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HIV and Health Care Workers: The Measurement and Prediction of Compliance with Universal Precautions

presented by

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HIV AND HEALTH CARE WORKERS: THE ASSESSMENT AND PREDICTION OF COMPLIANCE WITH UNIVERSAL PRECAUTIONS

By

Barbara A. Schillo

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ABSTRACT

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This study investigated current levels of compliance with universal precautions among a sample of 160 health care workers in a hospital setting and explored the relationships between knowledge and attitudes as predictors of universal precautions. Results revealed high overall levels of compliance with use of routine universal precautions, however, health care workers reported lower rates of compliance with the use of barrier precautions other than gloves and were less likely to comply with the guidelines for reporting occupational exposures. Participants reported several perceived barriers for compliance with universal precautions. While greater percentages of respondents reported perceived environmental barriers, individual-level barriers accounted for a greater degree of the variance in overall compliance scores. Consistent with previous research, current findings demonstrate that health care workers are knowledgeable of the major routes of HIV transmission in health care setting, but greatly overestimate the risk of becoming infected from nonviable transmission routes. High levels of perceived risk of occupational HIV infection were reported. Several between-group differences by hospital unit were identified on the compliance, knowledge, and attitudinal measures, suggesting differences in unit-specific dimensions that impact health care workers in regards to these measures. Methodological analyses established that

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social desirability does not pose a significant threat to the validity of self-report assessments of compliance with universal precautions and other predictor variables. Path analyses were conducted using LISREL VIII to test different versions of the Information-Motivation-Behavioral Skills Model of AIDS Risk Behavior Change as applied to compliance with universal precautions. While the current study provides little support for the predictive models, findings have useful implications for future research. This study has important implications for the continued investigation of the issues that surround HIV and health care workers, along with implications for training and policy.

As of the end of 1995, over 300,000 Americans had died of AIDS.
This work is dedicated to the families, lovers, and friends who miss them.

ACKNOWLEDGMENTS

I would like to thank the many health care professionals, managers, and administrators of the study hospital who assisting in making this research opportunity possible. Drs. Jeffrey Taylor and Elaine Beane have provided me with a tremendous employment opportunity which has allowed me to develop as a public health professional while also being supportive, flexible, and understanding of the work on my dissertation. I thank Lisa Fick, Monika Naegeli, and the rest of the MPHI-DSET crew who kept me going with their "cheerleading" during the hardest stretches of this process.

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Finally, I would like to thank my family and friends for their support. To my parents for their unending support and pride in my accomplishments; to my friend Maureen who was always there with a healthy dose of perspective; and to my partner Ann, who sacrificed much and supported me so patiently throughout the process. This work would not have been possible without you.

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Chapter 1

INTRODUCTION

From issues of the treatment of infected individuals to the threat of transmission in health care settings, the Human Immunodeficiency Virus (HIV) has had a significant impact on the occupational behaviors of health care workers. One of the most important changes has been the widespread institutional mandate that health care providers follow a set of universal precautions developed by the Centers for Disease Control and Prevention (1987). Although changes in the occupational behaviors of health care workers have been witnessed throughout the history of the medical profession, universal precautions were developed in response to HIV/AIDS, an epidemic surrounded by a tremendous degree of fear and stigma within our society. Additionally, HIV represents the first significant threat of occupational infection in the minds of many of the nation's health care workers. In the decades prior to the emergence of HIV/AIDS, antibiotics, vaccinations, and the elimination of many occupationally transmitted infections led many health care workers to believe they were at zero risk for occupational infection (Gerberding, 1988). Given the circumstances surrounding the introduction and implementation of universal precautions guidelines, it is not surprising that numerous studies have reported findings which suggest that compliance with universal precautions is poor (Turner, 1993).

The purpose of this research was to investigate current levels of compliance with universal precautions among health care workers within a context of health behavior -

that is to examine the use of universal precautions as health behaviors engaged in for purposes of preventing the transmission of HIV in the health care setting - and to examine the specific factors thought to influence these behaviors. More specifically, the relationships between knowledge and attitudes as predictors of use of universal precautions were explored within a theoretical model of AIDS-preventative behaviors. Furthermore, the methodology of the current study attempted to address several limitations inherent in the design and implementation of previous research.

Review of the Literature

This investigation is based on an extensive review of the literature generated from the study of compliance with universal precautions among health care workers. This review demonstrates the critical nature of the issues surrounding the threat of transmission of HIV in health care settings and identify compliance with universal precautions as a key strategy for responding to the fears and costs associated with these issues. A review of research findings establishes a need for further assessment of levels of compliance with universal precautions in order to address current gaps in existing knowledge and methodological limitations within this area of research. Most importantly, this review identifies a need to move beyond the traditional approach for measuring the use of universal precautions as an index of compliance with infection-control guidelines toward viewing these behaviors as preventative health behaviors. In that regard, this review examines theoretical frameworks that are relevant for exploring the factors that predict the degree to which health care workers are engaging in these prevention behaviors. The following literature review summarizes the major findings of

the research that have been generated from the study of compliance with precautionary behaviors among U.S. health care workers. An initial computer search using MEDLINE was conducted using the keywords *HIV* and *universal precautions*. Additional studies were cross-referenced from published research. Only those studies that assessed behaviors of U.S. health care workers (dental health care workers were not included in this review) were included for analysis of research findings; studies examining solely knowledge of, or attitudes toward, universal precautions were not included.

This review of the literature is organized into four major sections. The first section provides an overview of the issues surrounding the threat of HIV transmission in health care settings and policies for universal precautions. The second section of this review examines the findings and limitations of the research which addresses the degree to which health care workers are complying with guidelines for universal precautions. The third section of this review examines the research addressing the underlying factors responsible for the reported levels and patterns of compliance with universal precautions. The fourth section of this reviews focuses on the application of theory to this area of research.

Overview

From its initial recognition in the early 1980s, acquired immunodeficiency syndrome (AIDS) has been identified as a potential occupational threat to health care professionals. By the end of that decade, evidence of HIV transmission from an infected Florida dentist to 5 of his patients and ongoing reports of health care workers becoming infected through occupational exposures to the virus elevated this threat to an issue of

national concern. Fears surrounding the threat of HIV transmission in health care settings among both health care workers (Gerbert, Maguire, Badner, Altman & Stone, 1988) and the general public (Gerbert, Maguire, Hulley & Coates, 1989; Krantowitz, Springen, McCormick, Reiss & Hager, 1991) have been well documented. In a more recent national survey of over 6,000 adolescents, provider seronegativety was one of the leading factors influencing adolescents' decisions to seek health care (Ginsburg, et al., 1995). In 1992, the National Commission on AIDS reported that the level of public anxiety over this issue, "...might have left one with the mistaken impression that HIV disease is an illness largely visited upon dentists, surgeons or their patients" (p. vii).

The level of concern surrounding the transmission of HIV in health care settings is in disproportion to the actual risk of acquiring HIV in these settings. Surveillance studies have established that the risk of occupational transmission of HIV from infected patient to provider as the result of a percutaneous injury by a needle contaminated with HIV-infected blood is 0.3% (CDC, 1992). The risk following a single mucocutaneous exposure (i.e., an exposure through non-intact skin or mucous membranes) to HIV-infected blood or body fluids is even lower (Bell, 1990). Through the end of 1995, the Centers for Disease Control and Prevention (CDC) has identified 49 documented and 102 possible cases of health care workers seroconverting following occupational exposure to HIV (CDC, 1995). Although the precise risk of provider-to-patient transmission is unknown, it too is estimated to be extremely low. Five cases involving HIV transmission from a Florida dentist to his patients remain the only cases of provider-to-patient transmission to date, despite several large retrospective studies of patients of infected providers (CDC, 1991). To date, there are no documented cases of patient-to-patient

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transmission although a recent investigation of an infant with AIDS whose source of HIV is unknown supports the possibility of patient-to-patient transmission of HIV during medical care (Blank, et al., 1994).

