-resistance, although the Oxycillin antibiotic is often used to confirm this diagnosis. The more accurate definition of MRSA is Multi-drug Resistant *Staphylococcus aureus*.

Methicillin-resistant *Staphylococcus aureus* has been associated with STIs, necrotizing fasciitis, SSIs, pneumonia, necrotizing pneumonia, VAPs, CS, and death. Historically, some distinctions, based on symptomatology and strains, had been made between Community-acquired MRSA (CA-MRSA) and Healthcare-associated MRSA (HA-MRSA). Community-acquired MRSA was originally thought to be a milder case. However, it is important to note that this organism has genetically evolved over the years, thereby blurring the distinctions, making CA-MRSA just as serious as HA-MRSA, and nurses carry both strains. Traditional patient risk factors for infection include: damage to the integrity of the skin, a decreased immune system, older age, younger age, and comorbid medical diagnoses. Methicillin-resistant *Staphylococcus aureus* has evolved, which made this super-bacterium more virulent than ever. Because of the genetic mutation of strains, this super-bug affected people without traditional risk factors for infection. Furthermore, many adults and children without these risk factors died related to serious invasive MRSA infections (CDC, 1999; DeLeo et al., 2010; Groom et al., 2001; Naimi et al., 2001; Herold et al., 1998, Suggs et al., 1999).

It has been estimated that one-third of invasive MRSA infections were contracted in the hospital setting (Klevens et al., 2007). According to the CDCs Active Bacterial Core Surveillance Statistics (ABCs), 94,897 people developed serious invasive MRSA infections and 16,118 of those resulted in death in 2007. In a follow up ABC Surveillance Statistic report by the CDC (2008) there was a decrease in the number of invasive MRSA infections, describing that 89,785 people were affected and 15,249 of those infections resulted in death. These statistics demonstrate that the numbers of invasive MRSA infections and deaths related to invasive MRSA had decreased, but the prevalence of deaths related to MRSA remains stable (17%). It is important to note that the ABC Surveillance Statistic reports were limited to invasive MRSA infections and do not

account for the number of non-invasive infections that occur annually. Another significant trend reported in the literature is an exponential increase in the percentage of *S.aureus* infections that were confirmed as MRSA. In 1992, 35.9% of all *S.aureus* infections were confirmed as MRSA compared with 64.4% in 2003 (Klevens et al., 2006). Statistics of MRSA infections in the Intensive Care Unit (ICU) also reflect an exponential increase that is particularly concerning. In 1974, 2% of *S.aureus* infections in ICUs were MRSA, which increased to 22% in 1995, and 64% in 2004 (Klevens et al., 2006).

Methicillin-resistant *Staphylococcus aureus* colonization has been a discussion topic in many inpatient hospital settings. Colonization is defined as the process of a person carrying a particular bacterium without symptoms of infection. However, if an opportunity presents itself, either with a loss in skin integrity or a reduction in the immune system, then this bacterium has the potential to cause harm. Current practice in many inpatient hospital settings advocate for MRSA screenings to be completed on patients that were considered high risk for MRSA colonization (Peterson et al., 2007). If the patient is positive for this screen they were placed on contact isolation precautions in an effort to contain MRSA and decrease the susceptibility of cross-transmission to other patients. Although high risk patients were screened, many patients who were not screened also carried MRSA. Registered nurses are also susceptible to carrying MRSA based on the nature of the profession and routine exposure to this virulent organism. Screening patients for colonization and not screening RNs often left many confused about the screening practice, which may affect perceived severity and perceived susceptibility for cross-transmission of organisms. This may be a factor that influenced HH behaviors among RNs.

Because HH performance is directly linked to *transient* MRSA carrier status and nosocomial MRSA infections, it is important to evaluate measures for determining HH performance. According to WHO (2005), the current gold-standard for measuring HH performance is an observation method. This method used a calculation of 'actual HH' divided by 'opportunities for HH,' which was multiplied by one-hundred. This statistic represents a percentage of HH performance. Limitations for this gold-standard measurement include: Hawthorne effect, subjective data collection, inconsistent methods for gathering observation data, convenient timing for data collection, and personnel training. Although this is a gold standard for measurement, there were recommendations to identify more cost-effective methods for collecting these data, which include self-reported HH performance (Larson et al., 2004). For this reason, self-reported HH statistics were examined in this study.

PROBLEM STATEMENT

According to the CDC (2010), reducing MRSA in both healthcare and community settings is a continued priority that remains at the forefront. Registered nurses are a primary source of direct patient care in the hospital setting and they are known to carry MRSA more often than any other HCP. Moreover, one-third of invasive MRSA infections occur in the nosocomial setting and HH is the single-most effective means for decreasing the risk of cross-transmission in the hospital setting. The literature supports that RNs were often ineffective with HH and this is not fully understood. Complementary strategies for infection control are needed to combat MRSA in the hospital setting and decrease the risk of spreading MRSA infections. This includes cost-effective data collection methods as well as investigating MRSA knowledge gaps, barriers to HH

performance, and examining constructs from the HBM that may help researchers more clearly understand HH performance behaviors among RNs.

RESEARCH QUESTIONS

Research Question 1: *What was the self-reported rate of HH performance among RNs (before touching the patient, before clean/aseptic procedures, after body fluid exposure risk, after touching the patient, after touching the patient's surroundings, and 'overall HH' performance rate)?*

Research Question 2: *What was the level of RNs' knowledge related to the MRSA bacterium; and was there a relationship between MRSA knowledge and constructs in the HBM as they were measured using the Infection Control Perception Survey (e.g. perceived susceptibility, perceived severity related to infection control)?*

Research Question 3: *What were the barriers to the RNs' ability to perform HH behaviors in the inpatient hospital setting; and was there a relationship between barriers to HH performance scores and 'overall HH' performance rates?*

Research Question 4: *What were the relationships between constructs in the HBM (e.g. perceived susceptibility, perceived severity, self-efficacy, perceived barriers, cues-to-action, and perceived benefits) with 'overall HH' behaviors; and do these constructs predict 'overall HH' performance rates?*

Research Question 5: *What demographic characteristics (e.g. years of work experience, age, education level and frequency of working with MRSA patients) were related to the RNs' knowledge of MRSA, self-reported HH performance, and constructs in the HBM (e.g. perceived susceptibility and self-efficacy related to infection control)?*

THEORETICAL FRAMEWORK

The HBM, which originated in 1966 by Irwin Rosenstock, was used in this study in an effort to understand and explain HH behaviors among RNs in the inpatient hospital setting. This model was chosen for this study because the five constructs, as well as the underpinning of the philosophy, was a good fit for understanding HH behaviors among RNs. The philosophy of this model underscored that one must understand the rationale for decision making as well as influencing factors that affect behaviors related to health risks (Rosenstock, 1966). The model was originally created to increase knowledge and awareness among scholars related to gaps in behavioral research. Specifically, it was designed in an attempt to understand how people made decisions about their health practice because behaviors could be modified if there was first an understanding of the underlying processes that affect these behaviors (Rosenstock, 1966).

There were five key constructs that were established in the HBM, which include perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and cues-to-action (Rosenstock, 1966). These constructs were used extensively to understand behaviors that may influence health and illness. Because of inter-relatedness among constructs in the HBM and Social Cognitive Theory (SCT) many researchers included the construct of self-efficacy by Bandura (1977) when trying to explain behaviors that were related to health. This was the case with the instrument that has been chosen to assess knowledge and attitudes of RNs toward infection control and MRSA, which was used in this study (Lewis & Thompson, 2009). For this reason, self-efficacy was discussed as a construct that may influence HH behaviors among RNs in the inpatient hospital setting and was incorporated with the HBM as a variable that may influence HH behaviors among RNs.

The literature was reviewed with emphasis placed on studies that evaluated the relationships among constructs in the HBM. This review was completed in an effort to assist in diagraming a theoretical framework with defined relationships that would be used to guide this study. After reviewing articles with particular focus on understanding the relationships among constructs in the HBM, it was determined that there is inconsistency among scholars regarding how these constructs interrelate. Articles that were evaluated had incorporated a visual diagram of the HBM. In addition, the study had to include at least three of the five constructs in the HBM as defined by Rosenstock (1966). Four of these articles (Baghianimoghadam et al., 2012; Dobe, 2012; Ghaffari et al., 2012; Lewis & Thompson, 2009) included all five constructs from the HBM. Baghianimoghadam et al., (2012) identified no significant relationships among HBM constructs as they were measured in this study. Ghaffari et al. (2012), Dobe (2012), and Lewis and Thompson (2009) did not include a correlation analysis to define the strength and magnitude of the relationships among constructs in the HBM. One study (Liao et al., 2010) included the correlation coefficients in the HBM figure and significant relationships were present among variables in the HBM. However, researchers only used four of the five constructs and left out perceived barriers. The first four defined the relationship among constructs in the figure with one arrow between constructs, which infers independent and directional relationships among constructs. However, Liao et al. (2010) created a model that demonstrated interrelatedness among all constructs and reported direction and magnitude of the relationships. This study revealed significant relationships among knowledge (r=.21, p<.01), self-efficacy (r=.23, p<.01), and perceived susceptibility (r=.14, p<.05) as they related to HH behaviors.

The HBM is consistent with the philosophic approach of empiricism. The goal of this philosophy was to derive knowledge though the senses, observation and experiment

(Rodgers, 2005). The HBM was congruent with this philosophy because the key concepts of perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues-to-action, and self-efficacy require data to be gathered empirically. First, through the senses, the researchers identified that ineffective HH practices were a health threat. Second, through survey data collection, the researcher examined how the concepts from the HBM related to self-reported HH behaviors. Additionally, it was consistent with the empiricist philosophy because the researchers were not seeking knowledge for knowledge-sake, but rather in an effort to serve the public and humanity, which was consistent with Sir Frances Bacon's notion of empiricism (Rodgers, 2005). Specifically gathering data in an effort to decrease HAIs among patients at risk for MRSA infection is aligned with this philosophy.

In Figure 1 the HBM has thin lines that connect all constructs within the model. This infers that all constructs in the HBM are interrelated, but the strength and magnitude of the relationship is unknown. There is a thicker black line from the dependent variable, 'overall HH,' to all constructs in the HBM. There is not sufficient evidence in the literature to make predictions about the strength and magnitude of self-reported HH and constructs in the HBM. This study evaluated the magnitude and strength of the relationships among constructs in the HBM. In addition, the relationship among HBM constructs and 'overall HH' performance was evaluated. These findings will be described later in Chapter four and five. The constructs of the HBM (Rosenstock, 1966) and self-efficacy (Bandura, 1977) are defined below:

Perceived susceptibility: individual's "subjective risk associated with contracting a condition" (Rosenstock, 1966, p. 99).

Perceived severity: is influenced by individual's "degree of emotional arousal created by the thought of the disease, as well as by the kind of difficulties the health condition created for them" (Rosenstock, 1966, p. 99).

Perceived benefits: "direction of action is influenced by beliefs regarding the relative effectiveness of reducing the disease" (Rosenstock, 1966, p. 100).

Perceived barriers: "negative aspects of health action arouse conflicting motives of avoidance" (Rosenstock, 1966, p. 100).

Cues-to-action: "variables which constitute readiness to act" (Rosenstock, 1966, p. 101).

Self-efficacy: individual's perceived ability to perform a behavior, which is influenced by expectancies and incentives (Rosenstock et al., 1988).

-Expectancies: include environmental cues, beliefs about consequences of action, and belief regarding one's own competence to perform a particular behavior that is needed to influence outcomes.

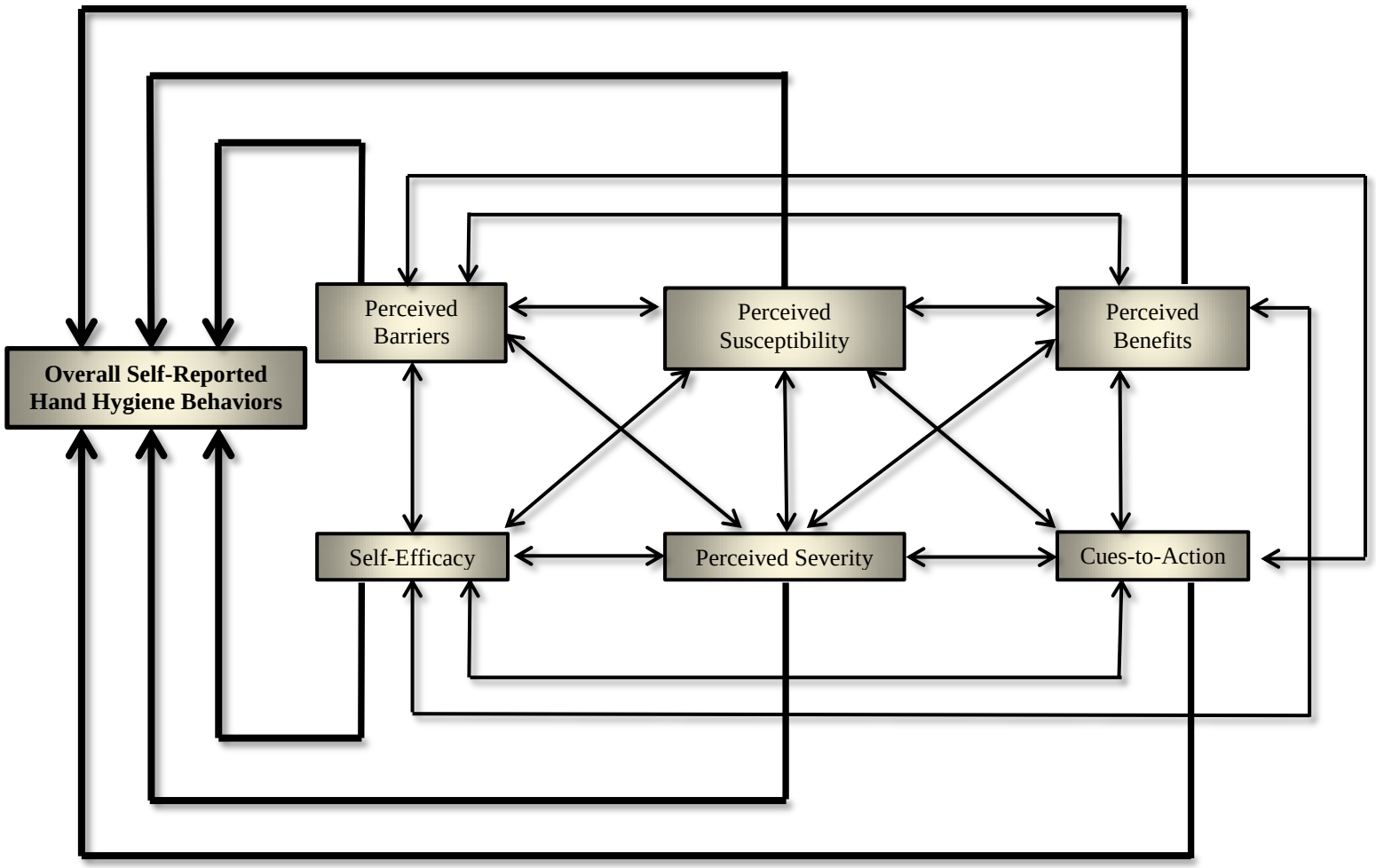
-Incentives: one's value of a particular outcome (i.e. health status, approval of others etc.).

Strengths and weaknesses of the HBM were evaluated using Walker and Avant's (2005) procedures for theory analysis. Strengths of this theory were that meaning and logical adequacy were present within this model. The concepts of perceived susceptibility, perceived severity, self-efficacy, perceived barriers, cues-to-action, perceived benefits and self-reported HH behaviors were very much related, which has been demonstrated in both the literature and practice settings. The concepts were well defined in the literature and they were easy to understand. The structure of the model and how the concepts relate was easily understood. Predictions related to this theory based on the interrelatedness of the concepts could be made. This model was very useful because the concepts were

recognized as being key components in predicting high risk behaviors. In this study, ineffective HH performance was considered to be a high risk behavior that influences HAIs. This theory also offers generalizability because it has been used widely in many types of healthcare settings to examine behaviors among RNs (Lewis & Thompson, 2009; Wolf et al., 2008). This model demonstrated transferability, because it has been often used in health related research that examined high risk behaviors affecting particular health conditions. This was evident in the abundance of literature using the HBM to explore health behaviors among conditions like Human Immunodeficiency Virus (Wutoh, 2005), breast cancer (Muthoni & Miller, 2010), chest pain (Katz et al., 2009), and diabetes (Schwab et al., 1994). This model was also parsimonious in that relationships between concepts could be easily understood and they were simple to understand. The HBM was useful in that the model remains practical and helpful in understanding and predicting outcomes. It has been widely used in behavioral sciences for understanding and predicting behavior. Testability was also strength of this model. Questions could be derived based on concepts, relationships could be established, and predications could be made. When evaluating the HBM using the steps outlined by Walker and Avant (2005) logical adequacy was the weakest step. This was primarily due to the fact that predictions were not made directly from the constructs in the HBM, but rather questions were posed to explore self-reported HH behaviors among RNs.

The HBM is a heuristic device because it could be easily understood and adapted to gain knowledge about RNs' self-reported HH behaviors and the relationship among this construct and behaviors that may influence or interfere with HH performance. The HBM incorporated all of the basic components of a theoretical framework: meaning, logical adequacy, usefulness, generalizability, parsimony, and testability. Research questions were developed based on potential relationships among concepts. This model

Figure 1: The Health Belief Model (HBM) and 'Overall Self-reported HH'



was useful and has demonstrated generalizability, because it has been widely used to explain high risk behaviors among groups. It was simple to understand and easy to use.

DEFINITIONS

The following empirical definitions were used for this study:

Self-reported HH Performance was defined as RNs' perception of their HH behaviors at every opportunity that presents itself for HH performance. This was measured by an assessment of the RNs' self-reported HH behaviors based on the WHO (2009) 'My 5 Moments for HH' (self-reported behaviors: before touching the patient, before clean/aseptic procedures, after body fluid exposure risk, after touching the patient, after touching the patient's surroundings, and 'overall HH' performance rate).

Hand Hygiene Behaviors was defined as hand washing, hand antisepsis, using hand gel, hand foam, sanitizer, or utilizing another form of HH approved at the participant's healthcare setting.

MRSA was defined as Methicillin-resistant *Staphylococcus aureus*, which is a gram-positive cocci found in clusters as confirmed by lab testing and antibiotic susceptibility.

MRSA Knowledge was defined as RNs' knowledge related to basic practices and guidelines as they relate to MRSA in the inpatient hospital setting. MRSA knowledge was measured using an instrument by Brady et al. (2009), which assessed MRSA knowledge among HCPs working in the inpatient hospital setting.

Barriers to HH Performance were defined as perceived obstacles that interfere with the RNs' ability to perform HH when opportunities were presented while working in the inpatient hospital setting. Barriers were assessed using the factors for poor adherence

that were published in the guidelines on HH in healthcare (WHO, 2009) and asked the RNs to rate the level of agreement with each of the barrier statements.

Nurse Demographic Characteristics were reported as age, years as registered nurse, years in healthcare, nursing education, employment setting, specific unit, acuity level, and frequency of working with patients that have MRSA infections.

ASSUMPTIONS

The following assumptions were made for this study:

1. Participants will answer honestly to the anonymous survey
2. Greater experience in caring for MRSA positive patients will increase knowledge related to MRSA
3. Knowledge alone will not affect self-reported HH performance

CHAPTER SUMMARY

In summary, MRSA can result in death for people that do not have traditional risk factors for infection. This organism has genetically mutated into virulent strains, some of which are deadly. One-third of invasive MRSA infections are cross-transmitted in the inpatient hospital setting. It is known that *transient* carriage of MRSA contributed to this statistic. It is also known that nurses carry MRSA and they carry MRSA more often than any other HCP (Amorim et al., 2009; Elie-Turenne et al., 2010; Johnston et al., 2007; Scarnato et al., 2003; Sufflotto et al., 2008). Because HH performance rates among RNs has remained low (40%) and HH is directly related to *transient* carriage of MRSA, it is prudent to understand the relationship between RNs' self-reported HH behaviors and potential variables that may help explain the RNs decision making about HH. For these reasons, it would be particularly important to explore self-reported HH behaviors among RNs, knowledge about the MRSA bacterium, and how the constructs within the HBM

relate to self-reported HH behaviors. This understanding may help explain this risky situation of low HH performance.

Chapter 2: Review of Literature

INTRODUCTION

This chapter will review evidence surrounding RNs' knowledge and attitudes and infection control practices with emphasis on how these constructs relate to HH behaviors. Because it has been well documented that ineffective HH performance is related to *transient* MRSA carrier status, it is prudent to explore behaviors that may influence this behavior, which potentially affects MRSA carrier status. There is an extensive body of literature surrounding HH performance and potential barriers that RNs may encounter, which could influence performance. Despite overcoming many barriers to performing HH, RNs continue to have difficulty performing HH on a regular basis. This chapter focuses on reviewing the literature specifically related to knowledge and attitudes about MRSA, infection control, guidelines for infection control, HH behaviors, and HH measurement among RNs in the inpatient hospital setting.