The low probability of HIV infection following a discrete exposure to HIV-infected blood and body fluids, however, should in no way be used to minimize the significant potential for HIV transmission in health care settings. Over 800,000 needlestick injuries occur each year in the United States (Jagger, 1990), accounting for 1/3 of all work-related injuries among health care workers (Henry & Thurn, 1991) and injuring an estimated 10% of all health care workers (DeLaune, 1990). Several studies have documented substantial rates of mucocutaneous exposures as well (Fahey, Koziol, Banks & Henderson, 1991; Gerberding & Schecter, 1991; Stockta, Wong, Williams, Stuart & Markowitz, 1991). With the prevalence of HIV infection among patient populations increasing (Kelen, 1990), so too does the potential for exposure to HIV-infected blood and body fluids. Unless infection control efforts are successful, the cumulative risk for many health care workers will continue to increase substantially over the next decade (Gerberding & Schecter, 1991).

This potential for exposure to HIV-infected blood and body fluids in health care settings prompted the introduction of universal precautions by the CDC in the 1980's (CDC 1985; CDC 1987; CDC 1988). Under universal precautions, blood and certain body fluids of all patients are considered potentially infectious for HIV and other blood-borne pathogens. Guidelines for universal precautions call for practices that include the use of barrier precautions (e.g., gloves, masks, and protective eye gear), procedures designed to prevent injuries from needles and other sharps (e.g., scalpels, broken glass, or

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any other object that can pierce, puncture or cut skin), and the reporting and medical follow-up for all exposure incidents. Universal precautions are designed to prevent percutaneous and mucocutaneous exposures to all bloodborne pathogens including HIV, reducing the risk of HIV-transmission in the health care setting from patient-to-provider, provider-to-patient, and patient-to-patient. Compliance with these guidelines became mandatory in all health care settings in 1991 following the adoption of the "Bloodborne Rule" issued by the Occupational Safety and Health Administration - OSHA (Department of Labor, 1991).

Compliance with these CDC and OSHA guidelines represent significant changes in the occupational behaviors of health care workers. For example, the standard practice for disposing of used needles in many health care settings prior to the implementation of universal precautions involved recapping the needle, carrying it to a central location, removing the sheath, and clipping the needle (New York State Department of Health, 1992). Under universal precaution guidelines, needles and other sharp instruments should not be recapped or clipped and should be disposed of immediately in puncture-proof containers to be located as close as practical to the use area (CDC, 1987).

The guidelines for universal precautions also require that health care professionals assess the potential for exposures to blood and body fluids prior to initiating medical care procedures, as the level of protection must fit the expected exposure. For example, gloves must be worn if a health care worker expects to have hand contact with blood or other potentially infectious materials, while eye and mouth protection must be worn if potentially infectious materials pose a hazard through the eyes, nose, or mouth. Even

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more extensive coverings such as gowns, aprons, surgical caps and hoods, shoe covers or boots are needed when gross contamination of blood and body fluids is expected.

Turner (1993) reports that the reported and observed lack of compliance with universal precautions has lead some researchers to abandon efforts to change behaviors in favor of approaches designed to make the health care environment safer. For example, it has been argued that only changes in needle hardware, rather than behavior modification, will significantly impact needlestick injuries (Jagger, Hunt, Brand-Elnagger & Pearson, 1988; Edmond, Khakoo, McTaggart & Solomon, 1988). Indeed, recent evaluations have reported significant reductions in needlestick injuries following the implementation of needleless devices (Gartner, 1992; New York State Department of Health, 1992; Skolnick, LaRocca, Barba & Paicius, 1993), however, many of these devices represent first generation technology which will need improvement before their wide-spread use is warranted (New York State Department of Health, 1992). In addition, initial evidence reveals that devices with safety features that rely on the worker for operation are less dependable than those devices in which the safety feature is automatically activated (New York State Health Department, 1992). Thus, even with the expected widespread implementation of safety devices, behavioral compliance will remain a salient issue in reducing the threat of HIV transmission in health care settings.

Ensuring compliance with guidelines for universal precautions through the modification of behavior remains an issue of critical importance. Universal precautions are not 100% effective in preventing exposures to blood and body fluids in health care settings, as some exposures to infected blood and body fluids have resulted even when health care workers were applying appropriate barrier and sharp precautions (Marcus &

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the CDC Cooperative Needlestick Surveillance Group, 1988). Existing data, however, suggests that most exposures to blood and body fluids would have been prevented if proper precautions for the handling and disposal of needles and sharps or the application of barriers precautions had been taken (CDC, 1992; Gerberding & Schecter, 1991; Marcus & the CDC Cooperative Needlestick Surveillance Group, 1988). The human costs of exposures to blood and body fluids in health care settings are tremendous in terms of anxiety and disease transmission, as are the financial costs with medical follow-up for needlestick injuries alone estimated to cost $3 billion per year (DeLaune, 1990). Responding to the anxiety, fear, and costs surrounding occupational transmission of HIV in health care settings hinges on the success of ensuring compliance with universal precautions.

Compliance with Universal Precautions

The major findings of studies assessing compliance with universal precautions have been organized according to type of precautionary behaviors which have been measured in these studies: 1) compliance with overall guidelines; 2) compliance with barrier precautions; and 3) compliance with precautions for sharps and needles. Following the review of these studies, a summary of the outcome evidence of evaluation studies related to compliance with universal precautions is presented. Finally, the limitations of this body of research are discussed.

Compliance with overall guidelines. The results of studies reporting a measure of overall compliance with universal precaution guidelines suggest that compliance with universal precautions is variable. These studies operationalized compliance as all or none

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- health care workers were assessed to be in compliance only if they used all necessary precautions during a specified procedure or situation defined by exposure to blood and/or other body fluids. Baseline observational assessments revealed that infractions in universal precautions occurred in 57% of procedures among surgical personnel at a University of Florida hospital (Courington, Patterson & Howard, 1991). A similar study revealed that prior to intervention efforts, surgical residents in a Miami, Florida hospital were observed to be in compliance with universal precautions in only 16% of trauma resuscitations (Hammond, Eckes, Gomez & Cunningham, 1990). Only 30% of hospital personnel caring for HIV-infected patients at San Francisco General Hospital self-reported proper use of universal precautions (Gerberding et al., 1987). Among the 70% failing to comply, 56% reported using no precautions and 14% reported using excessive precautions. Findings from self-report (Gruber et al., 1989) and observational (Denker, Jensen & Galego, 1991) studies assessing precautionary behaviors among nurses have revealed similar low levels of compliance with the exception of Conte (1992) in which 66% of neonatal nurses self-reported compliance with universal precautions.

Compliance with barrier precautions. A more detailed picture of the use of universal precautions is found in studies that have examined compliance with the specific components of universal precautions. Again, these studies operationalized compliance as all or none - health care workers were assessed to be in compliance only if they used all necessary barrier precautions during a specified procedure or situation defined by exposure to blood and/or other body fluids. Among studies assessing compliance with barrier precautions only, a survey of Michigan physicians was the only one to report that the majority (60%) of providers were using proper barrier precautions (Heald, 1988).

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Findings from other studies assessing compliance with these precautions reveal that the majority of health care workers are failing to protect themselves from exposures to blood and body fluids by applying appropriate personal protective equipment. Only 22% of directors of emergency medicine residencies reported that barrier attire was used during major resuscitations (Huff & Basala, 1989). Kelen et al. (1989) reported that only 44% of emergency personnel at Johns Hopkins Hospital were observed to be in adherence to universal precautions policies for barrier precautions. Other studies have revealed that less than 25% of surgeons (Mandlebrot et al., 1990) and 9% of nurses (Gorse & Messner, 1991) reported routine use of barriers.

Assessments of compliance with barrier precautions broken down by type of barrier suggest that the use of gloves to prevent exposures to blood and body fluids may be the most consistently used component of universal precautions among health care workers. In a random survey of registered nurses in Michigan, 71% of participants reported wearing gloves "almost always" when handling blood or body fluids (Schillo & Reischl, 1993). Likewise, Kelen et al. (1989) reported that gloves were worn in 74% of the emergency procedures observed. Observations of surgical personnel at San Francisco General Hospital revealed even higher levels of glove use with 87% double or triple gloving during surgical procedures (Gerberding, Littell, Tarkington, Brown, & Schecter, 1990). Compliance with the use of gloves, however, appears to be task-specific. Several studies have reported levels of compliance that ranged within studies from as low as 35 percent to as high as 100 percent depending on the type of procedure involved (Baraff & Talan, 1989; Kaczmareck et al., 1991; Willy, Dhillon, Loewen, Wesley & Henderson 1990).

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Even when gloves are worn, findings suggest that other barrier precautions are commonly ignored. Hammond et al. (1990) reported that prior to intervention, 37% of breaks in compliance with barrier precautions were due to not wearing a mask, 33% were due to failure to wear ankle protection, and 18% were due to failure to wear a gown or apron. Kelen et al. (1989) reported that when barrier precautions were inadequate, surgical masks (22%) were used least, followed by eye protection (45%), and gowns (50%). In a nation-wide survey of certified nurse midwives, only 42% reported wearing eyewear and 31% reported wearing masks during deliveries (Willy et al., 1990). The lowest levels of compliance with these other barrier precautions were evident in observations of emergency personnel performing trauma resuscitations at UCLA Medical Center (Baraff & Talan, 1989). Low percentages of these providers were observed wearing gowns (28%), protective eyewear (18%), and masks (1%).

Limited evidence suggest that compliance with other components of barriers precautions, such as handwashing and the use of resuscitation devices, is fairly common. Gruber et al. (1989) reported that 96% of nurses reported washing their hands following exposure to blood and body fluids. Other studies reported that nearly all providers used a protective device when performing mouth-to-mouth resuscitation (Schillo & Reischl, 1993; Smyser, Bryce, & Joseph, 1990).

Compliance with precautions for needles and sharps. While significant numbers of health care workers are failing to comply with guidelines for barrier precautions, research suggests that even fewer are adhering to guidelines for the handling of needles and sharps. Findings, although variable, suggest that a significant proportion of health care professionals are violating CDC and OSHA guidelines by recapping needles after

they have been used on patient, with self-reported rates of recapping ranging from 25-71% (Gruber et al., 1989; Schillo & Reischl, 1993; Smyser, et al., 1990; Willy et al., 1990). An observational study by Edmond et al. (1992) found 94% of nurses recapping needles prior to an intervention designed to reduce recapping. These high rates of recapping are supported by findings from two studies that reported high percentages of recapped needles observed in needle disposal boxes (Becker et al., 1990, Ribner & Ribner, 1990).

Although the majority of health care providers are recapping needles, findings suggest that they are much more compliant when it comes to other precautions for needles and sharps. Several studies reported that nearly all providers disposed used needles in puncture-resistant containers (Gruber et al., 1989; Schillo & Reischl, 1993; Willy et al., 1990) and complied with policies prohibiting clipping, cutting, or bending needles (Gorse & Messner, 1991; Willy et al., 1990).

Intervention outcomes. Only a handful of evaluation studies assessing changes in compliance with universal precautions following intervention efforts were evident in the literature. Based on this limited body of research, the evidence for increases in compliance with needle and sharp precautions following intervention efforts is mixed. Edmond et al. (1988) reported no significant decrease in rates of recapping following the installation of a disposal system for needles sharps along with the implementation of educational programming. Ribner & Ribner (1990), however, reported a significant decrease in the percentage of recapped needles found in disposal boxes following intervention efforts which included education and feedback. In contrast, those studies that have assessed changes in the use of barrier precautions following various

intervention efforts have reported significant increases in compliance (Devries, Burnette & Redmon, 1991; Hammond et al., 1990; Kelen et al., 1989, Talan & Baraff, 1990). It should be noted, however, that even when studies reported increases in compliance with the use of universal precautions, significant numbers of health care workers (ranging from 12-38%) were still failing to comply with universal precautions following these intervention efforts.

Limitations of the research assessing compliance. Although the above review provides a useful summary of the research examining health care workers' compliance with universal precautions, caution should be expressed about the comparability of the findings across studies. These studies represent work undertaken prior to OSHA's final ruling, at a time when many institutions had just recently adopted, or were in the process of adopting, a policy of universal precautions. It is likely that there was a great deal of variance in the degree to which these guidelines had been interpreted, implemented, and enforced within study settings.

While assessments of compliance with universal precautions among health care workers have focused on compliance with the use of barriers and precautions for needle/sharps, there are several additional components of universal precautions for which compliance has not been investigated. For example, an important and to-date overlooked component of universal precaution guidelines involves compliance with a protocol for medical evaluation and follow-up for incidents involving exposure to blood and body fluids. These medical evaluations involve several elements, including the collection and testing of the employee's blood for HIV antibodies and the administration of postexposure

prophylaxis when medically indicated. Prior research has not focused on this important component of universal precautions.

There are also several methodological limitations of the research which must be acknowledged. These include limitations of each of the two major approaches to the assessment of compliance with universal precautions evident in the literature: self-administered questionnaires and behavioral observations. Recall bias is a potential source of error for self-report measures. Studies utilizing self-administered questionnaires asked health care workers to recall rates of exposures and patterns of behavior that occurred over the past several months. Only one study reported efforts to reduce the potential for this source of bias by limiting recall to the last working shift (Wong et al., 1991).

Self-report bias in the use of self-administered questionnaires represents another potential source of error. In assessing compliance, health care workers were asked to report on behaviors with which they were expected, or even mandated, to comply. For studies conducted within the participants' place of employment, concerns over possible identification and reprisals from their employers, despite assurances of anonymity, may have influenced respondents to provide socially desirable responses indicating compliance with guidelines. Voelker (1991) reports a pattern of findings which suggest bias in self-reported levels of compliance. This study, which included 400 hours of observation in 2 Midwestern hospitals followed by self-assessments of compliance from more than 100 health care workers, found that health care workers report higher levels of compliance than what they actually practice. For example, 81% reported that they used gloves appropriately, while observations showed a 65% rate of compliance; 60% reported recapping needles while 76% were observed doing so. The overall degree to which this

source of error threatens the validity of self-reported findings is unknown, as the Voelker study remains the only investigation to include multiple methods of assessment.

The use of observational assessments eliminates these threats surrounding self-report measures. However, observational measures are subject to other potential sources of bias. The Hawthorne effect, or changes in behavior resulting from the participants' awareness of an observer, is a source of error which may threaten the external validity and generalizability of the findings from observational studies. Although descriptions of observational studies identified efforts to ensure that participants remained blind to the purpose of observations, it is likely that many respondents were aware of the presence of an observer. Two studies may have actually unmasked the purpose of the observations by disseminating pretest results to hospital personnel before posttest observations were conducted (Courington et al., 1991; Talan & Baraff, 1990). If the presence of the observer alone prompted participants to increase their compliance with the use of universal precautions, reported levels of compliance based on observational assessments would represent upper limits of compliance.