REVIEW OF LITERATURE: RNS AND MRSA

Methodology for Literature Search

A literature search was conducted using the CINAHL and PubMed databases. In the first search, the CINAHL database was used with the search terms 'MRSA' and 'Nurses,' which yielded 145 results. Limitations were placed on the search that included full text, English language, and humans. This reduced the articles from 145 to 57. Articles were evaluated without limitations to understand the rationale for the dramatic decrease in the number of articles after limitations were assigned. Discarded articles were mostly briefs, letters to the editor, and foreign language articles without English

translation. In the second literature search, the PubMed database was used, with the same search terms and limitations. The general search yielded 168 articles, which was reduced to 113 with the same limitations. Thirty-eight articles were repetitive between databases. The final 132 articles from 1982 to 2010 were evaluated for content and six categories emerged. Categories included: MRSA prevalence rate among HCPs (12), MRSA prevalence rate among patients (6), MRSA prevalence rates among HCPs and patients (3), HCP knowledge/attitudes towards MRSA (29), infection control (62), and guidelines for infection control (20). Special focus was placed on articles that described HCP knowledge and attitudes as well as infection control practices when they related to MRSA.

Knowledge and Attitudes

Knowledge and attitudes toward MRSA were key measures for implementation of effective infection control practices in the inpatient hospital setting. A baseline knowledge assessment helps guide planned interventions. In addition, it is imperative to explore attitudes and bias towards a particular phenomenon when changing a desired behavior. Knowledge and attitudes towards MRSA were assessed in the literature via questionnaire method in several studies (Brady et al., 2009; Easton et al., 2007; Mamhidir et al., 2010; Phillips et al., 2010). Reliability and validity of instruments were rarely described. The instruments were often developed by the research team and then administered to a convenience sample of participants, which incorporated a cross-sectional data collection design at one time point. There were significant differences noted among surveys, which indicated that there was no current standard measurement tool used to evaluate the RNs' knowledge and attitudes towards MRSA in the inpatient hospital setting.

Questionnaires that focused on MRSA knowledge inquired about type of bacteria, colonization, most effective hand-hygiene method, sources of infection, how to care for a MRSA patient, sites tested to determine carrier status, contact precautions to implement, common risk factors, and MRSA treatment (Brady et al., 2009; Easton et al., 2007; Mamhidir et al., 2010; Phillips et al., 2010). Most articles noted a deficiency in knowledge related to MRSA. Brady et al. (2009) found that less than 50% of HCPs could answer three questions properly on the questionnaire administered. For example, HCPs did not know that more than 40% of *Staphylococcus aureus* infections were MRSA; believed that all staff on a unit needed to be screened for MRSA if a new carrier was found among previously negative patients; and believed they could refuse to accept a patient transfer of a MRSA positive patient on the bases of risk posed to other patients by an individual's carrier status or infection with MRSA (Brady et al., 2009). Easton et al. (2007) identified that 25% of physicians and 7% of nurses could correctly identify the method of infection control in the management of the patient infected with MRSA; 30% of physicians and 36% of nurses could correctly identify the sites used to detect MRSA colonization; 34% of physicians and 17% of nurses could identify the most common sites for MRSA infection; and 69% of physicians and 67% of nurses identified that they needed more information and education related to MRSA topics. Mamhidir et al. (2010) used a questionnaire that asked specific questions related to MRSA. When questions related to HH and the spread of MRSA was asked, 93% of HCPs correctly agreed that proper HH was an effective method to prevent the spread of MRSA. However, knowledge was deficient when the HCPs were asked specific questions related to MRSA precautions. For example, 56% of HCPs incorrectly agreed that a mask should always be worn when a patient with MRSA is treated. In addition, 31% of HCPs incorrectly agreed that gloves gave complete protection against the spread of MRSA. Mamhidir et al.,

(2010) identified that knowledge was poor among all HCPs but physicians had significantly higher knowledge results when compared to nurses and clinical assistants. Phillips et al. (2010) demonstrated that there was not a significant between group difference among nurses and physicians when examining knowledge about MRSA. The questions used for assessing knowledge were incomplete in the tables and specific results to each question were not specified in the details of the manuscript.

Attitudes towards MRSA were evaluated differently in each study. Burkitt et al. (2010) asked whether the HCP thought that MRSA was a national health problem, a problem for their hospital, or a problem for their department (Burkitt et al., 2010). They examined the effect of HH practices and contact precautions on their perceived susceptibility of infecting themselves or patients (Burkitt et al., 2010). Burkitt et al. (2010) also asked about the comfort level of holding other staff members accountable for HH and contact precaution behaviors. In addition, they asked system related questions about staffing, transportation of MRSA positive patients, and whether or not the HCP believed that this contributed to MRSA transmission in the inpatient hospital setting. Another study by Phillips et al. (2010) evaluated attitudes of HCPs working with MRSA positive patients in an Ear Nose and Throat ward. Questions asked using a 5-point Likert scale were aimed at understanding the level of agreement towards specific statements regarding care of the MRSA patient. Statements include: MRSA positive patients take up more of my time, a patient infected with MRSA should not have visitors, hospital staff should spend as little time as possible with MRSA patients, patients colonized with MRSA have poor personal hygiene, MRSA infected patients were a burden to the staff, people colonized with MRSA were a danger to everyone they come in contact with, and a patient infected with MRSA does not make my job more difficult. The Ear, Nose and

Throat physicians displayed negative attitudes and incorrect knowledge related to MRSA. The nurses displayed more knowledge, and this difference among groups was significant.

When examining attitudes of staff it was also important to understand perceived susceptibility associated with contraction of an infectious disease. Gill et al. (2005) examined MRSA awareness and perceptions in an 800-bed inpatient hospital setting. The researchers specifically focused on three questions regarding MRSA including: awareness of MRSA, how they heard of MRSA, and their perception of susceptibility towards contracting MRSA. They identified that 100% of staff were aware of MRSA, 24% of HCPs learned about MRSA from media sources and 43% of HCPs learned about it in their general studies. In addition, 27% of nurses believed they were susceptible to MRSA and 52% of physicians believed they were at risk for contracting MRSA.

Questionnaires reviewed had several limitations. Most were tested in cross-section designs with data collected at one time point. Studies provided much more useful and valuable information when they evaluated knowledge and attitudes before and after infection control interventions were implemented to demonstrate change versus no change in outcome variables (Burkitt et al., 2010). The knowledge questionnaires had similar questions, while the attitude questionnaires varied tremendously. Although all of these studies contribute to the science, this review indicated that there was not a current standard measure for assessing RNs knowledge and attitudes as they relate to MRSA. A standardized instrument would be useful to capture and assess RNs' knowledge and attitudes in the inpatient hospital setting. Then studies could be easily compared and evidence-based interventions could be designed from them.

Infection Control

MRSA is known to be easily transmitted (Yamamoto & Marten, 2008) and the most frequently spread organism in the hospital setting (Blatnik & Lesnicar, 2005). It is widely known that HH is the single most important means in preventing the spread of MRSA infection. Additionally, *transient* MRSA carriage is highly associated with ineffective HH performance behaviors (Afif et al., 2002). Infection control programs highlight the importance of HH training for staff, prompt patient isolation, use of contact precautions with known or suspected cases of MRSA, flagging of medical records, and education programs specifically designed to increase staff monitoring and performance (Burkitt et al., 2010; Griffiths et al., 2002). However, these strategies were not sufficient as evidence by MRSA persisting as an invasive HAI in many settings.

Adherence to effective infection control measures was highly correlated with lower nurse carrier prevalence rates of MRSA within the inpatient hospital setting (Johnston et al., 2007). Infection control practices that were recognized as primary intervention tactics for lowering rates include, early detection of MRSA positive patients with implementation of contact precautions, strict HH behaviors, improved environmental cleaning, and staff education (Amorim et al., 2009). Identification of carrier status also was recognized as being a valuable contribution to infection control (Amorim et al., 2009). Current statistics demonstrate that MRSA infection rates persist and the death rate for patients infected with invasive MRSA infections remains stable at 17% (CDC, 2007; CDC, 2008). In addition, infection control practices were not always implemented. This signifies a need to find complementary strategies to combat MRSA. One way is by examining the nurse as a potential vector for cross-transmission, and another is by understanding the RNs' decision making when it comes to HH performance behaviors. Implications for the practice setting include examining the HH behaviors of

RNs, assessing barriers to performance, assessing knowledge related to MRSA, and exploring attitudes about infection control practices to better understand the RNs' decision making about HH behaviors.

Guidelines for Infection Control

The current infection control practice guidelines set forth by the CDC (Siegel et al., 2006) to prevent the spread of MRSA in the healthcare setting included the use of standard precautions with all patients, and contact isolation precautions to prevent transmission of MRSA. Additionally, the CDC (Siegel et al., 2006) did not recommend decolonization regimens, giving the rationale that current strategies were not effective and most often *transient* carriage results from ineffective HH performance. The CDC only recommended decolonization of HCPs that were linked to MRSA outbreaks in the hospital setting, and did not support routine screening and decolonization. This recommendation was also reinforced in Europe in a practice guideline by Coia et al. (2006) documented by The British Society of Antimicrobial Chemotherapy, Hospital Infection Society and Infection Control Nurses Association. There was agreement among scholars that inappropriate decolonization may lead to further antimicrobial resistance. They also agree that obtaining active surveillance cultures from staff was not recommended on a routine basis, unless association between an affected staff member and patient was established.

LITERATURE REVIEW: HH

Although it was well documented that HH performance was the most effective means for decreasing the spread of infection, the World Health Organization (2005) reports that nurses were roughly 40% compliant with this practice. In addition, ineffective HH performance has been associated with *transient* MRSA carriage in nurses. The focus

of this literature review was to assess HH behaviors among nurses; barriers to HH performance; HH measurement; and knowledge, attitudes, and perceptions of nurses towards HH performance. The data gathered from this literature review influenced the methodology for data collection for this study.

Methodology for Literature Search

A literature search was conducted with the PubMed and CINAHL databases in order to review HH literature pertaining directly to nurses working in the inpatient hospital environment. PubMed was used for the first search and the key term 'hand hygiene' was applied, which yielded 3449 results. Then 'hand hygiene, nurses' was searched, which generated 266 results. Limitations of full text, English language and humans were added, which reduced the number of articles to 191. Articles that were not specific to inpatient hospitals or HH were discarded, leaving 86 to review. Another search was conducted using the CINAHL database using the key term 'hand hygiene,' which yielded 1357 results. When 'hand hygiene, nurses' was entered it reduced the amount of articles to review to 51. When limitations were added this reduced the number of articles to review to 4. For this reason, limitations were removed and the original 51 articles were reviewed. There were 32 articles that were repetitive among the databases and four were published in a language other than English. Eight articles were discarded because they were nonspecific to nurses or inpatient hospital settings. This left seven articles to review from the CINAHL database. These were added to the 86 articles from PubMed for a total of 93 articles to review between databases. Titles of articles were reviewed and categories associated with HH performance emerged. Categories include: HH behaviors and performance (17), HH measurement: observation and self-report (11), knowledge, attitudes and perceptions towards HH (6), barriers to HH performance (9),

intervention studies (11), systems (24), guidelines (7), patient participation (5), and team approach (3). The last six categories were removed from this literature review, because the focus of these articles would assist with intervention planning strategies to increase HH performance. Because the nature of this study did not incorporate a HH intervention, these articles were read for content but then set aside. HH behaviors and performance; HH measurement: observation and self-report; and knowledge, attitudes and perceptions towards HH (*n*=34 studies) were the primary focus of this literature review and influenced the methodology for data collection for this study.

Hand Hygiene Behaviors and Performance

The Theory of Planned Behavior (TPB) has been used in numerous research studies to explain and predict HH behavior among RNs. The TPB operates under the assumption that behaviors were determined by one's intention to perform the behavior. It can be used to describe the intention to perform behaviors, which could be predicted by three variables (attitude, subjective norms, and perceived behavioral control). Furthermore, these variables were predicted by personal beliefs about the outcome of this behavior. Whitby et al. (2006) determined that community behavior, attitudes, and peer behavior were strong predictors of intent to perform HH behaviors. O'Boyle et al. (2001) identified that intention was predicted by motivational factors and self-reported HH was related to intention to perform this behavior. Wandel et al. (2010) used the Behavioral Theory Model to test a survey aimed at predicting determinants of ineffective HH performance. They found that low self-efficacy and a negative attitude predicted ineffective HH performance among nurses. Erasmus et al. (2010) incorporated Action Planning into their study. The researchers explain that action planning has been used in many other professions to close the "intention-behavior gap" (Erasmus et al., 2010,

p.161). The investigators expand on the rationale for using action plans because they were known for linking situational cues with behavior, which assist in moving intention toward behavior. Erasmus et al. (2010) explain that success in implementing plans related to HH performance was directly related to the RNs' ability to plan how they would fit routine HH into their practice.

Table 1: Hand Hygiene Performance among RNs

Date	Author	Performance Rate	Department
2001	O'Boyle et al.	70%	Critical Care
2004	Raboud et al.	46%	Acute care
2008	Qushmaq et al.	61%	Critical Care
2009	Asare et al.	21%	Neonatal
2009	Saint et al.	34%	Acute Care
2010	Davis, C. R.	24%	Surgery
2010	Randle et al.	75%	Acute Care
2010	Sahay et al.	61%	Critical Care
2011	Martino et al.	19%	Emergency Room
2011	Polat et al.	78%	Neonatal
2011	Scheithauer et al.	57%	Pediatric
2011	Scheithauer et al.	66%	Neonatal

The current literature review produced 12 observational studies between 2001 and 2011 (Table 1). It was interesting that the first article was published in 2001, because there were no date limitations set for this literature review. There were only two HH observation studies published between 2001 and 2008, yet 10 were published between 2008 and 2011. This may indicate a more recent epidemiological interest in understanding HH performance statistics, because reimbursement in inpatient hospital

settings will be influenced by HAIs. Several inpatient units were represented in this literature review including: neonatal (3), critical care (3), inpatient acute care (3), emergency room (1), surgery (1), and pediatrics (1). The rate of HH performance ranged from 19% to 78% (Table 1). These statistics are not ideal. More research is needed to increase HH motivation and positively influence performance.

Barriers to HH performance have been cited in a number of studies. The WHO (2009) has compiled a list of factors for poor adherence/low compliance in the WHO Guidelines on HH in Healthcare. Factors include resource availability (e.g. lack of sinks, inaccessible supplies), personal factors (e.g. skin irritation, lack of knowledge), interpersonal factors (e.g. interferes with HCP-patient relationship), and system factors (e.g. high workload, insufficient accountability) to name a few. The CDC (2002) identified additional system factors including professional category (e.g. nurse, physician), hospital ward, time of day, and patient acuity. McGuckin et al. (2006) reinforce resource availability (e.g. lack of sinks, lack of time, skin irritation, cost of products), personal factors (e.g. ignorance), and system factors (e.g. divided health culture and insufficient accountability) contribute to barriers in HH performance. The WHO (2009) factors for poor HH adherence are listed in Table 2.

Complacent attitudes towards HH emerged in the literature. Despite knowledge related to HAIs and MDROs, the perceived susceptibility of contracting MRSA among HCPs has remained low 34% (Gill et al., 2005). This may contribute to low HH performance rates among HCPs. It has been identified that knowledge alone did not decrease the risk of HAIs or increase HH performance among HCPs. The literature supports that HCPs often had some basic knowledge related to HH practices, but when it came to understanding procedure or when to perform HH, HCPs were not as well versed.

Table 3 represents Lewis and Thompson's (2009) results from a HH knowledge questionnaire administered to HCPs within a community based hospital.

Table 2: Poor HH Adherence (WHO, 2009)

Barriers to HH Performance
Resource Availability • Lack of sinks • Lack of soap, paper towel, hand washing agents **Personal Factors** • HH agents cause skin irritation and dryness • Belief that wearing of gloves is HH • Not thinking about it or forgetfulness • Lack of knowledge of guidelines • Belief that there is a lack of scientific information on effects of HH on HAIs • Perceived low risk of acquiring infection from patients • Lack of active participation in HH promotion at the individual level **Interpersonal Factors** • Interference with HCP-patient relationship • Patient's needs take priority • Activities with high risk for cross-transmission **System Factors** • Too busy or insufficient time for HH • Understaffing/overcrowding • High nurse-to-patient ratio • Working in high risk areas • Working on weekdays • Lack of active participation in HH promotion at the institutional level • Lack of role model for HH • Lack of institutional priority for HH • Lack of administrative sanction of non-compliers/rewarding compliers • Lack of institutional safety climate

Table 3: Results of HH knowledge questionnaire (Lewis & Thompson, 2009)

Results of HH Knowledge Questionnaire
• Hospital had a HH policy (100%) • Artificial nails were not allowed (98%) • Alcohol-based hand sanitizer was available (99%) • Gloves need not be changed when moving from contaminated body site to clean body site on the same patient (99%) • Hot water was not necessary for HH (57%) • One should rinse hands with finger tips pointing down (58%) • It was necessary to wash hands after contact with only medical equipment and supplies within patient areas (18%) • It was necessary to wash hands after coming in contact with patient's intact skin, such as taking blood pressure (88%)

Hand Hygiene Measurement: Observation and Self-Report

This literature review revealed the two most common forms of HH measurement, which include observation and self-report monitoring. The WHO (2005) recognized direct observation method as the gold-standard for assessment of HH performance. This method of data collection was universally calculated by observing 'actual HH' divided by 'opportunities for HH,' which was multiplied by one-hundred. This calculation represents percentage of HH performance for the observed period of time. This subjective form of measurement has significant limitations which included: Hawthorne affect, required trained personnel to complete observations, and the potential for inflated statistics because often these observations were conducted during times of convenience. The literature reveals that the average HH performance rate was roughly 40% for most HCPs (Boyce et al., 2002; WHO, 2005). Additionally, limitations in measurement may account for inflated statistics in some inpatient hospital settings. This was evident in hospitals reporting 100% HH performance. In the literature, direct observation studies used an observer, a HH audit tool, and calculated percentage of HH performance as described

previously (Polat et al., 2011; Qushmaq et al., 2008; Randle et al., 2010; Rosenthal et al., 2009; Scheithauer et al., 2011).

The studies included in this review were similar in calculation of HH performance; however they varied in data collection methods. Although direct observation has traditionally been recommended, it was met with numerous barriers that could affect the reliability of collected data. Barriers include the cost associated with directly monitoring RNs, the time it took to perform direct observations, and Hawthorne effect (Larson et al., 2004). In order to mediate the Hawthorne effect, Qushmaq et al. (2008) blinded the participants to the observation study. Healthcare professionals were notified by the infection prevention department that anonymous observers would be monitoring HH practices on their unit. Although the participants were aware that someone may be watching, they were blind to the direct observation event. The observers used discrete hand held devices to record observations. Qushmaq et al. (2008) explained that keeping the participants blind to the direct observation strengthened the study, as this assisted them in gathering more accurate data. Randle et al. (2010) conducted a direct observation study over a 24-hour period. In this study, the data collectors observed two units over a 24-hour period. The surveyors performed observations on unit one for 20 minutes and then traveled to unit two and observed for 20 minutes. Then the surveyors traveled back to unit one and continued this pattern. Randle et al. (2010) explained that this evidence-based method assisted them in gathering an accurate snapshot of HH performance for these two hospital units. They completed 823 total observations within 24-hours.

Self-report was another form of HH data collection. Larson et al. (2004) compared direct observation and self-report methods for gathering HH performance results. The researchers used a unique method for collecting data and analyzing results. In

this study, diary cards were provided to nurses to collect data. The nurses were instructed to prospectively record HH practices and actual HH performance was collected using tick marks for each HH episode. A trained observer also collected data using the same diary cards. Means and confidence intervals were calculated from both the nurse and the trained observer's diary cards. The means were compared by calculating effect sizes to examine differences between self-report and direct observation. Larson et al. (2004) explain that there were significant differences between observation and self-report methods. They argue that Hawthorne effect has a substantial influence on HH performance results. Because direct observation was time consuming and costly for many healthcare settings, they recommend using practical, less costly methods for collecting HH performance data. Larson et al. (2004) discussed that they were unable to assess which method was more accurate due to the process they used for data collection; however the researchers make final recommendations that more cost-effective methods for gathering HH performance data were needed and recommend examining self-reported HH performance statistics. Moret at al. (2004) also compared observation and self-report. In this study the method of data collection was not simultaneous. First, the researchers conducted a standard direct observation study. Then one week later the researchers asked the HCPs to self-assess their HH using a questionnaire. Self-reported performance was rated at 74%, which was similar to the observed performance rate of 80%. In other studies, self-report has been criticized as being flawed. Cole (2008) conducted a self-report study and used a questionnaire as well as an interview method to collect data. In this study, Cole (2008) identified that nursing students highly overestimated their self-assessments. They explain that this result may be the result of focusing on nursing students and level of experience may influence their ability to self-report HH behaviors.

Hand Hygiene Knowledge, Attitudes and Perceptions

Knowledge, attitudes and perceptions are important to measure when discussing HH behavior, because these concepts were identified as factors that may affect one's intent to perform behaviors. Five manuscripts were identified in this literature review that focused on assessing HCP's knowledge, attitudes and perceptions towards HH performance. Each of these studies were evaluated and entered in Table 4. Three questionnaires did not provide reliability or validity of the instrument used to measure knowledge, attitudes and perceptions. For this reason, they were set aside and the two instruments that measured reliability were evaluated.