The lack of psychometrically sophisticated instruments is an additional concern within this area of research. Many of the measures employed in these studies were flawed in that they failed to adequately operationalize compliance. The use of precautions is conditional on the potential for exposure to blood and body fluids. Therefore, a valid measure of compliance is calculated by first determining if the precaution is necessary, and then assessing whether or not the appropriate precaution is used. Some of the instruments used in both self-report and observational studies failed to first assess whether or not the respondent was involved in a situation warranting the use

of a precaution(s). As a result, it was recognized that some respondents may have reported or have been observed to be noncompliant when in fact they were not involved in a situation requiring the use of precautions (Baraff & Talan, 1989; Gruber et al., 1989; Schillo & Reischl, 1993).

Additionally, only one study assessed whether or not failure to comply involved the overutilization or underutilization of precautions (Gerberding et al., 1987). Overutilization represents an important form of noncompliance. Although it can be argued that health care workers who utilize excessive precautions are protected from exposures, overutilization is wasteful - both in terms of the resources used and the medical waste produced - and may have significant implications for quality of care when unnecessary barriers are placed between health care workers and their patients. In addition, none of the studies distinguished between proper and improper use in the applications of precautions. In limiting assessments to use versus nonuse, it is not known whether or not health care workers who reported or were observed using the required precautions applied, removed, and/or disposed of protective equipment or medical supplies appropriately.

In addition to inadequate operationalization, there was also a great deal of variability in the operationalization of compliance across studies. Several studies reported a global measure assessing compliance with all aspects of universal precautions, while other studies assessed compliance as a function of the specific components of guidelines for the use of barriers and needles/sharps. Furthermore, some studies assessed compliance during a specific medical procedure, while other studies summed compliance across several different types of medical procedures. The development of measures that

assess compliance with each component for universal precautions and are specific to different types of procedures appears critical, in light of reported variability in compliance across these dimensions.

Of additional concern is the lack of reported indices of reliability of instruments used to investigate the use of universal precautions. The assessment of interrater reliability for observational measures, in particular, is critical as assessing proper implementation of universal precautions may involve a judgement call on behalf of the observer (Gauthier, Turner, Langley, Neil & Rush, 1991). Gauthier et al. (1991) remains to-date, the only measurement study designed to develop a reliable and valid observational instrument for assessing compliance.

Finally, caution must be taken in generalizing the findings of these studies to all health care workers. Most of the samples were comprised of nurses and physicians working in acute care settings and the majority of studies were conducted within large teaching-hospitals located in U.S. metropolitan areas. Additionally, many of these settings were located in high prevalence areas for AIDS/HIV infection or were specifically identified as AIDS referral centers. The generalizability of the majority of these studies may be limited to similar groups of health care workers in similar settings.

Factors Influencing the Use of Universal Precautions

In her recent review of practices related to universal precautions among nurses, Turner (1993) concluded that "at this point, it is unclear how to effect any consistent changes in the use of universal precautions" (pg. 218). This lack of understanding is the likely result of little investigation into the underlying factors responsible for the reported

levels and patterns of compliance with universal precautions. To date, research examining the underlying factors responsible for the reported levels and patterns of compliance has been largely limited to questions asking health care workers why they failed to comply with guidelines for universal precautions. In response to these questions, health care workers have reported several environmental and individual-level barriers to the use of precautions (See Table 1).

Aside from the identification of self-reported barriers to the use of precautions, there has been little systematic investigation into how these and other potentially critical factors influence compliance with universal precautions. The following section critically examines the limited evidence that surrounds the major self-reported environmental and individual-level barriers to the use of universal precautions along with other critical factors evident in the literature.

Environmental barriers. It has been argued that health care workers in emergency situations who feel forced under guidelines for universal precautions to make split-second trade-offs between the patient's interest and their own, may forego the use of precautions (Kearnes, 1988). There is some evidence to support health care workers' claims that noncompliance is due, in part, to a perceived lack of time. Two observational studies have established that compliance with barrier precautions is significantly lower during emergency procedures (Wong et al., 1991) or major interventions which need to be performed immediately (Kelen et al., 1989).

Findings from several studies are also consistent with providers' reports that the use of certain precautions interferes with their ability to perform specific procedures. A critical issue appears to be the loss of dexterity and tactile sensation when using gloves

Table 1

Self-Reported Barriers for Compliance with Universal Precautions

Study First Author, Year Publication	Environmental-Level Barriers			Individual-Level Barriers			
	Lack of time	Interferes technical skills	Materials not available/ inadequate	Lack knowledge guidelines	Forgot	Precautions perceived unnecessary	Interferes patient relationship
Becker, 1990	X				X		
Conte, 1992	X	X	X	X			
Courington, 1991		X	X	X		X	
Gorse, 1991		X		X			
Gruber, 1989			X				
Hammond. 1990	X			X	X	X	
Kelen, 1989	X	X					
McNabb, 1991	X	X	X	X	X		
Schillo, 1993	X	X	X				
Voelker, 1991	X		X				
Willy, 1990		X		X		X	X

during phlebotomy or IV procedures. Studies have documented relatively lower levels of glove use during these procedures compared to other procedures in which the use of gloves in also warranted (Baraff & Talan, 1989; Voelker, 1991). Other researchers have concluded that health care workers who otherwise comply with precautions do not routinely use gloves for phlebotomy or the placement of IV catheters (Gerberding et al., 1987; McNabb & Keller, 1991). Conte (1992) reported that the inability to perform tasks while wearing gloves was the strongest predictor of use of universal precautions.

Findings reported in Kaczmereck et al. (1991), however, call into question the role that loss of dexterity plays in predicting compliance with the use of gloves. Health care workers in this study reported much higher levels of compliance with the use of gloves during arterial gas procedures (92%) than during phlebotomy (71%) procedures. Both of these procedures involve drawing blood, the only difference being that blood is drawn from the artery during arterial blood gas procedures rather than the vein, as is the case during phlebotomy. Differences, therefore, in levels of compliance between these two types of procedures would not be expected if loss of dexterity is the primary reason for not using gloves. The authors of this study cite research demonstrating that health care workers are more likely to be exposed to patients' blood during arterial blood gas procedures than during phlebotomy (Marcus, Bell, Srivastava & Culver, 1990) in arguing that differences in perceived risk of becoming infected, rather than loss of dexterity, account for the observed difference in levels of compliance by type of procedure.

Although formal investigation is lacking, the literature offers several explanations as to why so many health care workers continue to recap needles despite the danger involved in this activity. Certain aspects of procedures involving needles may explain

why some health care workers recap. Health care workers, for example, have reported recapping needles for safe storage when the contents of the syringe are administered in two or more doses over time (Jagger et al., 1988) or to protect themselves during the disassembly of a device with an exposed contaminated needle (Henry & Thurn, 1991). The design of the environment may also impact a provider's choice to recap as providers have reported recapping in order to transport a used needle to a disposal box (Henry & Thurn, 1991). As a result, several authors have concluded that the failure to effect behavior change may be due to the perception on the part of some health care workers that it is a greater risk to others, as well as to self, to handle and dispose of an uncapped needle, than to risk an injury by recapping (Becker et al., 1990; Edmond et al., 1988; Jagger, 1990; Jagger, Hunt, & Pearson, 1990; Ribner, Landry, Gholson, & Linden, 1987).

The need for continued research to identify other critical environmental factors that influence the use of precautions is evident. Although health care workers cite lack of accessible and adequate materials as a major barrier to compliance, the relationship between this factor and compliance has yet to be investigated. Further research is needed to determine the relative degree to which compliance is a function of the environment and to understand these structural barriers.

Individual-level barriers. Investigation into individual-level factors related to compliance with universal precautions has focused largely on the relationship between HIV-related knowledge and precautionary behavior. Research has clearly documented that providers have fairly high levels of knowledge about the etiology and viable modes of HIV transmission (Richardson, Lochner, McGuigan & Levine, 1987; Schillo & Reischl, 1993; Valenti & Anarella, 1986; Wertz, Sorenson, Liebling, Kessler & Heeren,

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1988) and are aware of the need to take precautions to prevent occupational transmission (van Servellen, Lewis & Leake, 1988). Likewise, educational programs have been evaluated to be effective in increasing health care workers' knowledge about AIDS (O'Donnell & O'Donnell, 1987; Turner, Gauthier, Ellison, Greiner, 1988; Wertz et al., 1987). However, given the current low levels of compliance with universal precautions, the extent to which knowledge is translated into precautionary behaviors remains questionable.

The results from studies testing this relationship between knowledge and precautionary behavior are inconclusive. Willy et al. (1990) reported that nurse midwives who complied with universal precautions had significantly higher HIV-transmission knowledge scores than those who failed to comply. Conte (1992), however, found that neonatal nurses with higher levels of knowledge were less likely to report using precautions. Similarly, Gruber et al. (1989) reported a nonsignificant, negative relationship between knowledge and the use of precautions. Arnow, Pottenger, Stocking, Siegler & DeLeeuw (1989) found no significant relationship between knowledge and the number of precautions surgeons reported that they would use.

The relationship between other potential individual-level factors and behaviors remains, for the most part, unexplored. Despite documentation of substantial levels of fear among health care workers, little is known about the relationship between perceived risk of infection and precautionary behaviors. Willy et al. (1990) reported that nurse midwives who complied with universal precautions were more likely than noncompliers to perceive themselves at risk for HIV. Gruber et al. (1989) reported a nonsignificant

trend for lower use of precautions among RNs who believed their risk for HIV infection was low.

Further investigation is also needed to gain specific insight into the individual-level factors that may predict recapping behaviors. Many providers have reported recapping out of habit (Gruber et al., 1989; McCormick, Meisch, Ircink, & Maki, 1991) or carelessness (Henry & Thurn, 1991). Jackson, Dechario, & Gardner (1986) reported that carelessness was perceived to be the most common reason for needlestick injuries among medical personnel while lack of knowledge of proper disposal technique was ranked last. These results suggest that recapping, may in part, be the result of well-established patterns of behavior which are occurring at a subconscious level, having little to do with either knowledge or attitudes.

Further research is needed to identify the important individual-level predictors of compliance with barrier precautions. While most intervention strategies have operated under the assumption that increases in general knowledge related to HIV would result in increased compliance, there is currently no evidence to support this relationship. Research suggests that despite adequate levels of HIV-related knowledge, health care workers are failing to comply with universal precautions. While it has been argued that perceived risk of occupational transmission may influence compliance with universal precautions, the direct impact of these fears on these behaviors remains to be seen.

There are also several other potential individual factors that to date, remain uninvestigated. Although health care workers have reported perceptions that precautions were perceived as unnecessary, the factors behind this reported barrier have yet to be identified. Kearnes (1988) argues that the perception that precautions are unnecessary

may be related to different levels of perceived efficacy of universal precautions. Health care workers may fail to comply with precautions if they believe that the threat of contracting HIV has been greatly exaggerated and that universal precautions are therefore unnecessary, or if they perceive that not enough is known about HIV transmission to develop adequate precautionary guidelines.

In addition to the perception that precautions are unnecessary, health care workers have cited interference with the patient relationship as another barrier to compliance with universal precautions. Again, the extent to which perceptions that precautions are a psychological and/or physical barrier between health care workers and their patients contributes to noncompliance, is unknown.

Theoretical Frameworks for Investigating Compliance

To date, most research has framed compliance with universal precautions as an issue of infection-control within the health care setting, rather than as individual-level behaviors which could be viewed in a context of prevention or health behavior. Advancing the use of theory within this field of research requires the incorporation of applicable theoretical frameworks for understanding compliance with universal precautions as a prevention behavior analogous to the adoption of safe sex behaviors, the use of clean injecting drug needles/equipment, or other behaviors designed to prevent the transmission of HIV. Reframing compliance behaviors in this way allows researchers to draw on the extensive body of knowledge generated through AIDS-prevention research.

To date, there has also been little overall application of theory to the investigation of health care workers' compliance with universal precautions. Turner (1993) cites this

deficit in the use of conceptual or theoretical models as a major flaw in the research related to compliance with universal precautions. The development of a theoretical framework in which to explore the issues surrounding compliance will be critical in facilitating the development of future investigations and effective interventions. Without theory, accounting for differences in compliance may contribute little to an understanding of the underlying processes that account for these behaviors. The inconsistencies in the research can appear random and it can be reasoned that if an environmental factor fails to enhance compliance, an individual factor will (Leventhal, Meyer & Nerenz, 1980).

A review of the literature identified only three articles which addressed the application of theory to the prediction of compliance with universal precautions. To date, Meisenhelder & LaCharite (1989) remain the only researchers to propose an original model specific to the prediction of compliance with universal precautions. This model of fear arousal for health care workers illustrates the use of precautionary behaviors as an affective response to the threat of AIDS. According to the model, fear of AIDS can impact precautionary behaviors in three ways: 1) those who perceive a high level of risk may overutilize precautions or engage in avoidance behaviors; 2) those who are not aware or deny they are at risk may under utilize precautions; while 3) those who perceive a level of risk similar to their actual level of risk may use appropriate precautions. Thus, the appropriate use of universal precautions would be achieved when a provider's level of perceived risk is brought in line with their level of actual risk. This proposed theoretical model, however, has yet to be tested.

In a recent qualitative study, Reutter and Northcott (1994) argue that nurses work to achieve a sense of control in dealing with AIDS through the use of different cognitive

and behavioral mechanisms. Within this theoretical context, the use of universal precautions is identified as a major coping strategy for dealing with the uncertainty and fear surrounding AIDS. Again, this model remains to be empirically tested.

Becker et al. (1990) examined noncompliance with precautions for needles/sharps within the health belief model, one of the most widely used models in the study of compliance with health behaviors (Janz & Becker, 1984). Applying this model to providers' precautionary behaviors, the health belief model predicts that health care workers are more likely to comply with universal precautions when they perceive themselves as susceptible to occupationally-acquired HIV infection, perceive the consequences of infection as severe, perceive that universal precautions are effective in reducing the threat of HIV infection, and perceive few costs or barriers to the use of precautions. The high levels of perceived susceptibility and perceived benefits for the use of precautions, reported in this study by Becker et al. (1990) did not correspond to compliance by not recapping, as the model would predict. This finding, however, may be explained by the fact that many of the providers were confused about the proper procedures for the handling and disposal of needles/sharps, and were viewing recapping as a protective, rather than a risk, behavior.

There are several other theories in addition to those mentioned above that may be applicable to the investigation of compliance with universal precautions. In addition to theories of fear arousal and cognitive-decision making, theories of interpersonal relationships may be useful for examining how precautionary behaviors are influenced by others in the environment (Levington, 1989). However, it is not clear at this point in the

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development of the research which of these major categories of theories will serve most useful in understanding the dynamics of compliance with universal precautions.