Table 4: Knowledge Attitudes and Perceptions of HH

Date	Author	Tool	Reliability
2005	Pessoa-Silva et al.	Unnamed: 74-item questionnaire	Cronbach alpha: Subscales: 0.72-0.84
2006	Quiros et al.	Attitudes Towards Practice Guidelines: 12-item questionnaire	Unreported
2009	Lewis et al.	Infection Control Perception Survey: 51-item questionnaire	Cronbach alpha: 0.82 Subscales: 0.65-0.81
2010	Burkitt et al.	Unnamed: 8-item questionnaire	Unreported
2011	Mamhidir et al.	Unnamed: 13-item questionnaire	Unreported

Pessoa-Silva et al. (2005) used a 74-item questionnaire to assess HCP's attitudes and perceptions towards HH performance. The cognitive items from this instrument were based on the concepts from the TPB. The researchers added explanatory variables for 'intention to comply with HH' and 'perception of risk.' This instrument reported high reliability for individual cognitive factors related to HH (Cronbach α ranges from 0.72 to

0.84). Although the internal consistency coefficient was high, there were some limitations to this instrument. The authors explain that infection prevention personnel administered the instrument, which potentially resulted in social desirability bias. In addition, social or environmental pressure may be reflected in the results rather than HH performance intention. Although at first glance this instrument appears to be a reasonable choice for this study, another instrument created by Lewis et al. (2009) was a better fit. In the study conducted by Lewis et al. (2009), researchers tested HCP's perceptions and knowledge of infection prevention practices in an inpatient setting. The Infection Control Perception Survey is a 51-item questionnaire that incorporated six highly reliable subscales. The subscales are listed as follows: perceived severity (0.81), perceived susceptibility (0.70), perceived benefits (0.75), cues-to-action (0.76), barriers (0.73), and self-efficacy (0.65). This tool was a more comprehensive scale that assessed a broader spectrum of behaviors that may influence HH behaviors. The researchers also report a high overall reliability for this instrument (*Cronbach* α= 0.82). For these reasons, this instrument was used for this study.

Discussion

The phenomenon of inadequate HH performance among RNs is not completely understood. What is known is that nurses are merely 40% compliant and poor HH may contribute to HAIs. Barriers to HH performance have been well established in the literature, but additional research is needed to understand how these barriers actually influence HH performance behaviors. In addition, it may be useful to correlate barriers with specific HH 'moments' to identify how specific barriers may influence different 'moments' of HH. Understanding MRSA knowledge and attitudes about infection control practices could be used to identify if constructs incorporated in the HBM are related or

could be predictors for self-reported HH behaviors among RNs. Further understanding of this phenomenon is necessary in order to provide a foundation for intervention planning aimed at increasing HH performance rates, increasing knowledge, alleviating HH performance barriers, and decreasing the rate of RNs that carry MRSA.

Chapter 3: Methodology

INTRODUCTION

The methodology for the study is described in this chapter. The discussion includes the research design, the sample, inclusion criteria, power analysis, protection of human subjects, data collection procedures, instruments, and analysis of data. The purposes of this study are to: explore the RNs' self-reported HH performance rate; explore the RNs' knowledge related to MRSA; identify relationships between MRSA knowledge and HBM Constructs; explore the RNs' barriers to HH performance; identify relationships between barriers and self-reported HH performance; explore relationships among HH behaviors and constructs in the HBM; explore predictors of 'overall HH' performance; and identify if certain demographic characteristics are related to MRSA knowledge, self-reported HH, and HBM constructs.

RESEARCH DESIGN

The design for the study is descriptive and cross-sectional using self-report data gathered in a questionnaire booklet. A descriptive research design was used to create an accurate portrayal of a group's characteristics where a particular phenomenon was occurring (Polit & Beck, 2004). For the purposes of this study, the phenomenon of interest was HH behaviors among RNs in Central Texas. A cross-sectional design was used to examine a particular phenomenon at one-time point (Polit & Beck, 2004). The questionnaire booklet was mailed to the RNs and captured data at a single time-point.

SAMPLE DESCRIPTION

Sample

A mailing list was purchased from the Texas Board of Nurse Examiners. The listing from the Texas Board of Nurse Examiners includes: license number, name,

mailing address, date of birth, nursing school name, nursing school state, year of graduation, license issuance, state of original licensure, license status, license expiration date, county name, gender, ethnicity, primary practice setting, primary practice position type, primary specialty, advanced practice recognition, and current board action information. Filters were placed on the database to focus on RNs that reside in Texas, live in the Core Central Texas area, currently licensed in Texas, and work in the inpatient hospital care setting. The list included a total of 253,895 RNs. The first filter placed on the database focused on RNs with a Texas license that reside in the state (*N*=237,383). The next filter included restricting the list to the 15 counties in the Core Central Texas area (*N*=23,985). A third filter was placed on RNs currently employed as a staff nurse (*N*=11,527). The final filter focused on primary practice setting and inpatient hospital care was selected (*N*=8,093). A computer software system was designed to randomly generate 720 participants from the filtered list of 8,093 potential RNs that lived in Central Texas. The 720 RNs and their information included from the Texas Board of Nurse Examiners was saved in an Excel spread sheet and was used for creating address labels for the study.

Inclusion Criteria

The inclusion criteria for the study were RNs currently licensed in the State of Texas, actively practicing as a RN, and practice in the inpatient hospital setting. The RNs with the following criteria were excluded from the study: a) in-active license, b) stipulations on license, and c) expired license. These RNs were excluded from the final list with filters as previously mentioned. Registered nurses that worked in the following areas were excluded from the study: nursing home, ambulatory care, long term acute care, home health, nursing education, school nursing, and out-patient dialysis clinics.

Registered nurses that did not work at the bedside within an inpatient hospital setting were excluded from the study.

Power Analysis- A Priori

Power is described as the probability to detect an effect within a particular population (Polit & Beck, 2004). A power analysis was completed after effect size, probability of error, and power were entered into the G*Power software version 3.1.6 (Erdfelder et al., 1996). After these data points were entered, a mathematical calculation computed the sample size needed to decrease the risk of a type II error, which is wrongly accepting the null hypothesis. This analysis identified the appropriate sample size in order to find a desired effect within a given population (Polit & Beck, 2004). Table 5 demonstrates the selections made in the G*Power software:

Table 5: Power Analysis A Priori

Input Variables		**Output Variables**	
Effect Size f^2	0.15	Non-centrality Parameter λ	16.4
α error probability	0.05	Critical F	2.03
1-β error probability	0.80	Numerator df	8
Number of Predictors	8	Denominator df	100
		Sample size	**109**

The *F*-test was selected for test family; linear multiple regression; Fixed model R^2 deviation from zero was selected for statistical test; and a priori was selected for type of power analysis. Input parameters include the following: effect size f^2=0.15, *α error probability*=0.05, *power* (*1-β error probability*)=0.80, and number of *predictors*=8. Output parameters include the following: the non-centrality parameter λ=16.35, *critical F*=2.03, *numerator degrees of freedom*=8, *denominator degrees of freedom*=100, total

sample size=109, and *actual power*=0.80. In behavioral research, the widely accepted value for *power*=0.80 and *α error probability*=0.05 (Cohen, 1992). A moderate effect size was chosen for the power analysis for the eight predictor variables: perceived severity, perceived susceptibility, perceived benefits, cues-to-action, perceived barriers, self-efficacy, knowledge of MRSA, and barriers for HH performance. The rationale for choosing the moderate effect size was based on a systematic review of the literature by Huis et al. (2012). The researchers searched the Medline, CINAHL, and Cochrane databases and reviewed 41 HH studies conducted between 2000 and 2009. The articles were reviewed and the researchers listed the most common determinants for HH studies (knowledge, awareness, action control and behavior). Because similar determinants were examined in this study, the effect sizes reported in the systematic review were used to select the effect size for the a priori power analysis. When examining only one determinant the effect size was smaller (.176), but as more determinants were examined the effect size increased. The following were the effect sizes reported based on number of determinants: two determinants (.257), three determinants (.423), and four determinants (.439). The review reported effect sizes that ranged from medium to large. This study examined all four determinants for HH as they relate to self-reported HH performance. For this reason a medium effect size has been selected. Although the effect size reported for determinants was between medium and large, the medium statistic was selected for a more conservative approach, which required more surveys to be collected. Noting the poor response rate (8-13%) to surveys, 720 RNs were randomly selected to participate in this study (Aitkin et al., 2008; Farmer, 2004).

PROTECTION OF HUMAN SUBJECTS

Privacy and Confidentiality of Participants

The study did not begin until approval was received from Institutional Review Board at the University of Texas at Austin (Appendix A). This measure ensured the protection of human subjects. The researcher included a cover letter (Appendix B) and a consent document (Appendix C), and the questionnaire (Appendix D) in the mailing. The potential participants were told not to sign or return these forms. The cover letter and consent form described the following: (1) purpose of the study; (2) procedures for data collection; (3) directions for anonymous data collection; (4) risks and benefits; (5) the confidential treatment of survey results; (6) voluntary nature of participation; (7) the lack of repercussions for not participating; and (8) a disclosure stating that returning the completed anonymous questionnaire booklet indicated voluntary consent for participation in the study. All responses to the surveys remained anonymous.

Confidentiality of Research Data

Once questionnaires were returned to the researcher, they were kept in a locked filing cabinet. The people that had access to these data included the researcher and the faculty that supported the study. All questionnaires that were sent out were pre-numbered one through 720. The SPSS data analysis software was used and surveys were entered as they were returned. The survey number was entered as their participant identification number. There was no participant list that could link identifiable information with number listed on questionnaires. There was no participant identifiers entered into SPSS because the surveys were anonymous. Electronic databases and storage devices required a password for protection of data.

DATA COLLECTION PROCEDURES

When the pre-notice postcard (Appendix E) was mailed to the 720 randomly selected participants, 44 of the postcards were returned. The returned postcards had two different messages 'not deliverable and unable to forward' (*n*=27) or 'forward time expired' (*n*=17). The 27 potential participants that were not deliverable were removed from the questionnaire mailing list. The 17 participants with the message 'forward time expired' had updated addresses listed on the postcard. These addresses were reviewed and RNs that lived in the Core Central Texas area were included in the study. Their addresses were updated before the questionnaire mailing. Nine of the 17 were excluded from the study because the address listed was outside the Core Central Texas area and eight were updated in the Excel spreadsheet.

The questionnaire booklet was mailed to a total of 684 RNs that lived in the Core Central Texas area, during the summer of 2013. A list of RNs was purchased from the Texas Board of Nurse Examiners, which was recently updated by the board in April of 2013. Enclosed in the mailing was a cover letter (Appendix B), consent form (Appendix C), and the questionnaire booklet (Appendix D). In addition, a self-addressed stamped envelope was included for the RNs to return the questionnaire booklet to the researcher. Participants were instructed to return the survey in the envelope provided.

The Texas Board of Nurse Examiners supplied the researcher with a list of RNs that were actively licensed in the State of Texas. This list was filtered to include only the RNs in the Core Central Texas area. It has been identified that Central Texas was split into two groups: Core Central Texas and outer Central Texas. Core Central Texas was used for this study, which incorporated 15 counties (Bastrop, Bell, Blanco, Burnet, Coryell, Falls, Gillespie, Hays, Lampasas, Lee, Llano, McLennan, Milam, Travis, and Williamson). These counties were the focus area for this study.

The researcher used the Tailored Design Method for mail survey data collection. The Tailored Design Method incorporated the following steps (Dillman, Smyth & Christian, 2009):

1. Mail a pre-notice postcard a few days prior to the questionnaire mailing.
2. Mail questionnaire with cover letter, questionnaire and pre-paid postage envelope.
3. Mail thank you postcard one week after the questionnaire.
4. Mail replacement questionnaires to non-respondents 2-4 weeks after the initial mailing.
5. Attempt a final contact with a different mode of delivery is suggested 2-4 weeks after the previous mailing.

There was an adequate response rate to the first mailing of the surveys with over 100 collected within one week of the questionnaire mailing. More surveys were returned during the second and third week. The questionnaire mailing included 684 potential participants. There were 21 questionnaires that were returned with an error message 'not deliverable and unable to forward.' This further reduced the list of potential participants to 663. The final response rate was 22.3% (n=148). The 148 returned surveys were reviewed and 28 were ineligible for participation in the study based on responses to the first three items, which were the eligibility criteria questions (Appendix D). The final 120 eligible participants were included in the study, which was 18% of the questionnaires mailed to the RNs in Core Central Texas. A thank you postcard was not sent to the respondents because data collection was anonymous. A replacement questionnaire was not mailed because the response rate was adequate according to the a priori power analysis. A final contact with a different mode of delivery was not necessary because the researcher achieved the desired response rate. There was a plan to move forward with

additional data collection if there was an inadequate response rate, but this was not the case because adequate sample size was achieved within four weeks of mailing the questionnaire.

POWER ANALYSIS POST HOC

The G*Power version 3.1.6 software was used for a post-hoc power analysis (Erdfelder, et al., 1996). The following were selections made in the G*Power software:

Table 6: Power Analysis Post Hoc

Input Variables		Output Variables	
Effect Size f^2	0.15	Non-centrality Parameter λ	18
α error probability	0.05	Critical F	2.02
Sample Size	120	Numerator df	8
Number of Predictors	8	Denominator df	111
		1-β error probability	**0.85**

The *F*-test was selected for test family; linear multiple regression: Fixed model R^2 deviation from zero was selected for statistical test; and a post hoc was selected for type of power analysis. Input parameters include the following: effect size f^2=0.15, *α error probability*=0.05, *sample size*=120, and number of *predictors*=8. Output parameters include the following: the non-centrality parameter λ=19.00, *critical F*=2.02, *numerator degrees of freedom*=8, *denominator degrees of freedom*=111, and *power* (*1-β error probability*)=0.85. This analysis indicated that the sample size had adequate power to find a desired effect within a given population if one was present (Polit & Beck, 2004).

QUESTIONNAIRE BOOKLET

General Information Assessment

The questionnaire booklet (Appendix D) was composed of five sections and took the participant 5-10 minutes to complete. The sections included Demographic characteristics; Assessment of MRSA Knowledge; Assessment of Self-reported HH; Assessment of HH Performance Barriers; and The Infection Control Perception Survey.

The Demographic characteristics survey is a 12-item general information assessment developed by the researcher to examine: inclusion criteria, nurse demographic characteristics, and professional work environment. The first three questions were to ensure that the participant met the inclusion criteria for the study: Are you currently licensed in the State of Texas? Are you currently practicing nursing? Are you currently practicing bedside nursing in the inpatient hospital setting?

The next questions assessed personal demographic characteristics: age, years as registered nurse, years in healthcare, and highest level of nursing education. The next questions assess the professional work environment including: magnet facility, type of employment setting, type of unit, average patient acuity, and frequency of working with MRSA patient population. The personal and professional demographic assessment questions were chosen because they were the most commonly reported characteristics used to describe the sample population and were reported as factors that may influence HH behaviors (Boyce & Pittet, 2002; Brady et al., 2009; Lewis & Thompson, 2009).

Assessment of MRSA Knowledge

The assessment of MRSA knowledge was published by Brady et al. (2009) and adapted from MRSA clinical practice guidelines. Originally, this survey consisted of 20 ‘true or false’ statements. When the original statements were forwarded to a review panel

consisting of experts in microbiology and infection control, 11 out of 20 items were unanimously described as being relevant to the clinical setting and were reasonable expectations of MRSA knowledge. The 11-item survey was piloted among surgical trainees and was reviewed by the participants. One question was dropped as a result of the pilot, because the item referred to issues that occur outside the hospital environment. The finalized scale had 10-items that focused on MRSA knowledge based on MRSA clinical practice guidelines for the inpatient hospital setting. For example, 'Alcohol gel is at least as effective as hand washing in reducing MRSA transmission.' This survey was administered to HCPs (infection control nurses, trainee surgeons, and physicians) at the British Medical Association's Representatives Meeting. The highest attainable score was a 10 for correctly answering all statements. Reliability and validity of this instrument were not included in the manuscript. An attempt to contact the author was made to express interest in the survey and to identify if reliability and validity were calculated on the instrument. Permission was granted to use the instrument; however response related to reliability and validity of the instrument was not received. Following the MRSA knowledge instrument were 11 descriptive questions aimed at assessing perceived susceptibility and perceived severity about MRSA (e.g. how often the nurse works with MRSA patients, does the nurse believe they carry MRSA, do they feel at risk for carrying MRSA).

Assessment of Self-Reported HH

Assessment of Self-Reported HH is a 6-item survey adapted by the researcher from 'My 5 Moments for HH' (Sax et al., 2007) to assess self-reported HH practices among RNs. 'My 5 Moments for HH' has been published in the WHO Guidelines for HH in healthcare. This model offers a user-centered approach incorporating the 'moments'

when HH was necessary to prevent cross-transmission of organisms. 'My 5 Moments for HH' was designed based on HAI evidence-based practice risk assessments for cross-transmission, incorporated the workflow of the HCP, simple to learn, easy to understand, and applicable to multiple healthcare settings. It has been used world-wide in the literature and in the clinical practice setting (Fitzgerald et al., 2013; Higgins, 2013; Magiorakos et al., 2010; Randle et al., 2010). 'My 5 Moments for HH' include the following time points:

- Before patient contact
- Before aseptic task
- After body fluid exposure
- After patient contact
- After contact with patient surroundings

The survey was adapted from the previously mentioned 'moments' by asking RNs to self-report their average percentage of HH performance. For example, 'Before touching the patient, please indicate the average percentage of the time that you perform HH.' The sixth question in this survey asks the registered nurse to think about the 'My 5 Moments for HH' that present themselves in the inpatient hospital setting and self-report their 'overall HH' performance rate. There were instructions to exclude emergency and out of the ordinary circumstances. Estimated response rates were reported as a continuous variable between 0-100 percent.

Assessment of HH Performance Barriers

The Assessment of HH Performance Barriers was adapted from the barriers listed in the WHO Guidelines on HH in Healthcare (2009). A comprehensive review of the literature was completed for this publication and a table compiled factors for poor

adherence/low compliance with HH behaviors. There were 20 barriers to HH performance that were consistently reported in the literature. These items were adapted into a survey by listing the barrier statements from the table and adding a 5-point Likert scale for agreement (1=strongly disagree, 5=strongly agree). For example: 'Inappropriate staffing interferes with my ability to perform HH.' The average score for this scale was reported. There was one item that was reverse-coded. Lower means indicated the RN overcoming HH performance barriers, while higher means indicate that barriers interfere with HH performance behaviors. Possible scores ranged from 1-5. Because this instrument was newly developed it was sent to a panel of 18 RNs to review for an internal consistency check. Data was reviewed for clarity and completeness. A preliminary Cronbach's α (.80) was completed for this scale.

Infection Control Perception Survey

The Infection Control Perception Survey published by Lewis and Thompson (2009) was used in this study. The Infection Control Perception Survey has been published in its entirety in the public domain. An attempt to contact the author to express interest was made but no responses were received. This instrument was created to measure the constructs in the HBM as they relate to infection control. This instrument incorporated 6-subscales adapted from the HBM with a total of 36-items that were measured using a 5-point Likert scale (1=strongly disagree, 5=strongly agree). Mean scores subscale were calculated.

This survey was developed to assess HCPs' perceptions and knowledge of infection control within a community hospital setting. The survey was administered to nurses working in a 250-bed, non-for-profit, community inpatient hospital setting. Eligible participants for the original study worked at the bedside and included a range of

HCPs (RNs, licensed practical nurses, and certified nurse assistants, physicians, physician assistants and nurse practitioners). A total of 130 individuals completed the survey.

The Perceived Severity subscale has 6-items that asked questions related to the severity of healthcare-associated infections. For example, 'Having a patient with a healthcare-associated infection is a very serious problem for this hospital.' The Perceived Susceptibility subscale has 8-items that asked questions related to how the nurse views their own infection control practices as they related to spreading infection. For example, 'If I do not engage in proper infection control practices, I could spread infection to my family.' The Perceived Benefits subscale has 5-items that asked questions related to the RNs' infection control behaviors as they relate to preventing, protecting and reducing the risk of spreading infections. For example, 'Engaging in proper infection control measure protects the HCP and the patient.' The cues-to-action subscale has 4-items that asked questions about the RNs' behaviors as they related to preventing infection. For example, 'Taking courses in infection control could prevent a patient from getting a healthcare-associated infection.' The Perceived Barriers subscale has 6-items that measured the RNs' potential barriers to HH performance. For example, 'I feel that it takes too much time to engage in proper infection control measures.' The self-efficacy subscale has 6-items that asked questions about how the nurse views infection control behaviors as they related to their own practice. For example, 'Engaging in proper infection control is important to me.' Lewis and Thompson (2009), reported the *Cronbach α* for overall reliability of the Infection Control Perception Survey to be high (α=0.82). The individual subscales also rated high for reliability: perceived severity (α=0.81), perceived susceptibility (α=0.70), perceived benefits (α=0.75), cues-to-action (α=0.76), perceived barriers (α=0.73), and self-efficacy (α=0.82).