There are several relatively new and general theoretical models that have been successfully developed and/or applied to the study of AIDS-preventive behaviors among HIV-infected individuals or those at risk for HIV infection that may have relevance for addressing issues of compliance among health care workers. An example of such a model is the Information-Motivation-Behavioral Skills Model for AIDS Risk Reduction (IMB) proposed by Fisher and Fisher (1993) (See Figure 1). This conceptually-based and highly generalizable model for understanding AIDS-risk behavior change was constructed on the basis of a comprehensive, critical review of the AIDS-risk reduction literature (Fisher & Fisher, 1992). Fisher and Fisher conclude that the most effective AIDS-risk reduction interventions are those that are conceptually based, group specific, and focus on providing AIDS-risk reduction information, motivation, and behavioral skills. Their model includes three major components which determine AIDS-prevention behavior, including: 1) information regarding AIDS transmission and prevention; 2) motivation to modify AIDS risk behavior; and 3) behavioral skills for performing specific AIDS preventive acts. Within this model, risk-reduction information and motivation serve to activate behavioral skills that are used to initiate and maintain patterns of preventive behavior. Although Fisher and Fisher (1993) propose that the presence of motivation and information together make it more likely that behavioral skills will be used, they argue that there is no necessary strong relationship between level of information and level of motivation. In addition, information and motivation can also have direct effects on AIDS-preventive behaviors when AIDS-specific skills are not necessary for the practice of

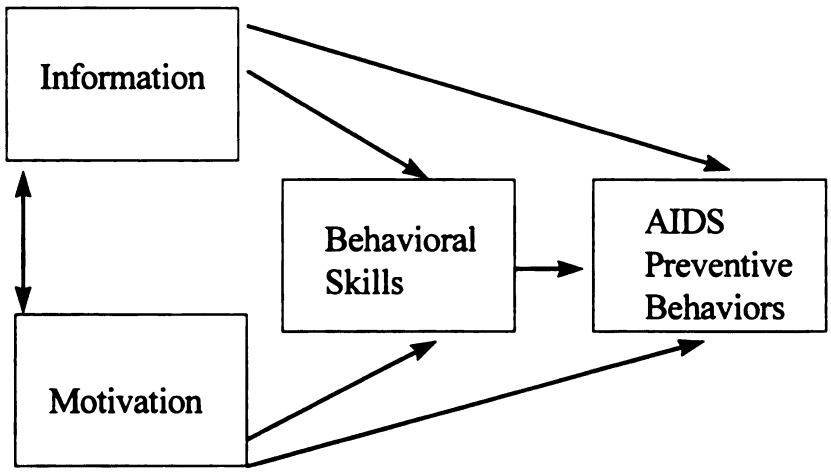

Figure 1. The Information-Motivation-Behavioral Skills Model for AIDS Risk Reduction. (Fisher & Fisher, 1992).

of preventive behavior. Research has documented consistent empirical support for the relationships hypothesized by the IMB model with both gay male and college student samples (Fisher & Fisher, 1992; Fisher, Fisher, Williams, & Mallay, 1994).

In terms of information, this model posits that risk reduction information plays an important role and must be relevant (same level of specificity and content domain) to the preventive behavior in order to impact behavior (Fisher and Fisher, 1992). Thus a global assessment of a health care worker's level of HIV-related knowledge may bear little relationship to her/his compliance with guidelines for universal precautions while knowledge of precautions may. This may help explain the lack of a relationship between knowledge and behavior apparent in the literature. According to the model, information must also be coupled with motivation and behavioral skills in order to change and maintain behavioral changes. Again, this argument would explain why one-time, information-only interventions have had little impact on preventive behavior.

Motivation within the IMB model is conceptualized within the framework of Fishbein and Ajzen's Theory of Reasoned Action (Ajzen & Fishbein, 1980). Fisher and Fisher state that the theory of reasoned action provides "... a well articulated social psychological conceptualization that may be applied to understanding and changing AIDS prevention motivation within diverse target groups" (p. 467). These authors cite extensive evidence to suggest that motivation to engage in AIDS-preventive behaviors is the function of two factors that affect motivation to act: 1) the individual's personal attitude toward performing the act in question; and 2) the individual's subjective norm or perception of what significant others think should be done with respect to performing the act in question. These attitudes in turn predict behavioral intentions to perform a specified behavior. In addition to personal attitudes toward preventive behavior and perceived social support for such behavior, numerous other factors - such as perceived vulnerability to infection - have also been investigated as possible motivators of AIDS preventive behaviors. The authors argue that in accordance with the Theory of Reasoned Action, these factors should be viewed as external motivators that operate through the major components of the model.

Behavioral skills, the third major component of the IMB model, are presented conceptually within the model as an AIDS-reduction behavioral sequence specific to engaging in preventive behaviors related to sexual behaviors. The authors of this model, however, are quick to point out that these behavioral sequences can easily be adapted to different groups or different types of behaviors. Operationally, the authors propose the measurement of behavioral skills through the assessment of self-efficacy with respect to performing specific AIDS-preventive behavior, based on extensive research documenting

that a strong sense of AIDS prevention self-efficacy is strongly bound to the performance of AIDS-preventive behaviors.

While the constructs of this model are general, its authors argue that these constructs are expected to have content that is specific to particular groups and particular behaviors. There are, however, two major shortcomings in the original model that require attention before the model is applied to the investigation of compliance with universal precautions. Although Fisher and Fisher propose using the theory of reasoned action to assess motivation to engage in AIDS preventive behaviors, the theory of planned behavior - an extension of Ajzen and Fishbein's original model - may be more appropriate for examining motivation to comply with universal precautions. The self-reported barriers associated with the use of universal precautions, as evident in the literature (See Table 1), suggest that some health care workers perceive that they have little control over these behaviors. According to the theory of planned behavior, perceived control over a behavior, that is the perceived ease or difficulty of performing a particular behavior, plays a role in determining intentions and behaviors when that behavior is not under complete volitional control (Ajzen & Madden, 1986). People who believe that they have neither the resources nor the opportunities to perform a behavior are unlikely to form strong behavioral intentions even when they hold favorable attitudes toward the behavior and believe that others would approve of their performing the behavior (Ajzen, 1988). Ajzen and Madden (1986) propose two versions of a model for the theory of planned behavior. The first version assumes that the effect of perceived behavioral control on behavior is mediated by intention and that intention is the immediate antecedent of behavior. The second version of the model assumes that in

addition to indirectly influencing behavior via intentions, perceived control can directly be used to predict behavior because it may be considered a partial substitute for a measure of actual control.

The second modification of the model that must be considered involves the relationship between motivation as assessed by behavioral intentions, behavioral skills, and behavioral compliance. Fisher and Fisher (1992) propose that intentions predict compliance by activating behavioral skills. Logically, however, it would appear that behavioral skills (as assessed by perceived efficacy for performing the behavior) should be viewed as preceding the formation of the intention or as moderating the relationship between intentions and compliance.

Applying a modified version of the IMB model will serve to examine the utility of framing compliance with universal precautions as AIDS-preventive behaviors within this particular theoretical model. Relationships between key factors that have been suggested in previous research as important factors influencing precautionary behaviors can be explored within this model. The role of perceived risk of HIV infection, along with other attitudes toward universal precaution guidelines, in predicting behaviors can be examined. In addition, a better understanding of the relationship between knowledge and behaviors would be gained by examining both the direct and indirect effects of this relationship. Results that support this model would identify which critical aspects of information and motivation need to be addressed in ensuring universal levels of compliance with these guidelines. A pattern of results that fails to support this model would identify a need to reconceptualize future investigations of compliance with universal precautions.