DATA ANALYSIS

The Statistical Package for the Social Sciences (SPSS for Windows, version 21.0) was used for analysis of this study. An assessment for questionnaire completion was completed as the surveys were returned to the researcher. Questionnaires were evaluated for completeness with particular focus on the following sections: self-reported HH, knowledge related to MRSA, Infection Control Perception Survey, and key demographic characteristics that were used as predictor variables for HH behaviors (i.e. years of work experience, education level, frequency of working with MRSA patients, size of institution). There was a plan to evaluate surveys for completion and if more than 5% of the survey was incomplete then it would not be used in the statistical analysis of data. In addition there was a plan to evaluate systematic versus random patterns for missing data in the questionnaire booklets. If needed missing data would be handled through imputation with the SPSS software. Imputation is the process of assigning values to missing responses. This process was used to remove bias from survey records caused by ignoring the questionnaire booklets with missing data (Brick & Kalton, 1996). This step was not needed because there were no missing data in the eligible surveys. Once the questionnaire booklet was accepted as complete, the data were entered in to SPSS for analysis. As the data were entered, each case was double checked for accuracy.

SPSS software was used for exploratory data analysis to examine the distribution of scores. Measures of central tendency, which included the mean, standard deviation, frequency distribution and percentages of key variables were examined. Data were evaluated for normality of the distribution and homoscedasticity. The variables that were examined included: key demographic characteristics (e.g. years of work experience, education level, frequency of working with MRSA patients), Assessment of MRSA knowledge scores; Assessment of self-reported HH scores; Assessment of HH

Performance Barriers scores; and The Infection Control Perception Survey scores. Histograms and box plots were reviewed to assess for outliers. This was important because participant errors could cause extreme outliers, which could influence the mean and standard deviation for the variables (Field, 2005). There were no extreme outliers identified in the data analysis. If an outlier would have been identified, there was a plan to remove, transform, or change the score. The methods outlined by Field (2005) would have been used to correct problems with outliers in the data set.

RESEARCH QUESTIONS

Research Question 1: *What was the self-reported rate of HH performance among RNs (before touching the patient, before clean/aseptic procedures, after body fluid exposure risk, after touching the patient, after touching the patient's surroundings, and 'overall HH' performance rate)?* Descriptive statistics were used to report the mean, standard deviation, and frequency distribution of RNs that self-reported HH performance behaviors. Statistics were reported by question: before touching the patient, before clean/aseptic procedures, after body fluid exposure risk, after touching the patient, after touching the patient's surroundings and 'overall HH' performance rate.

Research Question 2: *What was the level of RNs' knowledge related to the MRSA bacterium; and was there a relationship between MRSA knowledge and constructs in the HBM as they were measured using the Infection Control Perception Survey (e.g. perceived susceptibility, perceived severity related to infection control)?* Descriptive statistics were used to report the mean, standard deviation, and frequency distribution of scores for MRSA knowledge and each of the subscales in the Infection Control Perception Survey. Correlational analysis was used to identify the magnitude and

direction of the relationship between MRSA knowledge and the constructs in the Infection Control Perception Survey.

Research Question 3: *What were the barriers to the RNs' ability to perform HH behaviors in the inpatient hospital setting; and was there a relationship between barriers to HH performance scores and 'overall HH' performance rates?* Descriptive statistics were used to report the mean, standard deviation, and frequency distribution of scores for each item and the total score for the Assessment of HH Performance Barriers. Correlation analysis was conducted to identify the magnitude and direction of the relationship between barriers to HH performance and 'overall HH' performance rates.

Research Question 4: *What were the relationships between constructs in the HBM (e.g. perceived susceptibility, perceived severity, self-efficacy, perceived barriers, cues-to-action, and perceived benefits) with 'overall HH' behaviors; and do these constructs predict 'overall HH' performance rates?* Correlational analysis was used to identify the strength and magnitude of the relationships among constructs in the HBM (perceived severity, perceived susceptibility, self-efficacy, perceived benefits, perceived barriers and cues-to-action) and 'overall HH' performance rates. Pearson correlation statistics were used to identify which significant predictor variables were included in the backwards stepwise regression model. The relationships among predictor variables were reviewed and then entered into the model. This was accomplished with the SPSS software for data analysis. The predictor variables were entered into the model in the order of highest simple correlation with the outcome variable.

Research Question 5: *What demographic characteristics (e.g. years of work experience, age, education level and frequency of working with MRSA patients) were related to the RNs' knowledge of MRSA, self-reported HH performance, and constructs in the HBM (e.g. perceived susceptibility and self-efficacy related to infection control)?*

Correlational analysis was used to identify the magnitude and direction of relationships among key demographic characteristics (years of work experience, education level, frequency of working with MRSA patients, size of institution) as they relate to the RNs' knowledge of MRSA, self-reported HH performance, and constructs in the HBM measured using the Infection Control Perception Survey (perceived severity, perceived susceptibility, perceived benefits, cues-to-action perceived barriers, and self-efficacy).

SUMMARY

The focus of this chapter was to describe the methodology for this study in detail. A descriptive, cross-sectional study design was selected for this study. The sample, inclusion criteria, and power analysis was discussed. In addition, protection of human subjects and privacy of participants was reviewed. Data collection procedures and instruments used for this study were fully described. Finally, the steps for data analysis were reviewed in detail. The methods outlined in this chapter support the purpose of this study.

Chapter 4: Findings

INTRODUCTION

This chapter will summarize the findings from this study. First, demographic characteristics of the sample population and their work environment will be reported. This will be followed by descriptive statistics of the survey subscales. Finally, the five research questions will be reviewed and statistical analysis will be explained for each of the five research questions. All data were analyzed using the SPSS version 21.0 software.

SAMPLE DESCRIPTION

There were 148 RNs living in the Core Central Texas area that returned the mailed questionnaires (22%). Returned questionnaires were evaluated for completeness and eligibility for participation. One-hundred and twenty surveys (18% of those mailed out) met the eligibility criterion for this study. Twenty-eight participants were deemed ineligible for participation based on one or more responses to the first three items, which were used to verify participant eligibility (Appendix D). The participant (N=120) demographic characteristics are summarized in Table 7 and participant work environment is summarized in Table 8.

The age of participants ranged from 23-66 years (M= 42.3, SD= 11.7). Participant age ranges were evenly distributed over decades with the exception of RNs age 51-70 years representing 25.8% of the surveyed population. Years in nursing ranged from 1-45 years (M= 14.3, SD= 11.3) with a nonparametric distribution, which favored RNs with less experience. For example, 52.4% of RNs surveyed had less than 10 years of experience in nursing. Years as a healthcare provider ranged from 1-42 years (M= 16.2, SD= 10.9) and this demographic characteristic resembled a more parametric distribution in comparison with years in nursing. Education level ranged from Diploma (6.7%) to

Masters of Science in Nursing (4.2%) and 50% of RNs had a Baccalaureate of Science in Nursing. All RNs worked in an inpatient hospital setting either in a hospital (96.7%) or rehab facility (3.3%). Most RNs rated the average patient acuity level at Medium (48%) or High (48.3%). The type of patient population that the RN worked with in the inpatient setting varied with the highest representation in Medical/Surgical (18.3%), Intensive Care (18.3%), Emergency Department (13.3%), and Labor/Delivery (11.7%). Frequency of MRSA contact ranged from 'never' (2.5%) to 'always' (2.5%) with the highest percentage of RNs 'sometimes' (43.3%) and 'very often' (35%) having contact with MRSA positive patients.

Table 7: Demographic Characteristics- Participants

Participant Demographic Characteristics (*N*=120)			
		Frequency	**Percent**
Participant Age	20-30 Years	24	20.0%
	31-40 Years	34	28.3%
***M*= 42.3, *SD*= 11.7**	41-50 Years	31	25.8%
	51-60 Years	21	17.5%
	61-70 Years	10	8.3%
	Total	**120**	**100%**
Years in Nursing	0-5 Years	31	25.8%
	6-10 Years	32	26.6%
***M*= 14.3, *SD*= 11.3**	11-20 Years	25	20.9%
	21-30 Years	19	15.8%
	31-45 Years	13	10.9%
	Total	**120**	**100%**
Years as Healthcare Provider	0-5 Years	18	15.0%
	6-10 Years	29	24.2%
***M*= 16.2, *SD*= 10.9**	11-20 Years	34	38.4%
	21-30 Years	24	20.0%
	31-45 Years	15	12.4%
	Total	**120**	**100%**

Table 8: Demographic Characteristics- Work Environment

Education & Workplace Demographic Characteristics (*N*=120)			
		Frequency	**Percent**
Level of Education	Diploma	8	6.7%
	A.D.N	47	39.2%
	B.S.N.	60	50%
	M.S.N.	5	4.2%
	Total	**120**	**100%**
Unit	Cath Lab	2	1.7%
	Emergency Department	16	13.3%
	Intensive Care Unit	22	18.3%
	Intermediate Care Unit	3	2.5%
	Labor & Delivery	14	11.7%
	Medical/Surgical	22	18.3%
	Neonatal Intensive Care	8	6.7%
	Post-Partum	3	2.5%
	Surgical services	11	9.2%
	Telemetry	7	5.8%
	Other	12	10.0%
	Total	**120**	**100.00%**
Average Patient Acuity	Low	5	4.20%
	Medium	48	40.00%
	High	58	48.30%
	Extreme	9	7.50%
	Total	**120**	**100.00%**
Setting	Inpatient hospital	116	96.70%
	Inpatient rehab	4	3.30%
	Total	**120**	**100.00%**
MRSA Contact	Always	3	2.50%
	Very often	42	35%
	Sometimes	52	43.30%
	Rarely	20	16.70%
	Never	3	2.50%
	Total	**120**	**100%**

MRSA QUESTIONNAIRE- DESCRIPTIVE SURVEY

The MRSA survey was administered to understand perceived severity and perceived susceptibility about the MRSA bacterium within this sample of Core Central Texas RNs. The detail of these statistics is reported in Table 9. Eighty-three percent of RNs (*n*=100) believed they were at risk for carrying MRSA, but only 33% (*n*=40) believed that they were MRSA carriers. Seventy-five percent (*n*=90) of RNs believed they would want to know if they were MRSA carriers. Eighty-two percent of RNs (*n*=98) believed that understanding the direct relationship between ineffective HH performance and RNs who carry MRSA would increase their HH compliance. Similarly, 88% (*n*=105) of RNs surveyed believed they would be more likely to hold peers accountable if they understood the direct relationship between HH and MRSA carriage. This may reinforce that knowledge alone is not enough to change behavior, which has been reported in the literature. Possibly correlating knowledge with perceived susceptibility may be more beneficial in driving change. Understanding this relationship could assist in driving change and improving HH performance among RNs, which may have a positive influence on patient care and could decrease HAI rates.

More RNs were concerned that they could spread MRSA to their family (69%) than spreading MRSA to the community setting (57%). This statistic may be explained by the number of RNs that wear their scrubs into the community setting (42%). If RNs are less likely to wear their scrubs into the community setting, they may perceive that spreading infection was less of a concern. One registered nurse reported that they carried MRSA, but this was not confirmed with lab testing. Seventy-eight percent of the sample (*n*=94) would not object to hospitals screening for MRSA carrier status. These statistics are important for understanding perceived susceptibility among RNs, which may help with intervention planning.

Table 9: MRSA Questionnaire

MRSA Questionnaire (*N*=120)	**No**	**Yes**
Do you think you carry MRSA?	67%	**33%**
Do you feel that you are at risk for carrying MRSA?	17%	**83%**
Would you want to know if you carried MRSA?	25%	**75%**
Would understanding the direct relationship between ineffective HH performance and nurses who carry MRSA increase your compliance with HH?	18%	**82%**
Would understanding the direct relationship between ineffective HH performance and nurses who carry MRSA increase your willingness to hold others accountable with HH?	12%	**88%**
Are you concerned that you could take MRSA home to your family?	31%	**69%**
Are you concerned that you could spread MRSA into the community?	43%	**57%**
Do you wear your work scrubs into community settings?	58%	**42%**
Have you been told that you have MRSA?	99%	**1%**
If you have been told you carry MRSA, was this confirmed by lab testing? (*n*=1 that was applicable)	100%	**0%**
Would you object to hospitals screening for MRSA carrier status?	78%	**22%**

QUESTIONNAIRE ANALYSIS

The following section will provide the descriptive statistics for instruments used in the study (Table 10). The following were included: MRSA knowledge, Assessment of HH Performance Barriers, and the Infection Control Perception Survey (with six subscales: perceived severity, perceived susceptibility, perceived barriers, cues-to-action, perceived barriers, and self-efficacy). Histograms for each of the subscales were evaluated and found to have a normally distributed curve. However, the test for normality was significant for all scales and the standard error values for skewness and kurtosis were not equal to zero (Table 11), which indicates the scores were not normally distributed. For this reason, these scores were transformed to *z*-scores (Table 12). According to Field (2009) an absolute value greater than 1.96 is significant at $p<.05$ and above 2.58 is significant at $p<.01$. All *z*-scores for skewness were below the value 2.58. All *z*-scores for kurtosis, except for perceived benefits (-3.17), were below 2.58. These values were not significant ($p>.01$), which is aligned with the parametric data assumption.

Table 10: Questionnaire Instruments- Measures of Central Tendency

Questionnaire Subscales (*N*=120)	Mean	Median	SD	Range	Cronbach α
MRSA Knowledge	**6.63**	7	**1.53**	3 to 10	n/a
Assessment of HH Performance Barriers	**2.28**	2.4	**0.49**	1.10 to 3.40	.80
Perceived Severity	**4.01**	4	**0.6**	2.50 to 5.00	.72
Perceived Susceptibility	**3.72**	3.63	**0.47**	2.50 to 5.00	.67
Perceived Benefits	**4.61**	4.8	**0.45**	3.80 to 5.00	.91
Cues-to-Action	**3.59**	3.5	**0.7**	2.00 to 5.00	.72
Perceived Barriers	**1.7**	1.67	**0.47**	1.00 to 3.17	.75
Self-Efficacy	**4.01**	4	**0.55**	1.83 to 5.00	.70

Table 11: Questionnaire Instruments- Test for Normality

Tests of Normality (*N*=120)						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	Df	Sig.
MRSA Knowledge	0.203	120	0	0.939	120	0
Assessment of HH Barriers	0.124	120	0	0.971	120	0.011
Perceived Severity	0.091	120	0.017	0.96	120	0.001
Perceived Susceptibility	0.089	120	0.021	0.983	120	0.132
Perceived Benefits	0.284	120	0	0.771	120	0
Cues-to-Action	0.085	120	0.031	0.977	120	0.039
Perceived Barriers	0.158	120	0	0.953	120	0
Self- Efficacy	0.118	120	0	0.965	120	0.003

Table 12: Questionnaire Instruments- Conversion to *z*-scores

Questionnaire Subscales	**Skew-ness**	**Std. Error Skew-ness**	**Skew-ness *z*-scores**	**Kurtosis**	**Std. error Kurtosis**	**Kurtosis *z*-scores**
MRSA Knowledge	**-0.45**	0.22	**-2.04**	**0.86**	0.44	**1.96**
Assessment of HH Performance Barriers	**-0.32**	0.22	**-1.46**	**-0.6**	0.44	**-1.36**
Perceived Severity	**0.06**	0.22	**0.29**	**-0.67**	0.44	**-1.54**
Perceived Susceptibility	**0.26**	0.22	**1.17**	**-0.18**	0.44	**-0.41**
Perceived Benefits	**-0.57**	0.22	**-2.56**	**-1.39**	0.44	**-3.17**
Cues-to-Action	**0**	0.22	**0.01**	**-0.37**	0.44	**-0.85**
Perceived Barriers	**0.44**	0.22	**1.99**	**-0.3**	0.44	**-0.68**
Self-Efficacy	**-0.41**	0.22	**-1.83**	**1.1**	0.44	**2.52**

Variability in MRSA knowledge was demonstrated among RNs surveyed in this study. Scores ranged from three to 10 (M= 6.63, SD= 1.53) out of a possible 10 points. Merely 9.2% (n=11) received a score of nine or 10. Seventy-one percent (n=85) received a moderate score of 6, 7, or 8. Twenty percent (n=24) received a score of three, four or five. Higher scores indicate more knowledge about MRSA. Table 10 represents the descriptive scale characteristics for each of the instruments and subscales used in this study. For both questionnaires assessing barriers to HH performance, the Assessment of HH Barriers and the Perceived Barriers subscale, the mean scores were low indicating disagreement with measured barriers. Table 13 outlines the correlation analysis, which compared the relationship among instruments, which revealed some significant relationships. MRSA knowledge had a positive relationship with self-efficacy (r=.27, p<.01). There was a negative relationship between 'overall HH' with both Assessment of HH barriers (r=-.41, p<0.01) and the perceived barriers subscale from the Infection Control Perception Survey (r=-.29, p<.01). 'Overall HH' had a positive relationship with self-efficacy (r=.46, p<.01). There were several significant relationships discovered among subscales in the Infection Control Perception Survey, which will be discussed in more detail in the research questions section.

Table 13: Questionnaire Instruments- Pearson Correlation Table (*N*=120)

		MRSA Knowledge	Overall HH	Assess. of HH Barriers	Perceived Severity	Perceived Susceptibility	Perceived Benefits	Cues to Action	Perceived Barriers	Self-Efficacy
MRSA Knowledge	*r*	1	-0.055	-0.091	0.087	0.005	0.062	-0.035	-0.174	**.269****
	p		0.553	0.325	0.343	0.957	0.499	0.706	0.058	0.003
Overall HH	*r*	-0.055	1	**-.411****	0.102	0.126	-0.023	0.008	**-.285****	**.455****
	p	0.553		0.000	0.269	0.172	0.804	0.931	0.002	0.000
Assess. Of HH Barriers	*r*	-0.091	**-.411****	1	**-.242****	**-.195***	**-.292****	-0.077	**.560****	**-.456****
	p	0.325	0.000		0.008	0.033	0.001	0.403	0.000	0.000
Perceived Severity	*r*	0.087	0.102	**-.242****	1	**.479****	**.393****	**.264****	**-.250****	**.386****
	p	0.343	0.269	0.008		0.000	0.000	0.004	0.006	0.000
Perceived Susceptibility	*r*	0.005	0.126	**-.195***	**.479****	1	**.426****	**.310****	**-.196***	**.275****
	p	0.957	0.172	0.033	0.000		0.000	0.001	0.032	0.002
Perceived Benefits	*r*	0.062	-0.023	**-.292****	**.393****	**.426****	1	**.343****	**-.442****	**.264****
	p	0.499	0.804	0.001	0.000	0.000		0.000	0.000	0.004
Cues-to-Action	*r*	-0.035	0.008	-0.077	**.264****	**.310****	**.343****	1	-0.035	0.114
	p	0.706	0.931	0.403	0.004	0.001	0		0.703	0.216
Perceived Barriers	*r*	-0.174	**-.285****	**.560****	**-.250****	**-.196***	**-.442****	-0.035	1	**-.512****
	p	0.058	0.002	0.000	0.006	0.032	0.000	0.703		0
Self Efficacy	*r*	**.269****	**.455****	**-.456****	**.386****	**.275****	**.264****	0.114	**-.512****	1
	p	0.003	0.000	0.000	0.000	0.002	0.004	0.216	0.000	

**Correlation is significant at the 0.01 level (2-tailed) & *Correlation is significant at the 0.05 level (2-tailed)

RESEARCH QUESTIONS

The following section will review each of the research questions and data analysis as it pertains to each question.

Research Question 1: *What was the self-reported rate of HH performance among RNs (before touching the patient, before clean/aseptic procedures, after body fluid exposure risk, after touching the patient, after touching the patient's surroundings, and 'overall HH' performance rate)?* The RNs' self-reported rate of HH performance was measured using 'My 5 Moments for HH' (Sax et al., 2007). The percentage of HH performance for each 'moment' was recorded as a continuous variable by the participant. The sixth item on this instrument asked the registered nurse to consider all five 'moments' of HH and self-report an 'overall HH' performance rate. The summary of these findings are reported in Table 14. HH performance mean scores ranged from 78% to 98% depending on the 'moment' that was measured. The moments that are interpreted to have the highest perceived susceptibility were 'HH before clean/aseptic procedures' and 'after body fluid exposure risk.' The moment that was interpreted to have the least perceived susceptibility was 'after touching the patient's surroundings.' Registered nurses reported higher rates of HH performance when the 'moment' posed significant perceived risk, whether the perceived susceptibility was posed to them or their patients. For example, the mean HH performance rate 'after body fluid exposure risk' was 98% (*SD*=7.1). Additionally, RNs reported an average HH performance rate of 94% 'before clean/aseptic procedures.' However, when there was less perceived susceptibility associated with the interaction, as there may be 'after touching patient's surroundings,' HH performance rates decreased to 78% (*SD*= 18.9). Registered nurses were more likely to perform HH 'after touching the patient' (*M*=91%, *SD*= 14.2) as compared with 'before

touching' the patient (*M*=82%, *SD*= 22.9). These data reinforced that the RNs were more likely to perform HH when the 'moment' protected them, rather than to protect their patient from potential risk of cross-transmission of pathogens, which could result in HAIs.

Table 14: Self-Reported HH among RNs in Central Texas

Self-Reported HH Among RNs in Central Texas Using 'My 5 Moments for HH' (*N*=120)						
	HH Before Touching the Pt	**HH Before Clean/ Aseptic Procedures**	**HH After Body Fluid Exposure Risk**	**HH After Touching the Pt**	**HH After Touching the Pt's Surroundings**	**Overall HH**
Mean	82%	94%	98%	91%	78%	88%
Standard Deviation	22.9	10.5	7.1	14.2	18.9	10.0
Median	90	100	100	95	80	90
Min	0	50	35	25	0	50
Max	100	100	100	100	100	100

Research Question 2: *What was the level of RNs' knowledge related to the MRSA bacterium; and was there a relationship between MRSA knowledge and constructs in the HBM as they were measured using the Infection Control Perception Survey (e.g. perceived susceptibility, perceived severity related to infection control)?* Table 15 summarizes the MRSA knowledge survey, which had a parametric distribution in scores, which ranged from three to 10 (*M*=6.63, *SD*= 1.53). The maximum score was 10 points on this survey and higher scores indicated more knowledge related to MRSA in the clinical setting. The MRSA knowledge questionnaire was correlated with the Infection Control Perception Survey subscales. There was only one significant correlation identified in this analysis (Table 16). A positive correlation was identified between MRSA knowledge and self-efficacy (r=.27, p<.01). This was not surprising as the efficacy questions asked about seeking information, engaging in infection control,

following recommendations, and using HH products. Higher levels of self-efficacy behaviors were positively related to higher MRSA scores.

Table 15: MRSA Knowledge Scores

MRSA Knowledge (*N*=120)	**Correct**
1. MRSA is a gram positive cocci (True)	**79%**
2. Alcohol gel is at least as effective as hand washing in reducing MRSA transmission (True)	**57%**
3. Healthcare workers with eczema or psoriasis should not be involved in the care of patients with MRSA (False)	**59%**
4. >40% of *Staphylococcus aureus* bloodstream infections are due to the methicillin strains (True)	**75%**
5. In carriers of methicillin-sensitive *Staphylococcus aureus*, the axilla and groin are most commonly colonized than the anterior nares (False)	**68%**
6. Colonization of infection with MRSA is a contraindication to the transfer of a patient to a nursing home (False)	**80%**
7. MRSA colonized patients, their relatives and caregivers should be advised to reduce close physical and social interaction with children and the elderly, until nasal surveillance is negative for colonization (False)	**35%**
8. Many studies have demonstrated rates of nosocomial infection associated with high levels of nursing staff workload (True)	**84%**
9. If a new positive MRSA carrier is found among the previously negative inpatients in a hospital ward, healthcare staff from that ward should be screened (False)	**47%**
10. Refusal to accept transfer of a patient is justifiable on the basis of the risk posed to other patients posed to other patients by an individual's carriage of or infection with MRSA (False)	**79%**

Table 16: Pearson Correlation Table- MRSA knowledge and Infection Control Perception Survey

Correlation Table (*N*=120)								
	Overall HH	Assessment of HH Barriers	Perceived Severity	Perceived Susceptibility	Perceived Benefits	Cues-to-Action	Perceived Barriers	Self-Efficacy
MRSA Knowledge	-0.055	-0.091	0.087	0.005	0.062	-0.035	-0.174	**.269****
Sig.- 2 tailed	0.553	0.325	0.343	0.957	0.499	0.706	0.058	**0.003**
**Correlation is significant at the 0.01 level (2-tailed) & *Correlation is significant at the 0.05 level (2-tailed)								

Research Question 3: *What were the barriers to the RNs' ability to perform HH behaviors in the inpatient hospital setting; and was there a relationship between barriers to HH performance scores and 'overall HH' performance rates?* There were several significant correlations among the self-reported HH 'moments' and items on the Assessment of HH Performance Barriers (Table 17). The highest (98.4%) HH performance rate was noted 'After body fluid exposure risk' while the lowest (79.3%) HH performance rate was 'after touching the patient's surroundings.' Those HH 'moments' that were perceived to have higher risk also had the highest performance and the fewest associated barriers. Conversely, those 'moments' interpreted to have lower perceived susceptibility had more barriers that were significantly correlated with HH opportunities. For example 'after touching the patient's surroundings' significantly correlated with 12 barriers including 'a high workload influences my HH' (r=-.39, p<0.01); 'The number of patient's in my assignment influences HH' (r=-.37, p<0.01), and 'I don't think about it or forget to perform HH' (r=-.34, p<0.01). Higher risk 'moments,' like 'after body fluid exposure risk' and 'before clean/aseptic procedures' were correlated with one barrier each. There were seven barriers that emerged across four HH 'moments.' These barriers included 'I don't think about it or I forget to perform HH,' 'at times I am too busy for HH,' 'a high workload influences my HH,' 'inappropriate staffing influences my HH,' 'I perform HH when there is a higher risk for cross-transmission,' 'the number of patient's in my assignment influences my HH,' and 'there is a lack of personal accountability culture for HCPs to perform HH.' All of the statements, with the exception of one, are related to system factors.

Most of the RNs indicated that their average patient acuity level is Medium (48%) or High (48.3%). In addition, the barriers that were most significantly related to HH performance included staffing, workload, and being busy. When HH 'moments' are

Table 17: Pearson Correlation Table- Self-Reported HH and HH Performance Barriers

Measures of Central Tendency for Assessment of HH Barriers to HH Performance (*N*=120) with Correlations to Self-Reported HH								
** Correlation is significant at 0.01 level (2-tailed) * Correlation is significant at 0.05 level (2-tailed)	*Mean*	*SD*	HH Before Touching	HH Before Procedures	HH After Fluid Risk	HH After Touching	HH After Surroundings	Overall HH
HH agents irritate my skin	**2.72**	**1.31**						
I have access to HH supplies	**1.28**	**0.69**						
HH interferes with the HCP-Pt relationship	**1.54**	**0.85**			**-.210***	**-.234****		
Pt needs take priority over HH	**2.25**	**1.07**						
Wearing gloves is HH	**2.43**	**1.17**	**-.283****				**-.210***	**-.277****
I don't think about it or forget to perform HH	**1.98**	**0.98**	**-.234****			**-.324****	**-.341****	**-.329****
Lack rewards/encouragement to perform HH	**2.03**	**0.94**						
Lack of scientific information…	**1.66**	**0.99**						
At times I am too busy for HH	**2.40**	**1.21**	**-.284****			**-.432****	**-.301****	**-.370****
A high workload influences my HH	**2.84**	**1.30**	**-.220***			**-.381****	**-.388****	**-.396****
Inappropriate staffing influences my HH	**2.49**	**1.22**	**-.262****			**-.273****	**-.286****	**-.369****
I perform HH when there is higher risk for transmission	**3.98**	**1.19**	**-.238****			**-.224***	**-.234****	**-.238****
Lack of HH promotion at the individual level	**2.33**	**1.07**					**-.275****	
Lack of HH promotion at the institutional level	**2.03**	**0.89**		**.197***				
Lack of a role model for HH at my workplace	**2.02**	**0.90**					**-.310****	
Lack of institutional HH guidelines/protocols	**1.65**	**0.72**						
Lack of administrative sanction for non-compliers	**2.91**	**1.20**				**-.189***	**-.255****	**-.252****
The number of Pts in my assignment influences HH	**2.54**	**1.22**	**-.355****			**-.324****	**-.372****	**-.424****
There is a low risk for acquiring infection from Pts	**1.84**	**0.89**						
There is a lack of personal accountability culture	**2.63**	**1.16**	**-.193***			**-.189***	**-.187***	**-.215***

presented to the RNs, they are more likely to perform HH during times of elevated risk to themselves ('after body fluid exposure risk') or to their patients ('before clean/aseptic procedures'). When the HH 'moments' represent perceived less risky circumstances, the RNs are more likely to engage in HH to protect themselves ('after touching'), rather than protecting the patient from HAIs ('before touching').

Research Question 4: *What were the relationships between constructs in the HBM (e.g. perceived susceptibility, perceived severity, self-efficacy, perceived barriers, cues-to-action, and perceived benefits) with 'overall HH' behaviors; and do these constructs predict 'overall HH' performance rates?* A correlation analysis was completed with all five HH 'moments' plus the 'overall HH' performance statistic with the Infection Control Perception Survey subscales (Table 19). The strongest relationship was identified between 'overall HH' and self-efficacy (r=.46, p<.01). Self-efficacy was the only construct that was significantly correlated with all HH 'moments.' Perceived barriers had a negative relationship that was significantly correlated with four HH 'moments' (HH after body fluid exposure risk, HH after touching the patient, HH after touching a patient's surroundings, and overall HH). This relationship is best explained as when barriers decreased, HH performance increased. A small but interesting relationship was identified between Perceived Benefits and 'HH before clean/aseptic procedures' (r=-.18, p<.05). This indicates that as HH performance before a high risk activity increased, perceived benefits decreased. This phenomenon was not completely understood. For this reason, questions associated with perceived benefits were evaluated. Items included level of agreement with the following statements: engaging in proper infection control measures protects the HCP and patient, engaging in proper infection control measures could prevent or reduce the risk of HAIs, improving practices could prevent my patients from getting HAIs, I feel good about myself when I engage in proper infection control,

and engaging in proper infection control measures could save the facility money. These items, at first glance, appear to be reasonable measures of 'perceived benefits' but knowledge related to cost may be different among RNs. Also, 'feeling good about myself when I engage in proper infection control' may not measure perceived benefits. Instead it may be a measure of self-efficacy.

After the correlation analysis was reviewed, subscales that had significant relationships with the 'overall HH' were entered into a backwards linear regression model. The following order was used for the backwards regression: self-efficacy (r=.46, p<.01), Assessment of HH Barriers (r=-.411, p<.01), and Infection Control Perception Survey Perceived Barriers subscale (r=-.29, p<.01). Significant predictors were identified in the second model when the Perceived Barriers subscale was eliminated (Table 20). The model summaries are located in Table 18 and 20. R^2=.26, which explains 26% of the variation in 'overall HH.' This indicates that 74% of the variability in 'overall HH' scores is not explained in this model.

Table 18: Model Summary- Backwards Stepwise Linear Regression

Model Summary[c]				
Model	R	R^2	Adjusted R^2	Std. Error of the Estimate
1	.511[a]	0.261	0.242	8.725
2	.510[b]	0.26	0.247	8.697
a. Predictors: (Constant), Perceived Barriers, Self-Efficacy, Assessment of HH Performance Barriers				
b. Predictors: (Constant), Self-Efficacy, Assessment of HH Performance Barriers				
c. Dependent Variable: 'Overall HH' Performance Rate				

Table 19: Pearson Correlation Table- HBM Constructs and Self-Reported HH Behaviors

Correlations (*N*=120)							
	Perceived Severity	Perceived Susceptibility	Perceived Benefits	Cues-to-Action	Perceived Barriers	Self-Efficacy	Assess. of HH Barriers
HH Before Touching Pt	-.001	.068	-.014	-.043	-.169	**.285****	**-.331****
	.992	.462	.883	.639	.066	**.002**	**.000**
HH Before Clean/Aseptic Procedures	-.132	-.008	**-.184***	.048	-.125	**.187***	-.100
	.151	.930	**.044**	.602	.174	**.041**	.277
HH After Body Fluid Exposure Risk	.100	-.012	-.069	-.064	**-.371****	**.277****	-.093
	.276	.896	.454	.487	**.000**	**.002**	.310
HH After Touching Pt	.116	.098	-.026	-.077	**-.377****	**.367****	**-.376****
	.206	.285	.776	.404	**.000**	**.000**	**.000**
HH After Touching Pt's surroundings	.072	.178	.008	.038	**-.246****	**.392****	**-.432****
	.435	.052	.934	.678	**.007**	**.000**	**.000**
Overall HH	.102	.126	-.023	.008	**-.285****	**.455****	**-.411****
	.269	.172	.804	.931	**.002**	**.000**	**.000**

**Correlation is significant at the 0.01 level (2-tailed) & *Correlation is significant at the 0.05 level

Table 20: Regression Model- Significant Predictors for ‘Overall HH’

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	73.178	10.218		7.162	**0.000**		
	Self-Efficacy	6.51	1.752	0.356	3.716	**0.000**	0.696	1.437
	Assessment of HH Performance Barriers	-5.697	2.03	-0.278	-2.806	**0.006**	0.647	1.545
	Perceived Barriers	1.129	2.197	0.053	0.514	0.608	0.603	1.659
2	(Constant)	75.34	9.282		8.117	**0.000**		
	Self-Efficacy	6.197	1.637	0.338	3.785	**0.000**	0.792	1.263
	Assessment of HH Performance Barriers	-5.251	1.83	-0.257	-2.87	**0.005**	0.792	1.263
a. Dependent Variable: HH_6								

Research Question 5: *What demographic characteristics (e.g. years of work experience, age, education level and frequency of working with MRSA patients) were related to the RNs’ knowledge of MRSA, self-reported HH performance, and constructs in the HBM (e.g. perceived susceptibility and self-efficacy related to infection control)?* There were no significant relationships among demographic characteristics and MRSA knowledge (Table 21). Years as a registered nurse had a negative relationship with three self-reported HH ‘moments:’ ‘HH before clean/aseptic procedures’ (r=-.22, p<.05), ‘HH after touching the patient’s surroundings’ (r=-.20, p<.05), and ‘overall HH' (r=-.29, p<0.01) (Table 22). The characteristic ‘years as HCP’ had similar significant correlations with the same HH ‘moments.’

Table 21: Pearson Correlation Table- Demographic Characteristics and MRSA Knowledge

Correlations						
		Years in Nursing	**Years as HCP**	**Age**	**Level of Education**	**Frequency of MRSA Contact**
MRSA Knowledge	Pearson Correlation	.047	.000	-.021	.150	-.126
	Significance	.610	1.000	.821	.101	.169

Table 22: Pearson Correlation Table- Demographic Characteristics and 'My 5 Moments for HH'

(*N*=120)	**Years as RN**	**Years HCP**	**Age**	**Level of Education**	**MRSA Contact**
HH Before Touching the Pt	-.140 .127	-.111 .226	-.047 .614	.041 .655	.010 .918
HH Before Clean/Aseptic Procedures	**-.216*** **.018**	**-.230*** **.011**	**-.193*** **.034**	.046 .615	.069 .455
HH After Body Fluid Exposure Risk	-.046 .615	-.025 .787	-.098 .288	-.014 .876	-.042 .653
HH After Touching the Pt	-.159 .084	-.096 .296	-.140 .128	.026 .780	-.090 .330
HH After Touching the Pt's Surroundings	**-.201*** **.027**	**-.193*** **.035**	-.162 .078	.038 .681	**-.179*** **.050**
Overall HH	**-.289**** **.001**	**-.245**** **.007**	**-.219*** **.016**	.071 .440	-.048 .605

** Pearson Correlation are significant at the 0.01 level
*Pearson Correlation are significant at the 0.05 level

These relationships indicate that less experienced RNs are more compliant with some HH practices when compared to more experienced RNs. Age had a negative relationship with 'HH before clean/aseptic procedures' (r=-.19, p<.05) and 'overall HH' (r=-.219, p<.05). There was not a significant relationship between level of education and

self-reported HH behaviors. Frequency of MRSA contact had a negative relationship with 'HH after touching patient's surroundings.' This indicated that as the frequency of MRSA contact decreases, 'HH after touching the patient's surroundings' increases. This relationship is not completely understood. The same demographic characteristics were compared to the questionnaire subscales (Table 23). There were no significant relationships between the demographic characteristics and the following subscales: perceived severity, perceived susceptibility, cues-to-action, perceived barriers and self-efficacy. There were two significant correlations among years as HCP and Assessment of HH Performance Barriers (r=-.19, p<0.5) and perceived benefits (r=.24, p<.01). Interestingly this did not correlate with nursing years.

Table 23: Correlation Table: Demographic Characteristics and Questionnaire Instruments

(*N*=120)	**Years in Nursing**	**Years as HCP**	**Age**	**Level of Education**	**Frequency of MRSA Contact**
Assessment of HH Performance Barriers	-.105 .255	**-.193*** **.035**	-.177 .053	.117 .205	.132 .150
Perceived Severity	.121 .188	.145 .114	.085 .358	-.117 .202	-.107 .244
Perceived Susceptibility	-.009 .923	-.014 .877	-.001 .988	.118 .199	-.069 .456
Perceived Benefits	.164 .073	**.244**** **.007**	.099 .281	.043 .637	-.163 .075
Cues-to-Action	.101 .271	.087 .345	.056 .543	.110 .232	-.011 .909
Perceived Barriers	.015 .868	-.086 .353	-.001 .994	-.069 .452	.056 .543
Self-Efficacy	-.031 .734	-.019 .835	-.031 .737	.063 .496	-.093 .312

**Pearson Correlation is significant at the 0.01 level & *Correlation is significant at the 0.05 level

CONCLUSION

This chapter described in detail the data analysis for the study. Demographic characteristics of the sample were analyzed. In addition, descriptive statistics for each of the instruments were discussed. Correlation analysis identified some significant relationships among study variables. In addition, backwards stepwise regression identified that the Assessment of HH Performance Barriers and self-efficacy were significant predictors for self-reported 'overall HH' performance in Model 2.

Chapter 5

INTRODUCTION

This chapter will summarize the findings from this study. First, the outcomes are revisited and compared with the current literature review. This is followed by limitations and strengths of this study. Implications are reviewed and recommendations for future research are made based on the findings. Finally, statistical interpretation of the HBM is explained.

KNOWLEDGE OF MRSA

The MRSA knowledge scores ranged from three to 10 (*M*=6.63, *SD*= 1.53) out of a possible 10 points. The MRSA knowledge scores obtained in this study were comparable with the MRSA knowledge scores identified in the clinical group by the developers of this instrument. Brady et al (2009) identified that the mean score for the nonclinical control group was 4.7 (*SD*=1.80) and 6.6 (*SD*= 1.68) for physicians. In their study, infection control nurses had the highest knowledge scores (*M*= 8.69, *SD*= 1.12). Although the mean scores for Central Texas RNs are comparable with the clinical group, they still demonstrate moderate knowledge scores related to the MRSA bacterium. The questions in the knowledge survey were evaluated closely to identify if certain items could be answered differently depending on a particular institution's policies and procedures. Item seven was identified as the weakest item because only 35% of respondents answered it correctly. This item used the following true or false statement, 'MRSA colonized patients, their relatives and caregivers should be advised to reduce close physical and social interaction with children and the elderly, until nasal surveillance is negative for colonization,' which is a false statement on the questionnaire. An explanation for this response rate is an actual knowledge deficit, but more importantly it

is a knowledge deficit related to understanding the difference between colonization and active infection. Item nine on this questionnaire was correctly answered by 47% of RNs. This item used the following true or false statement: 'If a new positive MRSA carrier is found among the previously negative inpatients in a hospital ward, healthcare staff from that ward should be screened,' which is a false statement. This item also reinforces that there is a knowledge deficit among RNs understanding the relationship among HH behaviors and MRSA carrier status. In this situation, there is a high likelihood that there was cross-transmission of organisms but it would be difficult to isolate the exact cause or exact route for cross-transmission. Because it is well-established that HH is the single most effective means for reducing the risk for cross-transmission, the CDC does not recommend screening HCPs but rather reinforcing HH performance (Siegel et al., 2006). Surprisingly, only 57% of RNs surveyed knew that alcohol gel is at least as effective as hand washing in reducing MRSA transmission. This may explain why Central Texas RNs did not perceive 'access to HH supplies' as a barrier. Nurses may have access to these supplies, but they may not fully understand how alcohol gel, in many cases, is even more effective than hand washing, which would decrease their risk for cross-transmission. Item eight on the MRSA knowledge questionnaire was answered correctly by most respondents (84%). The item states 'Many studies have demonstrated rates of nosocomial infection are associated with high levels of nursing staff workload,' which is a true statement. This finding was particularly interesting because the most frequent barriers to HH performance reported by Central Texas RNs were associated with the system factors of workload and staffing. This phenomenon will be discussed in more detail later in this chapter.

Other studies that measured MRSA knowledge were reviewed to compare MRSA knowledge among Central Texas RNs and other HCPs. Phillips et al. (2010) evaluated

MRSA knowledge on an Ear, Nose and Throat unit. Although the researchers document MRSA knowledge scores that were similar (72.5%) to what was demonstrated with the Central Texas RNs, the MRSA knowledge items were not comparable. Specifically, they were less generalizable items that focused on a specific institution's policy and procedures. For example, '3 negative MRSA screens are needed before a patient with a MRSA infection can return to an open ward' and 'a patient with a MRSA infection would be nursed in a side room.' Another study by Mamhidir et al., (2010) was compared with Central Texas RN knowledge scores. The researchers in this study did not report an overall MRSA knowledge score, but they did report scores by item. Specifically they identified that only 36% of participants knew that antibiotics are not used when a patient was colonized with MRSA. Mamhidir et al. (2010) asked questions that were more generalizable than Phillips et al. (2010) but many of their questions did not differentiate between MRSA infection and MRSA colonization, which may have affected some of the scores. For example the item, 'Apron should always be worn when treating a patient with MRSA' would be answered differently for a MRSA colonized versus MRSA infected patient. Current literature would support wearing an apron for patients with draining MRSA wounds that cannot be contained, but not necessarily for patients colonized with MRSA. Easton et al. (2007) asked similar knowledge questions when compared with the MRSA knowledge instrument used in this study. They identified 83% of participants knew that *Staphylococcus aureus* is a gram positive organism, which was similar when compared with 79% of Central Texas RNs. More Central Texas RNs (68%) were knowledgeable about common sites colonized with MRSA when compared with 36% of nurses identified by Easton et al. (2007). One explanation for the differences in scores may be related to time between studies. As MRSA has become more prevalent in the acute care setting there has been more knowledge gained as a result of increased

frequency of contact with MRSA patients. In addition, the study by Easton et al. (2007) was conducted in Scotland and there may be a difference in cohorts based on experiences including MRAS knowledge and frequency of MRSA contact. Additionally, Central Texas RNs (75%) were more knowledgeable about common sites for MRSA infection when compared with 26% identified by Easton et al. (2007). Although the knowledge scores obtained from the Central Texas RNs were moderate, they demonstrate more knowledge in some areas when compared with the literature review.