Implications

Research has documented levels of compliance with universal precautions that are far from universal. Overall, intervention strategies to date, have failed to meet the objective of achieving universal levels of compliance with universal precautions. Substantial numbers of health care workers continue to recap needles and this behavior appears most resistant to change, a finding of critical concern in light of evidence that the majority of documented cases of occupationally-acquired HIV have resulted from recapping (CDC, 1992). The low levels of use of barriers precautions, especially those other than gloves, illustrates that significant numbers of health care providers are failing to protect themselves from potential exposures to HIV (along with several other bloodborne pathogens) in the workplace.

The preceding review of the research literature identified several gaps and limitations in the research which warrant further investigation. These include:

1. A need to assess current levels of compliance with universal precautions in this period following OSHA's final ruling on bloodborne pathogens. Although it was perceived that this ruling would result in increased levels of compliance, research has yet to substantiate this belief. In addition to further assessing compliance with barrier and needle/precautions, investigation into health care workers' compliance with protocol for exposure incidents - an area in which data are scarce - is warranted.
2. A need to assess and study compliance with universal precautions among health care workers who have not been typically represented in the research. The majority of the existing research has been conducted with physicians and nurses in

acute care settings of large teaching hospitals in major metropolitan areas. Additionally, many of these settings were located in high prevalence areas or served as AIDS referral centers. As the epidemic of HIV is diffused from large metropolitan to less urban areas, the need to determine levels of compliance with universal precautions among health care workers in these areas is imperative (Kaczmarek et al., 1991).

3. A need to conduct a program of research that addresses and or contributes knowledge to the methodological limitations evident in previous studies. Measures of compliance must be developed that are reliable, specific to both the task and the type of precaution, and are operationalized to differentiate between over and under utilization of precautions. Efforts to limit the period of recall and reassure participants of the confidentiality of their responses are needed to assist in limiting sources of bias surrounding self-reported assessments. In addition, future research efforts should include an assessment of the degree to which social desirability and other psychological defenses influence responses to self-report assessments of compliance with universal precautions and other variables thought to predict compliance.

4. A need to investigate compliance across types of medical procedures in order to gain insight into how these factors are related to the use of universal precautions.

5. A need to systematically examine the relationships and contribution of perceived barriers to the use of universal precautions.

6. A need to investigate the factors believed to influence these behaviors within the context of a theoretical model. The development of effective intervention efforts

and decisions about how to best allocate resources to address the issues surrounding the potential for HIV transmission in health care settings necessitate a more in-depth understanding of the context in which compliance with universal precautions occurs. Research is needed to assess current barriers to compliance and examine the relative importance of environmental versus individual-level barriers in predicting compliance. The nature of the relationship between knowledge, attitudes, and precautionary behavior has been largely unexplored, pointing to a need for the development and testing of a predictive model. In relation, there is a need to assess these relationships within a theoretical context that frames compliance as AIDS-preventive behaviors.

Current Study

The major objectives of this study were as follows:

1. To assess current levels and patterns of compliance with universal precautions among selected groups of health care workers working in a hospital located in an area with a rate of HIV infection at or below the national average. The three general areas of compliance with universal precautions that were assessed within this study included: 1) compliance with the use of barrier precautions; 2) compliance with guidelines for the handling and disposal of needles and sharps; and 3) compliance with the protocol for the reporting and follow-up of exposure incidents;
2. To contribute to the further development of methodology for assessing compliance with universal precautions;

3. To assess variability in compliance with universal precautions across types of medical procedures;
4. To assess current barriers to the use of universal precautions and examine the relative importance of environmental versus individual-level barriers; and
5. To develop and test a model of the factors that predict compliance with universal precautions.

Research Questions and Hypotheses

Based on the relationships and deficits revealed in previous research, the following research questions and hypotheses were tested:

1. What are current patterns of compliance with universal precautions?
2. Is social desirability a significant source of response bias in the assessment of compliance with universal precautions and other HIV-related constructs?
3. Do different approaches (measurement methodologies) to assessing self-reported compliance with universal precautions yield different results?
4. Are there significant differences in levels of compliance by medical procedure?
    a. Findings from several studies are consistent with providers' reports that the loss of dexterity and tactile sensation when using gloves during phlebotomy or IV procedures is a significant barrier to the use of gloves (Baraff & Talan, 1989; Conte, 1992; Gerberding et al., 1987; McNabb & Keller, 1991; Voelker, 1991). Findings reported in Kaczmereck et al. (1991), however, call into question the role that loss of dexterity plays in

impacting compliance with the use of gloves. On the basis of these findings, the following hypotheses were tested:

Hypothesis 1: Compliance with the use of gloves will be lower during procedures involving a high degree of dexterity compared to other procedures.

Hypothesis 2: Compliance with the use of gloves will be higher during procedures in which there is a greater likelihood for exposure to patients' blood and body fluids compared to procedures with a lower level of risk.

Hypothesis 3: The likelihood of exposure to blood and body fluids will be a stronger predictor than loss of dexterity in predicting compliance with the use of gloves.

5. There has been little systematic investigation into the barriers related to levels and patterns of compliance with universal precautions. As a result, it is currently unknown to what extent these behaviors are influenced by environmental-level barriers relative to individual-level barriers. This study examined whether self-reported environmental-level or individual-level barriers are a stronger predictor of compliance.

Testing a theoretically-based model. The current study also tested the utility of framing universal precautions as AIDS-preventive behaviors in understanding the factors that predict compliance. The relationships between several key factors and these behaviors were tested using a modified version of the Information-Motivation-Behavioral Skills Model of AIDS Risk-Behavior Change (Fisher & Fisher, 1993). For

the purposes of this study, information was operationalized as the specific knowledge domains of 1) knowledge of HIV transmission in health care settings and 2) knowledge of universal precautions. These measures of knowledge were intended to measure knowledge at the same level of specificity and with a similar content domain as the behaviors in question. This approach was designed to address one of the cited methodological reasons for the failure to observe a consistent relationship between AIDS-related knowledge and AIDS-preventive behavior (Fisher & Fisher, 1992).

Motivation was assessed in accord with the principles of the Theory of Reasoned Action (Ajzen & Fishbein, 1980) and the Theory of Planned Behavior (Ajzen & Madden, 1986). Scales assessed the following: 1) behavioral intentions to appropriately utilize universal precautions; 2) beliefs about the perceived efficacy of universal precautions; 3) subjective norms for compliance with universal precautions; and 4) perceived behavioral control, operationalized as the perceived ease or difficulty of using universal precautions. Perceived risk for occupational transmission was also assessed and applied to the model as an external factor which works to indirectly impact preventive behaviors by acting on the intention, attitudes, and normative components of the model. Finally, behavioral skills were operationalized as perceived self-efficacy for performing medical procedures when complying with guidelines for universal precautions.

Three different versions of the model were tested. The first version of the model tested the theoretical model proposed by Fisher and Fisher (1993), examining the relationships between the latent variables within the IMB model as applied to this study to determine the overall utility of this theoretical framework in understanding the factors

that predict compliance (See Figure 2). Within this model, the following hypotheses were tested:

Hypothesis 4: Higher levels of information will predict a significantly higher level of behavioral skills for complying with the guidelines for universal precautions. Knowledge may have direct effects on behavior, however, it is predicted that this relationship, if significant, will be weaker than the effect of information on behaviors as mediated through behavioral skills.

Hypothesis 5: Higher levels of motivation will predict significantly higher levels of compliance with AIDS-preventive behaviors, with this relationship being moderated by level of behavioral skills for complying with the guidelines for universal precautions.

Hypothesis 6: Higher levels of behavioral skills for complying with the guidelines for universal precautions will predict significantly higher levels of compliance with AIDS-preventive behaviors.