When evaluating the results from the MRSA knowledge instrument, it is important to remember that RNs self-reported HH performance statistics that were highest during 'moments' with increased perceived risk, especially with increased perceived risk to self. For this reason, it was suggested that increasing knowledge related to HH will only be effective if the RN truly understands the perceived susceptibility for colonization and cross-transmission of organisms. Increasing perceived susceptibility about colonization and cross-transmission may be a starting point for improving HH performance behaviors among RNs. Knowledge alone related to MRSA facts may not be enough to drive HH performance. This was observed in this study because there was no significant relationship between MRSA knowledge and 'overall HH' performance (r=-0.06, p=.56). Although there was not a significant relationship, knowledge did have a role in this model because a significant positive relationship identified between knowledge and self-efficacy (r=.27, p<.01), and self-efficacy was the strongest predictor for 'overall HH' in the regression analysis. This finding is important to understand when developing strategies to empower the nurse and improve self-efficacy behaviors because knowledge about MRSA facts may not be enough to improve HH behaviors among RNs. However, focusing education programs on perceived susceptibility may be more beneficial because RNs self-report higher HH statistics for 'moments' associated with

higher perceived risk. Teaching the RNs about perceived susceptibility of cross-transmission may drive improvements in HH performance among RNs. To understand this phenomenon further, the MRSA questionnaire was administered to evaluate the perceived susceptibility and perceived severity of MRSA among Central Texas RNs. In addition, questions were posed that asked how understanding perceived susceptibility would influence self-efficacy, which in turn would drive HH performance behaviors. This will be discussed in the following section.

MRSA QUESTIONNAIRE

The MRSA questionnaire was administered to the Central Texas RNs with the purpose of understanding perceived severity and perceived susceptibility related to MRSA. In addition, some items asked about self-efficacy behaviors as they related to increased knowledge about perceived susceptibility to MRSA. Among Central Texas RNs, 33% believed that they carried MRSA but only one RN had been told by their HCP that they carried MRSA. This is new information because this data has not been reported in other studies. More Central Texas RNs (83%) believed that they were at risk for MRSA carriage when compared to 46% in a study conducted by Wolf et al. (2008). Among Central Texas RNs, 75% stated that they would want to know if they carried MRSA and 78% of RNs said they would not object to hospitals screening for MRSA carrier status. In addition, 82% of RNs stated that their self-efficacy behaviors would improve by 'understanding the direct relationship between ineffective HH and RNs who carry MRSA.' Also, 88% of RNs stated that their self-efficacy behaviors would improve for holding others accountable by 'understanding the direct relationship between ineffective HH and RNs that carry MRSA.' These findings indicate a need for closing the knowledge gap between MRSA carrier status and HH behaviors. These statistics may

explain how knowledge alone related to the MRSA bacterium does not change behaviors. However, HH campaigns designed not only to increase knowledge but also improve understanding of perceived severity and perceived susceptibility of MRSA may be more effective when attempting to modify HH behaviors among RNs. Sixty-nine percent of RNs stated they were concerned they could take MRSA home to their family and 57% were concerned that they could spread MRSA into the community. This demonstrated a heightened awareness for the potential risk for cross-transmission of pathogens. Campaigns focused on protection of one's self, one's family and the community may be a good strategy to improve HH behaviors. In addition, these statistics reinforce the importance of increasing knowledge related to perceived susceptibility about colonization and cross-transmission. Although it may be important to understand MRSA facts, these facts are not the information that drives improvements in HH performance among RNs. First, the perceived risk must be established, then reinforce this risk with MRSA facts.

SELF-REPORTED HH BEHAVIORS

Self-reported HH was measured among RNs using 'My 5 Moments for HH.' These 'moments' included: before patient contact, before clean/aseptic task, after body fluid exposure risk, after patient contact, and after contact with patient surroundings. In addition to these 'moments,' a question was posed, which asked the RN to think about 'My 5 Moments for HH' and rate an 'overall HH' performance statistic (see Table 14). This was the first time that HH had been studied using the RN's self-reported rates at all of the 'My 5 Moments for HH.' The HH 'moment' that has been interpreted as having the highest perceived susceptibility to the RN was 'HH after body fluid exposure risk' and HH performance was ranked highest for this 'moment' (98%). The HH 'moment' that has been interpreted to have the least perceived susceptibility to the RN was 'HH

after touching the patient's surroundings' and HH performance was ranked the poorest for this 'moment' (78%). This may indicate that the RNs decision making related to HH behaviors is highly related to perceived susceptibility for acquiring or cross-transmitting pathogens, especially when the perceived susceptibility is directed toward the RN. For this reason, educational programs must focus on perceived susceptibility, especially between MRSA carrier status and cross-transmission of pathogens. Once this perceived susceptibility is established, it can be reinforced with the MRSA facts (e.g. morbidity/mortality statistics and non-reimbursable costs associated with HAIs), but these facts alone are not enough to change HH performance among RNs.

Table 24: Self-Reported HH (*N*=120) Compared with HH Observation Reports from the Literature Review

Current Study	HH Before Touch Pt	HH Before Clean/ Aseptic Procedure	HH After Body Fluid Exposure Risk	HH After Touch Pt	HH After Touch Pt's Surround-ings	Overall HH	**HH statistics reported from the literature (Table 1)**
Acute Care (*n*=29)	84%	95%	100%	91%	77%	89%	**34%, 46%, 75%**
Critical Care (*n*=25)	81%	89%	97%	93%	80%	87%	**61%, 61%, 70%**
Emergency (*n*=16)	71%	93%	100%	87%	79%	86%	**19%**
Surgery (*n*=13)	79%	96%	100%	91%	76%	91%	**24%**
Neonatal (n=8)	96%	99%	100%	98%	89%	96%	**21%, 66%, 78%**
Women's (*n*=17)	82%	91%	97%	89%	78%	86%	**n/a**
Other (*n*=12)	93%	97%	95%	88%	82%	89%	**n/a**

Hand hygiene 'before touching' and 'after touching' the patient are typically the 'moments' used in observation studies. However, it is important to note that in a review completed by the WHO (2005), methods for HH observation varied among studies. In addition, most studies reviewed failed to include HH 'after contact with the patient's surroundings.' For these reasons, HH performance statistics (before and after patient contact) among Central Texas RNs will be compared with HH observational studies in the literature. Observation studies have traditionally reported lower statistics than self-report because healthcare providers tend to overestimate their self-efficacy behaviors (Haas & Larson, 2007). HH performance in the literature ranged from 5% to 81% with an average rate of 40% (WHO, 2005). Additionally, HH behavior statistics have varied by patient population. A summary of 'My 5 Moments for HH' is compared by patient population and with the literature in Table 24. Central Texas RNs reported higher frequencies of HH performance behaviors than those reported in the literature. For example, the poorest unit-based HH performance statistic occurred in the emergency department, which was 19% (Martino et al., 2011). However, the Central Texas RNs working in the emergency department (n=16) ranked HH performance between 71% (before touching) to 87% (after touching). Neonatal units reported the highest HH performance in the literature (78%), which was also identified among Central Texas RNs. HH among Central Texas RNs in the neonatal unit ranged from 96% (before touching) to 98% (after touching). It was interesting that neonatal RNs reported the highest HH statistics across all 'moments.' In addition, they had the narrowest gap in percentile points between contacts (before and touching). This may represent a cultural difference among units. In the neonatal environment, the RN may place particular emphasis on the perceived susceptibility of the infant and view the patient as being particularly vulnerable, which may drive their self-efficacy for HH performance. Differences in

percentile points before and after patient contact, after excluding neonatal units, ranged from eight (critical care) to 16 points (emergency department) when comparing all nursing units. This was an interesting finding because critical care often has a smaller nurse to patient ratio than the emergency room and critical care may be viewed as a more controlled and stable environment. These system-related differences among units may play a role when explaining the RNs self-reported HH rates and their ability to overcome barriers. When compared with the literature review, the acute care unit's HH performance statistics ranged from 34% to 75% depending on the study being evaluated. This statistic was relatively low when compared with Central Texas RNs that reported HH performance between 84% (before touching) to 91% (after touching). Hand hygiene performance statistics during the 'moments' that have been interpreted to have the highest perceived susceptibility (HH after body fluid exposure risk) were similarly ranked across units and ranged from 95% to 100%. Hand hygiene performance during 'moments' interpreted to have the lowest perceived susceptibility (HH after touching patient's surroundings) were similarly ranked from 76% to 89%.

BARRIERS TO HH PERFORMANCE

Barriers to HH performance have been noted in the literature. The WHO (2009) completed an extensive literature review revealing 20 of the most commonly reported HH barriers. These barriers served as items in the Assessment of HH Performance Barriers questionnaire. These barriers were correlated with the 'My 5 Moments for HH' and self-rated 'overall HH' performance statistic (Table 17).

There were seven barriers that did not have a significant relationship with any of the 'moments' for HH. These barriers included: 'HH agents irritate my skin,' 'I have access to HH supplies,' 'patient needs take priority over HH,' 'lack of rewards and

encouragement to perform HH,' 'lack of scientific information,' 'lack of institutional HH guidelines and protocols,' and 'there is a low risk for acquiring infection from patients.' The literature was examined with specific focus on the above mentioned barriers to try and explain the rationale for the barriers no longer affecting the present day RN. The studies cited by the WHO were not current. For the barrier: 'HH agents irritate my skin,' 11 articles were cited that were published between 1982 and 2005; 'I have access to HH supplies' 14 articles were cited between 1982 to 2000; 'patient needs take priority over HH' three articles were cited between 1998 and 2005; 'lack of rewards and encouragement to perform HH' three articles were cited between 1982 and 1991; 'lack of scientific information' three articles were cited between 1999 and 2000; 'lack of institutional HH guidelines and protocols' seven articles were cited between 1982 and 2007; and 'there is a low risk for acquiring infection from patients' one article was cited from 2000. Becuase the literature is older, this may indicate that this barrier has decreased over time. Specifically, HH product manufacturers have improved their ingredients and inpatient hospital settings have improved access to supplies. For the barrier, 'patient needs take priority' may have been answered differently among Central Texas RNs based on the questionnaire instructions. For this study, the directions asked the RN to exclude emergent situations. If emergent situations are removed from this barrier, then the RN may not perceive the patient's needs as taking priority over the HH behavior. In studies that evaluated this barrier, the context was not explained (e.g. emergent versus non-emergent circumstance). Merely two RNs stated that they strongly agreed that the 'patient's needs took priority over HH.' Among Central Texas RNs only six agreed that there was 'lack of rewards and encouragement to perform HH' and eight RNs agreed with the barrier 'lack of scientific information.' This may be related to the

well-established science for HH and Infection Control. In future studies examining barriers to HH performance, these could potentially be eliminated.

Next, the barriers that had the strongest relationship and were correlated most often with at least four HH 'moments' will be discussed. These were mostly 'system factors' (see Table 17). There was one additional factor that was associated with high perceived risk for cross-transmission, which was significant and negatively correlated with four HH 'moments.' These barriers include: 'at times I am too busy for HH,' 'a high workload influences HH,' 'the number of patients in my assignment influences HH,' 'there is lack of personal accountability culture,' and 'I perform HH when there is higher risk for cross transmission.' Although there are increased costs associated with alleviating the staffing/workload burden for RNs, detrimental financial impact is associated with HAIs. It is prudent to evaluate barriers to one's institution to identify if an upstream approach should be taken to alleviate some system factors that are perceived by the RN as the most significant obstacles that directly influence HH performance.

There were two HH 'moments' that did not correlate with barriers. These included 'HH before clean/aseptic procedures' and 'HH after body fluid risk exposure.' This finding reinforces that when perceived risk for cross-transmission is present, then the HH 'moment' takes priority for RNs, and they are likely to overcome the barrier.

INFECTION CONTROL PERCEPTION SURVEY

The Infection Control Perception Survey assesses the RNs' attitudes toward infection control using the Health Belief Model. This instrument incorporated six subscales of perceived severity, perceived susceptibility, perceived barriers, perceived benefits, cues-to-action, and self-efficacy.

Perceived Severity

Perceived Severity had a mean score of 4.01 (*SD*=0.6). These scores were compared to the findings from Lewis and Thompson (2009) (*M*=4.2, *SD*=0.59), which were similar. The scores indicated a level of agreement among Central Texas RNs that HAIs are a serious problem. Neutral responses to statements were not common among those surveyed. In fact, four out of six items did not have a single neutral response. This indicates that the RNs have taken a position and most agree or strongly agree that having a patient with a HAI is a very serious problem for the hospital, the patient, and the nurse. The RNs also agree that a patient with HAI could die, could cost a lot, and could cause them trouble. There was consensus among 100% of those surveyed that 'having a patient with HAI could cost a lot,' and was the only item the RNs did not disagree on at all. Because RNs agreed that cost associated with a HAI is a severe problem, then focusing attention on costs associated with specific HAIs may be beneficial for improvement of HH performance behaviors.

Perceived Susceptibility

Perceived Susceptibility had a mean score of 3.72 (*SD*=0.47). These scores were compared with Lewis and Thompson (2009) (*M*=3.8, *SD*=0.46) and found to be comparable with this study. The mean score favors a more neutral level of agreement among Central Texas RNs. This was explained after the scores for each item were individually inspected and it was observed that there was some inconsistency in how items were scored. Lewis and Thompson (2009) averaged the perceived severity scores for the level of agreement among HCPs. They did not indicate that any of the items in this instrument were reverse-coded. However, reverse-coding may have been appropriate for one of the items. For example, 98% of RNs agreed with the item 'if I do not engage in proper infection control practices, I could spread infection to my family' and 99% RNs

agreed that 'if I do not engage in IC practices, I could spread infection to my patients.' Additionally, 93% of RNs agreed that 'they practice infection control practices because they are concerned for their own health' and 90% agreed that they 'practice infection control because they are concerned for the health of their family.' However, 92% of RNs disagreed with the item 'I get sick with communicable/infectious diseases all the time.' This item may have needed to be reverse-coded to properly measure perceived susceptibility in the summated scale. The rationale for reverse-coding this item is because this statement potentially implies that the RN is not engaging in proper infection control processes and this is the rationale for getting sick with communicable diseases on a regular basis. When this item is reverse-coded the correlation between perceived susceptibility and 'overall HH' slightly improved from r=.13 (p=.17) to r=.16 (p=.07), which approached significance but was not. Because the relationship was not significant, and it had no effect on the backwards regression analysis, the choice was made to keep the item scoring consistent with the authors of the instrument. If needed, in future studies this item may be reevaluated for reverse-coding to identify if this construct is significantly related to self-reported HH behaviors among RNs.

Perceived Barriers

Perceived Barriers had a mean score of 1.70 (SD=0.47). These scores were compared to the findings from Lewis and Thompson (2009) (M=1.7, SD=0.52), which were comparable. The scores indicated a level of agreement among RNs that certain barriers to infection control are a problem. There were two items on this scale that were scored neutral by more than 5% of RNs. These items were 'engaging in proper infection control practices is expensive' (n=23 neutral responses) and 'infection control practices interfere with patient care' (n=11 neutral responses). There was one item that had

unanimous disagreement (*n*=120) among RNs surveyed, which was 'I do not feel that engaging in proper infection control is my responsibility.' Nearly all (99%) of Central Texas RNs disagreed with the following statement 'I feel that engaging in infection control measures is too hard.' Similarly, 94% of the RNs disagree with 'I do not like engaging in proper infection control.' There was also agreement among 88% of the RNs that believed they had enough knowledge about infection control, it did not take too much time to engage in infection control, and that it does not interfere with patient care. In summary, Central Texas RNs feel that it is not hard, they do not dislike engaging, and they feel it is their responsibility to participate in proper infection control.

Perceived Benefits

Perceived Benefits had a mean score of 4.61 (*SD*=0.45). These scores were compared to the findings from Lewis and Thompson (2009) (*M*=4.6, *SD*=0.38), which were similar. There were no Central Texas RNs that disagreed with the items measuring Perceived Benefits and there were four or less neutral responses to three of the five items. The scores indicated a high level of agreement among Central Texas RNs that infection control behaviors benefit the patient, the hospital, and themselves.

Cues-to-Action

Cues-to-action had a mean score of 3.59 (*SD*=0.70). These scores were compared to the findings from Lewis and Thompson (2009) (*M*=3.2, *SD*=0.38), which were comparable. This mean score favors a more neutral response among registered nurse to the statements aimed at measuring the construct cues-to-action. This is likely the reason it was not significantly correlated with 'overall HH.' It was interesting that cues-to-action had the largest percentage of neutral responses and largest standard deviation among all subscales in the Infection Control Perception Survey. This may indicate that the items

used to assess cues-to-action are not an accurate reflection of this construct. Qualitative studies may be needed to further understand this phenomenon. It was interesting that 83% percent of Central Texas RNs agreed that taking infection control courses may prevent a patient from getting a HAI but only 56% reported that attending a professional development seminar on infection control would help them remember to engage in proper infection control activities. This may reflect that the RNs would prefer to be engaged in shorter learning activities to reinforce knowledge related to bacterium, HH, and infection control. The most frequent neutral response (38%) was in regard to the item 'If a poster was present in the wash-room, I would remember to wash my hands' (*n*=46). In addition, 23% (*n*=27) disagreed that the poster would be an effective reminder. This indicates that 61% of Central Texas RNs believe that posters may be ineffective for HH campaigns, yet this method of awareness is regularly observed in the inpatient hospital setting. This may be explained as the posters do not have influence if they are simply a reminder 'please do not forget to wash your hands.' It may be more effective to explore the effects of cues-to-action on HH by modifying 'cues' at particular intervals (e.g. monthly) and adding information about perceived susceptibility to see if these cues are more effective than a simple reminder. Sixty-three percent of Central Texas RNs believed that if a coworker reminded them to regularly engage in infection control practices they would remember. This may be an important factor when planning interventions aimed at increasing knowledge. Especially because 88% of Central Texas RNs reported that understanding the direct relationship between HH and MRSA carrier status may empower them to hold each other accountable for HH.

Self-Efficacy

Self-efficacy had a mean score of 4.01 (*SD*=0.55). These scores were compared to the findings from Lewis and Thompson (2009) (*M*=4.3, *SD*=0.51), which were comparable. Most RNs agreed with self-efficacy statements. Greater than 90% of Central Texas RNs agreed that they 'engage in good infection control practices,' believe that 'engaging in proper infection control is important,' 'follow recommendations regularly,' and 'often use sanitizer while working in the healthcare setting.' There were two items that had mixed results. The first item stated 'I seek information on infection control practices' and only 60% of Central Texas RNs agreed with this statement. The second item stated 'hand sanitizers are as effective as hand washing in controlling infection.' Forty-eight percent were either neutral or disagreed with this response, which is alarming because hand sanitizer is considered more effective than hand washing unless the HCP is working with a patient infected with a spore (i.e. *Clostridium difficile*). This item is listed as a self-efficacy statement, but it is not aimed at understanding the participant's ability to perform a behavior. In future studies, this item may need to be reworded to accurately assess self-efficacy by stating 'I use hand sanitizer at every opportunity that presents itself because this behavior assists with controlling infection,' rather than using a statement that assesses knowledge about infection control practices.

RESEARCH QUESTION 1

What was the self-reported rate of HH performance among RNs (before touching the patient, before clean/aseptic procedures, after body fluid exposure risk, after touching the patient, after touching the patient's surroundings, and 'overall HH' performance rate)? The RNs' self-reported rate of HH performance (Table 14) was measured using 'My 5 Moments for HH' (Sax et al., 2007). The mean HH performance rate 'before touching' the patient was 82% (*SD*=22.9). This was the largest standard deviation

reported by ‘moment,’ which indicates more variability with this ‘moment.’ This variability may be related to differences in the RN’s patient population that they primarily worked with in the inpatient setting and potential barriers to HH within the RN’s hospital system (Table 24). Hand hygiene statistics were reported the highest among the two ‘moments’ interpreted to have the highest perceived susceptibility for cross transmission. The first ‘moment’ was HH ‘before clean/aseptic procedures’ was reported as 94% (*SD*=10.5). The second ‘moment’ was HH ‘after body fluid exposure risk,’ was reported at 98% (SD=7.1). This smaller standard deviation for the perceived risk to the nurse was smaller than the perceived risk to the patient. The mean HH performance statistic reported for ‘after touching the patient’ was 91% (SD=14.2). ‘After touching the patient’ is the third highest percentage for HH performance reported by Central Texas RNs. This ‘moment’ can be explained as having higher perceived susceptibility than the other two ‘moments’ (‘before touching the patient’ and ‘after touching the patient’s surroundings’), but not as high of a risk as with ‘body fluid exposure risk’ or ‘clean/aseptic procedures.’ This may be an important finding because *transient* carriage of bacteria on the hands of healthcare workers ‘after touching the patient’ is the highest risk factor for cross-transmission of organisms.

The data reflected some hierarchical importance that may have clinical significance for understanding an RN’s decision making associated with ‘My 5 Moments for HH.’ The RNs reported they were more likely to perform HH during ‘moments' of highest risk posed to themselves (98%), which was followed by the highest risk ‘moment’ that would protect their patient (94%). These two ‘moments’ interpreted to have the highest perceived risk were followed by a slightly lower response rate for ‘after touching the patient’ (91%). This ‘moment’ can pose potential for cross-transmission, but the RN may never realize the effect of cross-transmission. This may be related to

incubation times for infection and pathogens that may lay dormant on surfaces for a period of time. Because many RNs never recognize how their actions have affected another individual, which could affect their perceived susceptibility for cross-transmission. The next 'moment' 'before touching' the patient was reported at 82% (SD=22.9). This 'moment' poses risk to the patient, but not as much risk as an invasive procedure. Registered Nurses may modify their HH behaviors based on the perceived susceptibility associated with the HH 'moment.' Unfortunately, if HH does not occur 9% of the time 'after touching' the previous patient and HH is not performed 18% of the time 'before touching' their next patient, then the risk for cross-transmission of organisms is a continued threat. Hand hygiene 'after touching the patient's surroundings' was reported with a mean of 78% (*SD*= 18.9%), which was the poorest HH performance statistic reported by the Central Texas RNs. This may be because it is associated with the least perceived susceptibility when compared with all other 'moments.'

RESEARCH QUESTION 2

What was the level of RNs' knowledge related to the MRSA bacterium; and was there a relationship between MRSA knowledge and constructs in the HBM as they were measured using the Infection Control Perception Survey (e.g. perceived susceptibility, perceived severity related to infection control)? There was only one significant relationship identified between MRSA knowledge and HBM constructs. This positive relationship was identified with self-efficacy (r=.27, p<.01) indicating as MRSA knowledge increased, self-efficacy behaviors also increased. MRSA knowledge and perceived barriers approached significance (r=-.17, p=.06) and may present clinical significance. This relationship can be described as MRSA knowledge increases RNs are more likely to overcome barriers to infection control. It was interesting that no other

constructs had a relationship with knowledge. This may be because knowledge does not directly influence perceived severity, perceived susceptibility, perceived benefits, perceived barriers, or cues-to-action. Intuitively, one could hypothesize that there would be some type of relationship between knowledge and these constructs, but there does not appear to be one between MRSA knowledge as it was measured in this study for five of the six constructs in the HBM. MRSA knowledge may be mediating factor that will influence other constructs in the HBM, but may not be directly related to the constructs.

This questionnaire was used to assess MRSA knowledge because it was the most generalizable questionnaire published in the literature and knowledge related to the MRSA bacterium was selected because it was the most commonly isolated MDRO identified in the inpatient hospital setting. Although these are important factors to consider when selecting an instrument, the items in the MRSA questionnaire may not be related to the constructs in the HBM and higher (or lower) scores are not related to constructs in the HBM. MRSA knowledge may have a role in the model as a factor that is related to self-efficacy, but does not appear to directly affect other constructs in the HBM.

RESEARCH QUESTION 3

What were the barriers to the RNs' ability to perform HH behaviors in the inpatient hospital setting; and was there a relationship between barriers to HH performance scores and 'overall HH' performance rates? The Assessment of HH Performance Barriers was correlated with all of the 'My 5 Moments for HH' (Table 17), which revealed that there were seven variables that were not rated as barriers by the RNs in this study. The following barriers did not correlate with any of the HH 'moments:' 'HH agents irritate my skin,' 'I have access to HH supplies,' 'patient needs take priority

over HH,' 'lack of rewards/encouragement to perform HH,' 'lack of scientific information,' 'lack of institutional protocols/guidelines,' and 'there is low risk of acquiring infection from patients.' The following barriers only correlated with one or two of the 'My 5 Moments for HH:' 'HH interferes with the HCP-patient relationship,' 'lack of HH promotion at the individual level,' 'lack of HH promotion at the institutional level,' and 'lack of a role model for HH at my workplace.' Reliability statistics for the Assessment of HH Performance Barriers (α=.80) were compared with the reliability of the instrument after removing the seven non-significant variables (α=.82), which demonstrated some improvement in the scale after the non-significant variables were removed. Reliability was also calculated after removing the seven non-significant variables and the four barriers that correlated with one or two 'moments' and reliability did not improve (α=.77). For this reason, it may be prudent to remove the variables that are not significantly related to 'overall HH.'

The barriers that had the strongest relationship were also correlated with at least four HH 'moments'. These included the five system factors: 'at times I am too busy for HH,' 'a high workload influences HH,' 'inappropriate staffing influences my HH,' 'the number of patients in my assignment influences HH,' and 'lack of personal accountability culture;' and one perceived risk barrier: 'I perform HH when there is higher risk for cross transmission.' The barriers including, 'wearing gloves is HH' and 'lack of administrative sanction for non-compliers' are correlated with three of the HH moments. Table 17 summarizes the relationships among HH performance barriers and the self-reported HH 'moments.' The strongest relationships were among the following variables: 'At times I am too busy to perform HH' and 'HH after touching the patient (r=-.43, p<.01),' and 'the number of patients in my assignment influences HH' and 'overall HH' (r=-.42, p<.01). This indicates that inpatient hospital settings may need to examine

system factors related to the number of patients in a RN's assignment and how busy they are during their shift. If HAI infection rates are a problem for a particular inpatient hospital setting, these factors should be examined and alleviated in order to decrease barriers and increase HH performance among RNs.

RESEARCH QUESTION 4

What were the relationships between constructs in the HBM (e.g. perceived susceptibility, perceived severity, self-efficacy, perceived barriers, cues-to-action, and perceived benefits) with 'overall HH' behaviors; and do these constructs predict 'overall HH' performance rates? There were significant relationships with 'overall HH' among three variables (see Table 19). 'Overall HH' was significantly associated with the Assessment for HH Performance Barriers (r=-.41, p<.01), perceived barriers (r=-.29, p<.01) and self-efficacy (r=.46, p<.01). This indicates that the three variables that were most likely to predict 'overall HH' performance were overcoming barriers and one's ability to perform a behavior and were entered into the stepwise backwards regression model. Two constructs had non-significant relationships with perceived severity (r=.10, p=.27) and perceived susceptibility (r=.13, p=.17). The Infection Control Perception Survey had some limitations when evaluating perceived susceptibility, especially in relation to one item that would be a more accurate representation of the construct if it were reverse-coded. This item was reverse-coded and the subscale was recalculated in SPSS. After re-calculation, the correlation analysis was repeated and the relationship improved slightly r=.13 (p=.17) to r=.16 (p=.07) and approached significance. Because the relationship was not significant, it was not entered into the backwards regression model.

The regression analysis reveals there was a significant relationship among variables in model two once perceived barriers was removed (r=.51, p<.01). Model 2 accounted for 26% of the variance in 'overall HH.' This statistic indicates that 74% of the variability in 'overall HH' scores remain to be explained and more research is needed in this area to fully understand HH performance predictors and factors that may influence this behavior (see Tables 19 and 20).

RESEARCH QUESTION 5

What demographic characteristics (e.g. years of work experience, age, education level and frequency of working with MRSA patients) were related to the RNs' knowledge of MRSA, self-reported HH performance, and constructs in the HBM (e.g. perceived susceptibility and self-efficacy related to infection control)? There were no demographic characteristics that were related to MRSA knowledge (see Table 21). Years in nursing, age, level of education and frequency of MRSA contact were not significantly correlated with constructs in the HBM (see Table 23). Years as HCP significantly correlated with Assessment of HH Performance Barriers (r=-.19, p<.05) and perceived benefits (r=.24, p<.01). This is best explained as the RN is able to overcome barriers when they have more experience in the healthcare environment. In addition, more years as a HCP was positively related to higher perceived benefits for infection control compliance. There were some significant relationships noted among 'My 5 Moments for HH' and demographic characteristics (see Table 22). Hand hygiene 'before clean/aseptic procedures' was negatively correlated with years as RN (r=-.21, p<.05), years as HCP (r=-.23, p<.05), and age (r=-.19, p<.05). This indicates that when it comes to high risk situations, younger RNs are more likely to perform HH. This may represent that as the RN ages, and their level of experience increases, they have a more complacent attitude

toward HH and infection prevention. Hand hygiene 'after touching the patient's surroundings' was negatively correlated with years as RN (r=-.20, p<.05), years as HCP (r=-.19, p<.05), and frequency of MRSA contact (r=-.18, p<.05). This may reinforce that RNs become more complacent with HH as they increases in age and level of experience. 'Overall HH' was negatively correlated with years as RN (r=-.29, p<.01), years as HCP (r=-.25, p<.01), and age (r=-.22, p<.05). Again, with 'overall HH' the RN becomes complacent with HH performance as they gain experience. This may be because their perceived susceptibility decreases over time. There were no demographic characteristics that correlated with HH 'before touching' the patient, 'HH after body fluid exposure risk,' and 'HH after touching the patient.'

STATISTICAL INTERPRETATION OF THE HBM

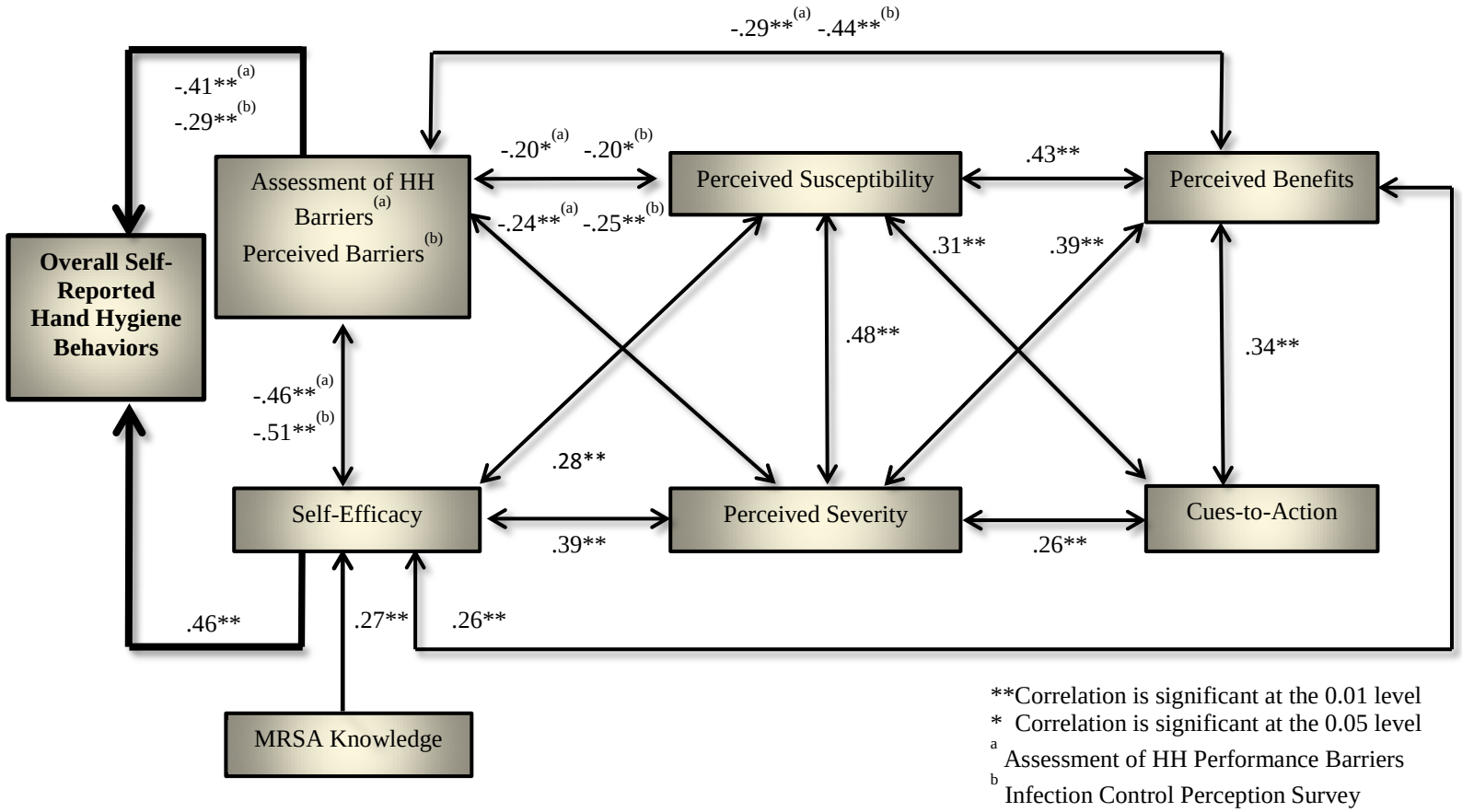
Once the correlational analysis was completed the arrows pointing to variables in the model were modified to reflect the relationships among constructs (see Figure 2). There was an addition of one variable, which was MRSA knowledge with an arrow pointing to self-efficacy. All HBM constructs remained in the model, but some arrows indicating a non-significant relationship were eliminated. Cues-to-action had significant relationships with only three constructs in the HBM, which included perceived severity, perceived susceptibility and perceived benefits. Arrows to the other constructs were removed in Figure 2. In addition, there were only two constructs that were related to 'overall HH,' which were self-efficacy and barriers (barriers reported in both the Infection Control Perception Survey subscale and Assessment of Barriers to HH Performance). These constructs have darker arrows pointing to 'overall HH' to represent them as significant variables related to 'overall HH' among Central Texas RNs. Because the predictor variables in this study merely represented 26% of the variability in 'overall

HH,' more research is needed to identify other potential significant predictor variables that may explain the variance in HH performance among RNs. This may be explored further with the Infection Control Perception Survey or the survey could be adapted to account for more accurate measurement of the constructs in the HBM. This could potentially include adding, deleting or reverse-coding some items based on reliability and validity statistics. Future studies aimed at fine tuning instruments used to measure HBM constructs are needed in order to identify if this model is a good fit for predicting 'overall HH' among RNs in the inpatient hospital setting.

STRENGTHS AND LIMITATIONS

There were several strengths associated with this study. The first strength is that the study used the most current list available for all RNs licensed in the State of Texas. This list was filtered to focus on the Core Central Texas area and a program was used to randomly generate 720 RNs from the filtered list. Because this study used a random selection of participants, the results of this study are more generalizable. Another strength of this study was that the survey responses remained anonymous, which may allow for more truthful responses to the questionnaire. The use of a theoretical model that has been well defined in the literature to guide the study is also noted as a strength. This study included an apriori power analysis used to identify the target number of participants to include in this study. In addition, a post-hoc power analysis was also completed that demonstrated the study had sufficient power. The instruments used to guide the study were either published in the public domain or adapted from the literature. This allowed for findings to be compared with current literature. Another strength for this study was that it included steps from the Tailored Design Method for mail survey data collection, which is an evidence based model for data collection (Dillman, Smyth & Christian,

Figure 2: Significant Relationships among Self-reported HH and Constructs in the Health Belief Model



**Correlation is significant at the 0.01 level
* Correlation is significant at the 0.05 level
[a] Assessment of HH Performance Barriers
[b] Infection Control Perception Survey

2009). Finally, the reliability statistics were calculated for the questionnaire instruments and the findings indicated that the instruments were reliable.

There were a number of limitations to this study. One limitation was that the study focused only on RNs in the Core Central Texas area. This focus may limit findings to represent RNs isolated to this specific area. If the study included all RNs in Texas, the findings may have been more generalizable. Another limitation is that this study used a cross-sectional design with data collected at one time point. The response rate was relatively low for this study, which may reflect a heightened probability of response bias.

IMPLICATIONS AND RECOMMENDATIONS

Implications for Nursing Practice

This study provided an exploration of MRSA knowledge, self-reported HH, barriers to HH performance, and attitudes toward infection control using the HBM among Central Texas RNs. There were multiple implications that have emerged from this study. The first implication for nursing practice is that knowledge alone may not change practice. However focusing education programs on perceived susceptibility may be beneficial because perceived susceptibility drives self-efficacy behaviors for HH performance among RNs. Specifically, it was identified that HH performance was influenced by the riskiness of the 'moment' that was presented, especially if the risk was posed to the self. Although there was no direct association between knowledge and 'overall HH,' there was a relationship between knowledge and self-efficacy. Knowledge has a positive and significant relationship with self-efficacy (r=.27, p<.01) and self-efficacy was the most significant predictor of 'overall HH.' Education programs focused on perceived susceptibility may improve HH performance because the perceived risk associated with colonization or cross-transmission would be highlighted. These risks can

be reinforced with MRSA facts including morbidity/mortality statistics and costs associated with HAIs, but the focus of the education cannot only be on MRSA facts and there must be a correlation between perceived susceptibility and HH performance. In fact, Central Texas RNs reported that they would be more likely to perform HH and hold others accountable if they understood the direct relationship between MRSA carrier status and HH.

Another implication for improving HH performance among RNs is incorporating a section of the knowledge campaign on protecting one's self, one's family and the community. Because Central Texas RNs reported high perceived susceptibility for bringing MRSA home to their family (69%) and their community (57%), this focus could provide a foundation for empowering RNs to take more responsibility for their potential roles as vectors for cross-transmission of organisms. When education programs are created the perceived susceptibility focus should include a segment on case studies including situations where MRSA has affected the loved ones of HCPs. This perceived susceptibility can be highlighted with MRSA facts (e.g. people without risk factors for infection can become infected with MRSA and die, 17% of invasive MRSA infections result in death), but MRSA facts should not be the focus of the knowledge campaign.

Another potential implication for nursing practice is to take an upstream approach to prevent HAIs by assessing potential system factors that act as barriers to HH performance. Alleviating these barriers would prevent detrimental financial impact of HAIs and the publically reported HAI rates. If a particular institution is starting a new campaign for HH performance based on HAI rates, they must examine the barriers to HH performance and they cannot rely on knowledge alone to improve HH performance among RNs. It is imperative for the inpatient hospital to evaluate how system related factors may contribute to ineffective HH performance in their setting. For example, if

SSIs and CAUTIs are high on an acute care ward, then barriers to HH may need to be evaluated. Because Central Texas RNs have reported that system factors are the most frequently correlated barrier with HH performance, then these factors could be examined first or the inpatient hospital should do a self-assessment and identify barriers that may be specific to their particular institution. A cost analysis is beneficial, which should include current HAI rates, non-reimbursable expenses, projections for future loss, and potential penalization from the Centers for Medicare and Medicaid Services. Then data should be correlated with system factors that were most frequently reported (e.g. 'too busy,' 'high workload,' 'number of patient in assignment') and costs associated with supporting staffing especially during times of high volume should be evaluated to identify if any of these system factors are an opportunity to improve HH performance and decrease HAIs.

Another implication for nursing practice would be to reevaluate the cues-to-action that are currently employed. Because more than half of the Central Texas RNs identified that posters were ineffective in reminding them to perform HH, this should not be the entire focus for a HH campaign in the inpatient hospital setting. Posters may have a supporting role for increasing HH performance, but the data should be regularly updated and should incorporate the concept of perceived susceptibility for infection.

There is a need for developing campaigns aimed at increasing knowledge with particular focus on perceived susceptibility. The knowledge related to perceived susceptibility would include understanding the difference between colonization versus active infection with MRSA; how this can affect the RN and their patient; the direct relationship between *transient* MRSA carrier status and HH; the rationale for HH compliance decreasing the risk of *transiently* carrying MRSA; and implications of *Transient* MRSA carrier status for the RN, their family, and the community. These implications can be reinforced with case studies, morbidity/mortality statistics, and costs

associated with HAIs. Although perceived susceptibility should be the focus of HH campaigns, there are some HH facts that may need to be highlighted. This would include the differences among types of HH (e.g. hand washing, hand gel) as well as the appropriate use for types of HH. Also clarifying myths about HH is needed because 38% of RNs believed that 'gloving is the same as HH.'

Nursing Research

Researchers still do not fully understand the RN's decision making when choosing whether or not to perform HH. In this study, it was noted that 'moments' with higher perceived susceptibility for cross-transmission were directly related to increased HH performance statistics, but this needs to be validated in future studies. This study identified two predictors for HH performance, which included self-efficacy and barriers to HH as measured using the Assessment for Barriers to HH Performance. Although significant predictors were isolated, they only accounted for 26% of the variability in 'overall HH.' Because 74% of the variability in 'overall HH' remains unexplained, future studies should be devoted to understanding this phenomenon in more detail. Specifically, qualitative studies may be needed to understand the essence of HH decision making and to identify if there are additional barriers other than those listed in the Assessment of HH Performance Barriers instrument. From this understanding, instruments may be improved and may be more likely to explain the variability in HH performance. Understanding the predictors for HH performance will assist researchers in developing tailored interventions aimed at increasing HH performance among RNs. Instrument development should be closely examined and tailored to more accurately assess the constructs in the HBM as they related to self-reported HH performance among RNs.

After completing this study, there were a few questions that remained unanswered. In hindsight, asking the RNs some open-ended questions may have been beneficial to elaborate on HH decision making, which could have provided a spring-board for future studies. Specifically, asking the open-ended question 'what guides your HH decision making' may have offered insight about self-efficacy and perceived susceptibility. In addition, asking what information was most meaningful and likely to influence HH performance (e.g. cost associated with HAIs, morbidity/mortality statistics, knowledge related to HH or knowledge related to infection control) could aid researchers as the develop HH campaigns. Another open-ended question could have asked the RN to 'list resources, other than identified system barriers, which are needed to help the RN improve HH performance.'

CONCLUSION

This study explored MRSA knowledge, self-reported HH behaviors, barriers to HH performance, and attitudes toward infection control using the HBM. MRSA knowledge scores were comparable to other studies in the literature and in several cases Central Texas RNs had greater knowledge than what was reported in the literature. Self-reported HH was explored using 'My 5 Moments for HH,' and self-reporting statistics by 'moment,' which had not been captured before in other studies. Examining these self-reported statistics using the methods outlined in this study provided some insight into the RN's decision making about HH. It was identified that the RN's decision making for HH is based on perceived susceptibility for cross-transmission and infection. In addition, when barriers to performance are present RNs are more likely to overcome the barriers during times associated with higher perceived risk for cross-transmission. Barriers to HH were identified to be system factors for the most part. These barriers should be assessed

when planning a HH intervention to identify if these system factors could be contributing to poor HH statistics, which can influence HAI rates. Attitudes toward infection control were evaluated and relationships among the constructs within the HBM were established. However, there were only two constructs that were correlated with 'overall HH,' and these were self-efficacy and perceived barriers. This study provided a foundation for understanding the phenomenon of HH performance among Central Texas RNs and this foundation will help guide future studies aimed at improving HH performance among RNs.

Appendix A

OFFICE OF RESEARCH SUPPORT

THE UNIVERSITY OF TEXAS AT AUSTIN

P.O. Box 7426, Austin, Texas 78713 · Mail Code A3200
(512) 471-8871 · FAX (512) 471-8873

FWA # 00002030

Date: 07/16/13

PI: Sharon D Horner

Dept: Nursing

Title: Using the Health Belief Model to Explore Infection Control Perception, Methicillin Resistant Staphylococcus Aureus & Self-Reported Hand Hygiene Behaviors Among Registered Nurses in the Inpatient Setting

Re: IRB Exempt Determination for Protocol Number 2013-06-0027

Dear Sharon D Horner:

Recognition of Exempt status based on 45 CFR 46.101(b)(2).

Qualifying Period: 07/16/2013 to 07/15/2016. *Expires 12 a.m. [midnight] of this date.*
A continuing review report must be submitted in three years if the research is ongoing.

Responsibilities of the Principal Investigator:

Research that is determined to be Exempt from Institutional Review Board (IRB) review is not exempt from ensuring protection of human subjects. The following criteria to protect human subjects must be met. The Principal Investigator (PI):

1. Assures that all investigators and co-principal investigators are trained in the ethical principles, relevant federal regulations, and institutional policies governing human subject research.

2. Will provide subjects with pertinent information (e.g., risks and benefits, contact information for investigators and IRB Chair) and ensures that human subjects will voluntarily consent to participate in the research when appropriate (e.g., surveys, interviews).

3. Assures the subjects will be selected equitably, so that the risks and benefits of the research are justly distributed.

4. Assures that the IRB will be immediately informed of any information or unanticipated problems that may increase the risk to the subjects and cause the category of review to be reclassified to expedited or full board review.

5. Assures that the IRB will be immediately informed of any complaints from subjects regarding their risks and benefits.

6. Assures that confidentiality and privacy of the subjects and the research data will be maintained appropriately to ensure minimal risks to subjects.

7. Will report, by amendment, any changes in the research study that alter the level of risk to subjects.

These criteria are specified in the PI Assurance Statement that was signed before determination of exempt status was granted. The PI's signature acknowledges that they understand and accept these conditions. Refer to the Office of Research Support (ORS) website www.utexas.edu/irb for specific information on training, voluntary informed consent, privacy, and how to notify the IRB of unanticipated problems.

1. Closure: Upon completion of the research study, a Closure Report must be submitted to the ORS.

2. Unanticipated Problems: Any unanticipated problems or complaints must be reported to the IRB/ORS immediately. Further information concerning unanticipated problems can be found in the IRB Policies and Procedure Manual.

3. Continuing Review: A Continuing Review Report must be submitted if the study will continue beyond the three year qualifying period.

4. Amendments: Modifications that affect the exempt category or the criteria for exempt determination must be submitted as an amendment. Investigators are strongly encouraged to contact the IRB Program Coordinator(s) to describe any changes prior to submitting an amendment. The IRB Program Coordinator(s) can help investigators determine if a formal amendment is necessary or if the modification does not require a formal amendment process.

If you have any questions contact the ORS by phone at (512) 471-8871 or via e-mail at orsc@uts.cc.utexas.edu.

Sincerely,

James P. Wilson

James Wilson, Ph.D.
Institutional Review Board Chair

Appendix B

Dear Registered Nurse,

My name is Michelle Farci Gillespie, RN and I am currently a doctoral student at the University of Texas at Austin School of Nursing. I am conducting a study to learn about hand hygiene behaviors of registered nurses (RNs) working in the inpatient setting. The purpose of this study is to understand the RN's knowledge of methicillin-resistant *Staphylococcus aureus* (MRSA), experiences in caring for patients with MRSA, and hand hygiene practices performed in the inpatient settings.

Enclosed you will find three additional documents: a consent letter that explains the study in more detail; the questionnaire booklet; and a stamped return-addressed envelope for mailing the questionnaire back to me. This is an anonymous survey to protect participants. Please do not return the consent form and do not write your name on the questionnaire. You may sign the consent form and keep it for your own records. If you have any questions, please do not hesitate to contact me by email.

Thank you for your consideration in participating in this study,

Michelle Farci Gillespie, RN, Doctoral Candidate
University of Texas at Austin School of Nursing
m_farci@utexas.edu

Appendix C

Consent for Participation in Research

Title: Exploring Self-Reported Hand Hygiene Behaviors among Central Texas Registered Nurses in the Inpatient Setting using the Health Belief Model

Introduction

The purpose of this form is to provide you information that may affect your decision as to whether or not to participate in this research study. If you decide to be involved in this study, please complete the anonymous questionnaire booklet and return to the researcher. Completing and returning the booklet to the researcher will indicate voluntary consent for participation in the study. Do not sign or return this consent document. Please retain for your own records.

Purpose of the Study

You have been asked to participate in a research study about hand hygiene behaviors of registered nurses (RNs) working in the inpatient setting. The purpose of this study is to understand the RN's knowledge of methicillin-resistant *Staphylococcus aureus* (MRSA), experiences in caring for patients with MRSA, and hand hygiene practices performed in the inpatient settings.

What will you to be asked to do?

If you agree to participate in this study, you will be asked to

- Complete the questionnaire booklet
- Return the questionnaire booklet to the researcher using the envelope enclosed

This questionnaire will take approximately 5-10 minutes to complete and the study will include approximately 707 study participants.

What are the risks involved in this study?

The potential risk to the participants is no greater than everyday life.

What are the possible benefits of this study?

You will receive no direct benefit from participating in this study; however, the possible benefits of participation in this study include contributing to the science of understanding hand hygiene behaviors among registered nurses. This understanding may positively impact healthcare because future interventions aimed at improving hand hygiene compliance may be tailored to improve behaviors among registered nurses, which in turn will likely decrease hospital-acquired infections.

Do you have to participate?

No, your participation is voluntary. You may decide not to participate at all or, if you start the study, you may withdraw at any time. Withdrawal or refusing to participate will not affect your relationship with The University of Texas at Austin in anyway.

If you would like to participate, please complete the enclosed questionnaire booklet and return the booklet in the envelope enclosed. Do not sign and return this consent form. This is your copy of the consent form.

Will there be any compensation?

You will not receive any type of payment participating in this study.

What are my confidentiality or privacy protections when participating in this research study?

Once questionnaires are returned to the researcher, they will be kept in a locked filling cabinet. This study is anonymous and there will be no links to your name. Please do not write your name on the questionnaire booklet. There will be no participant identifiers entered into the software system used for data analysis as the surveys anonymous. Electronic databases and storage devices used in this study will require a password for protection of data. There is no participant list that could link identifying information with questionnaires. The data resulting from your participation may be used for future research or be made available to other researchers for research purposes not detailed within this consent form

Whom to contact with questions about the study?

Prior, during or after your participation you can contact the researcher **Michelle Farci Gillespie** by email at **m_farci@utexas.edu**

This study has been processed by the Office of Research Support and the study number is **[2013-06-0027]**.

Whom to contact with questions concerning your rights as a research participant?

For questions about your rights or any dissatisfaction with any part of this study, you can contact, anonymously if you wish, the Office of Research Support by phone at (512) 471-8871 or email at orsc@uts.cc.utexas.edu.

Participation

If you agree to participate, please complete the questionnaire booklet and return in the enclosed envelope.

Signature

You have been informed about this study's purpose, procedures, possible benefits and risks, and this is your copy of this form. You have been given the opportunity to ask questions by email and you have been told that you can ask other questions at any time. You voluntarily agree to participate in this study. By participating in the study, you are not waiving any of your legal rights.

DO NOT RETURN THIS FORM- KEEP FOR YOUR OWN RECORDS

Appendix D

Please circle the response that best represents you in your current practice

1. Are you currently licensed as a Registered Nurse in the state of Texas?		Yes	No
2. Are you currently practicing nursing?		Yes	No
3. Are you currently practicing bedside nursing in an inpatient setting?		Yes	No
If you have selected "no" to any of questions 1-3, you may stop completing the questionnaire booklet. Please return the questionnaire in the enclosed envelope and thank you for your willingness to participate in this study.			
4. How many years have you been a Registered Nurse?		_____ number of years	
5. How many years have you worked in healthcare?		_____ number of years	
6. As of today, what is your current age?		_____ years old	
7. What is your highest level of nursing education?	Diploma	ADN	BSN
	MSN	PhD	DNP
8. Do you currently work in a Magnet hospital?		Yes	No

Please circle the response that best represents you in your current practice

9. What type of employment setting are you currently working in at this time? (circle all that apply)	Acute Care Hospital (Inpatient)	Ambulatory Care	Nursing Home	Long Term Acute Care	Home Health
	Inpatient Rehab	Inpatient Hospice	Education	School Nurse	Dialysis Center
	Other: _____				
10. If you circled "Acute Care Hospital Inpatient" setting, what type of unit(s) do you work on a regular basis? (circle all that apply)	Medical/ Surgical	Intensive Care Unit (ICU)	Inter-mediate Care Unit (IMC)	Emergency Department (ED)	Surgical Services
	Neonatal Intensive Care Unit (NICU)	Labor and Delivery	Post-Partum	Telemetry	Cath Lab
	Pediatrics	Other: _____			
11. What is the average patient acuity (level of care) for your nursing unit?		Low	Medium	High	Extreme
12. On average, how often would you say that you work with patients with MRSA?	Always	Very Often	Sometimes	Rarely	Never

Please circle the best response for the following questions.

1. MRSA is a Gram-positive cocci	True	False
2. Alcohol gel is as effective as washing in reducing MRSA transmission	True	False
3. Nurses with eczema or psoriasis should not be involved in caring for MRSA positive patients	True	False
4. >40% of *Staphylococcus aureus* infections bloodstream infections are due to the methicillin-resistant strains	True	False
5. In carriers of methicillin-sensitive *Staphylococcus aureus*, the axilla and groin are more commonly colonized than the anterior nares	True	False
6. Colonization or infection with MRSA is a contraindication to the transfer of a patient to a nursing home	True	False
7. MRSA-colonized patients, their relatives and caregivers should be advised to reduce close physical and social interaction with children and the elderly, until nasal surveillance is negative for colonization	True	False
8. Many studies have demonstrated rates of nosocomial infection are associated with high levels of nursing staff workload	True	False
9. If a new positive MRSA carrier is found among the previously negative inpatients in the hospital, staff from that ward should be screened	True	False
10. Refusal to accept transfer of a patient is justifiable on the basis of the risk posed to other patients by an individual's carriage of or infection with MRSA	True	False

Please circle the best response for the following questions

11. Do you think you carry MRSA?	Yes	No
12. Do you feel that you are at risk for carrying MRSA?	Yes	No
13. Would you want to know if you carried MRSA?	Yes	No
14. Would understanding the direct relationship between ineffective hand hygiene performance and nurses who carry MRSA increase your compliance with Hand Hygiene?	Yes	No
15. Would understanding the direct relationship between ineffective hand hygiene performance and nurses who carry MRSA increase your willingness to hold others accountable with Hand Hygiene?	Yes	No
16. Are you concerned that you could take MRSA home to your family?	Yes	No
17. Are you concerned that you could spread MRSA into the community?	Yes	No
18. Do you wear your work scrubs into community settings?	Yes	No
19. Have you been told that you have MRSA?	Yes	No
20. If you have been told you carry MRSA, was this confirmed by lab testing?	Yes	No
21. Would you object to hospitals screening for MRSA carrier status?	Yes	No

For the following questions, please think about your average patient care day and self-report a percentage of the time that you perform hand hygiene during the following activities (exclude emergencies and out of ordinary circumstances)

Hand hygiene is defined as hand washing, alcohol-based gel, alcohol based-foam or any form of hand hygiene recognized by your employer.

1. **Before touching the patient**, please indicate the average percentage of the time that you perform hand hygiene.	_____% Est. 0-100%
2. **Before clean/aseptic procedures**, please indicate the average percentage of the time that you perform hand hygiene.	_____% Est. 0-100%
3. **After body fluid exposure risk**, please indicate the average percentage of the time that you perform hand hygiene.	_____% Est. 0-100%
4. **After touching a patient**, please indicate the average percentage of the time that you perform hand hygiene.	_____% Est. 0-100%
5. **After touching a patient's surroundings**, please indicate the average percentage of the time that you perform hand hygiene.	_____% Est. 0-100%
6. When thinking about the 5 Moments for Hand Hygiene that present themselves each shift, please indicate your **overall hand hygiene performance rate** (exclude emergency situations). Examples of opportunities: • Before touching the patient • Before clean/aseptic procedures • After body fluid exposure risk • After touching a patient • After touching a patient's surroundings	_____% Est. 0-100%

For the following questions, please think about the last month caring for patients and indicate a response that best represents your average day-to-day shift.

	Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5
1. Hand hygiene agents irritate my skin	1	2	3	4	5
2. I have access to hand hygiene supplies	1	2	3	4	5
3. Hand hygiene interferes with the healthcare provider-patient relationship	1	2	3	4	5
4. Patient needs take priority over hand hygiene	1	2	3	4	5
5. Wearing gloves is hand hygiene	1	2	3	4	5
6. I don't think about it or forget to perform hand hygiene	1	2	3	4	5
7. Lack of rewards and encouragement to perform hand hygiene	1	2	3	4	5
8. There is a lack of scientific information on the effect of hand hygiene on nosocomial infection rates	1	2	3	4	5
9. At times I am too busy for hand hygiene	1	2	3	4	5
10. A high workload influences my ability to perform hand hygiene	1	2	3	4	5

For the following questions, please think about the last month caring for patients and indicate a response that best represents your average day-to-day shift.

	Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5
11. Inappropriate staffing influences my ability to perform hand hygiene	1	2	3	4	5
12. I perform hand hygiene when there is higher risk for cross-transmission	1	2	3	4	5
13. There is a lack of hand-hygiene promotion at the individual level	1	2	3	4	5
14. There is a lack of hand-hygiene promotion at the institutional level	1	2	3	4	5
15. There is lack of a role model for hand hygiene at my workplace	1	2	3	4	5
16. There is lack of institutional hand hygiene guidelines and protocols	1	2	3	4	5
17. There is lack of administrative sanction for non-compliers	1	2	3	4	5
18. The number of patients in my assignment influences hand hygiene	1	2	3	4	5
19. There is a low risk for acquiring infection from patients	1	2	3	4	5
20. There is a lack of personal accountability culture for healthcare workers to perform hand hygiene	1	2	3	4	5

Please think of your nursing practice over the last month and circle the number that corresponds with your level of agreement about infection control.

	Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5
1. Having a patient with a heath care associated infection is a serious problem for my hospital	1	2	3	4	5
2. Having a patient with a hospital-acquired infection is a very serious problem for my patient	1	2	3	4	5
3. Having a patient with a hospital-acquired infection is a very serious problem for me	1	2	3	4	5
4. A patient that acquires a hospital-acquired infection could die	1	2	3	4	5
5. Having a patient obtain a hospital-acquired infection could cost a lot	1	2	3	4	5
6. Having a patient obtain a hospital-acquired infection could cause me trouble	1	2	3	4	5

Please think of your nursing practice over the last month and circle the number that corresponds with your level of agreement about infection control.

	Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5
1. If I do not engage in proper infection control, I could spread infection to my family	1	2	3	4	5
2. If I do not engage in infection control practices, I could spread infection to my patients	1	2	3	4	5
3. I get sick with communicable/ infectious diseases all the time	1	2	3	4	5
4. Getting a hospital-acquired infection is easy in **any** healthcare setting	1	2	3	4	5
5. Getting a hospital-acquired infection is easy in **my** healthcare setting	1	2	3	4	5
6. Infection control is one of my top concerns as a healthcare professional	1	2	3	4	5
7. I practice proper infection control because I am concerned for my own health	1	2	3	4	5
8. I practice proper infection control because I am concerned for my family	1	2	3	4	5

Please think of your nursing practice over the last month and circle the number that corresponds with your level of agreement about infection control.

	Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5
1. Engaging in proper infection control measure protects the healthcare provider and the patient	1	2	3	4	5
2. Engaging in proper infection control measure could prevent or reduce the risk of hospital-acquired infections	1	2	3	4	5
3. Improving my infection control practices could prevent my patients from getting hospital-acquired infections	1	2	3	4	5
4. I feel good about myself when I engage in proper infection control practices	1	2	3	4	5
5. Engaging in proper infection control measures could save the healthcare facility money	1	2	3	4	5

Please think of your nursing practice over the last month and circle the number that corresponds with your level of agreement about infection control.

	Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5
1. Taking courses in infection control could prevent a patient from getting a hospital-acquired infection	1	2	3	4	5
2. If a poster was present in the wash-room, I would remember to wash my hands	1	2	3	4	5
3. If a coworker or infection control practitioner reminded me regularly to engage in infection control practices, I would remember	1	2	3	4	5
4. Attending professional development seminars on infection control would help me remember to engage in proper infection control activities	1	2	3	4	5

Please think of your nursing practice over the last month and circle the number that corresponds with your level of agreement about infection control.

	Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5
1. Engaging in proper control practices is expensive	1	2	3	4	5
2. I do not feel that I have enough knowledge about infection control practices	1	2	3	4	5
3. I do not like engaging in proper infection control practices	1	2	3	4	5
4. I do not feel that engaging in proper infection control practices is my responsibility	1	2	3	4	5
5. I feel that it takes too much time to engage in proper infection control measures	1	2	3	4	5
6. I feel that engaging in proper infection control measures is too hard	1	2	3	4	5
7. Infection control practices interfere with patient care.	1	2	3	4	5

Please think of your nursing practice over the last month and circle the number that corresponds with your level of agreement about infection control.

	Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5
1. I engage in good infection control practices	1	2	3	4	5
2. I seek information on infection control practices	1	2	3	4	5
3. Engaging in proper infection control is important to me	1	2	3	4	5
4. I follow infection control recommendations regularly	1	2	3	4	5
5. I often use sanitizer while working in the healthcare setting	1	2	3	4	5
6. Hand sanitizers are as effective as hand washing in controlling infections	1	2	3	4	5

Appendix E

Front of Postcard

Your input is valuable

Please contribute to our nursing science

A questionnaire will be mailed in the next week to examine hand hygiene behaviors of RNs working in hospitals in Central Texas

Back of postcard

Dear Registered Nurse,

My name is Michelle Farci Gillespie, RN and I am a doctoral student at the University of Texas at Austin School of Nursing. The purpose of this study is to understand the RN's knowledge of methicillin-resistant *Staphylococcus aureus* (MRSA), experiences in caring for patients with MRSA, and hand hygiene practices performed in the inpatient settings.

I value your input tremendously and appreciate your consideration in completing the survey. Please look for the survey, which will be mailed to this address in the next week.

Thank you for your consideration,
Michelle Farci Gillespie, RN
m_farci@utexas.edu

Stamp

Address Label

Appendix F

Front of postcard

Your input is valuable

Please contribute to our nursing science

I appreciate your consideration to complete the questionnaire that was sent by mail last week

Back of postcard

Stamp

Dear Registered Nurse,

I have recently mailed a survey for my dissertation study with purpose of understanding the RN's knowledge of methicillin-resistant *Staphylococcus aureus* (MRSA), experiences in caring for patients with MRSA, and hand hygiene practices performed in the inpatient settings.

I value your input tremendously and would appreciate your consideration in participating in this study. Please complete the survey, which will take 5-10 minutes, and mail back in the self-addressed stamped envelope.

Address Label

Thank you for your consideration,
Michelle Farci Gillespie, RN
m_farci@utexas.edu

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