Hypothesis 7: Within this model, information and motivation are each thought to influence the likelihood of preventive behavior, but are viewed as separate constructs that influence behavior differently (Fisher and Fisher, 1992). It is predicted that information and motivation will be statistically independent factors, and will therefore not be highly correlated.

The second and third models examined the relationships between the observed variables within the theoretical model, in an attempt to further explore the relationships

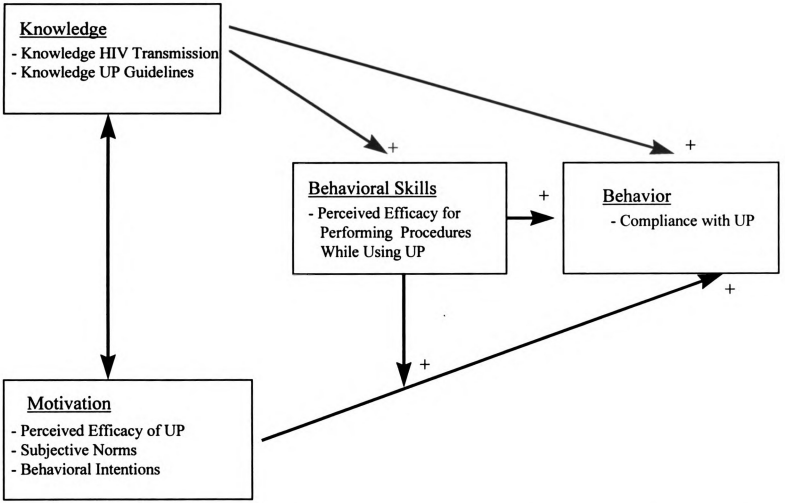

Figure 2. Information-Motivation-Behavioral Skills Model Applied to Compliance with Universal Precautions

among the observed variables and to compare different versions of the model (Theory of Reasoned Action versus the Theory of Planned Behavior) for goodness of fit with the data. The model illustrated in Figure 3 assessed motivation using the conceptual framework of the Theory of Reasoned Actions as originally proposed by Fisher and Fisher (1993). In this version of the model, the predicted relationships were as follows:

Hypothesis 8: Higher levels of HIV knowledge and knowledge of universal precaution guidelines will predict higher levels of perceived efficacy for performing procedures while using universal precautions. The two knowledge measures will also correlate positively with compliance with universal precautions, however, the strength of these direct relationships will be lesser than the indirect effects of knowledge as mediated through perceived efficacy for performing procedures while using universal precautions.

Hypothesis 9: Perceived efficacy of universal precautions and subjective norms for complying with universal precautions will be positively correlated with behavioral intentions for complying with universal precautions. The relationship between perceived risk for HIV infection and the other motivational variables will be explored.

Hypothesis 10: Higher levels of behavioral intentions for complying with universal precautions will predict significantly higher levels of compliance with universal precautions, with this relationship being moderated

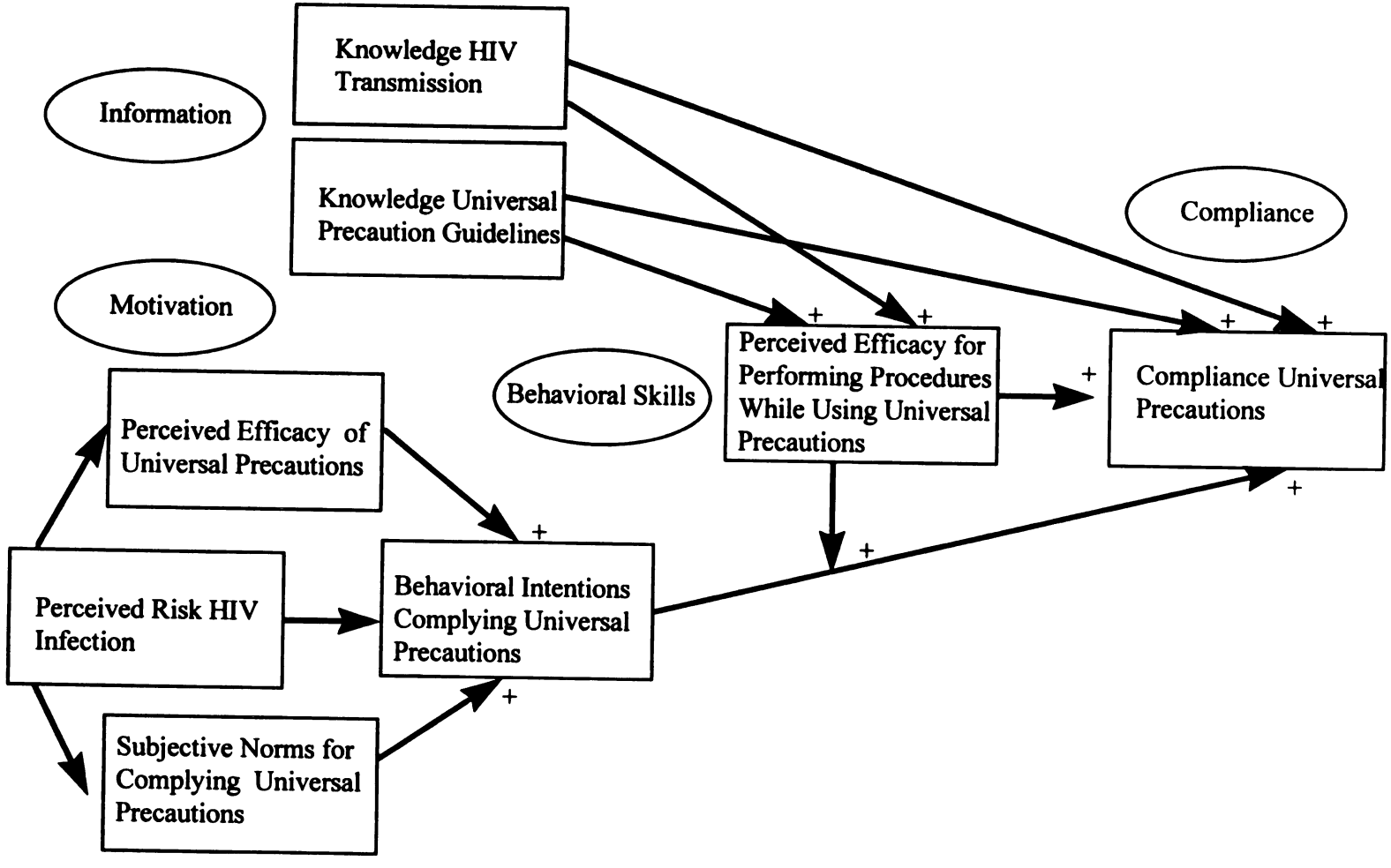

Figure 3. Observed IMB Model Framing Motivation Within the Theory of Reasoned Action

by level of behavioral skills for complying with the guidelines for universal precautions.

Hypothesis 11: Higher levels of perceived efficacy for performing procedures while using universal precautions will predict significantly higher levels of compliance with universal precautions.

The third version of the model (See Figure 4) assessed motivation using the conceptual framework of the Theory of Planned Behavior, with the addition of the variable of perceived behavioral control. The relationships laid out in this model are consistent with those in hypotheses 8-11, with an additional hypothesis predicting the relationship of perceived behavioral control to compliance with universal precautions.

Hypothesis 12: Higher levels of perceived behavioral control will predict higher levels of compliance with universal precautions. (Both the direct and indirect [i.e., as mediated by intention] effects of perceived behavioral control on compliance with universal precautions were examined.)

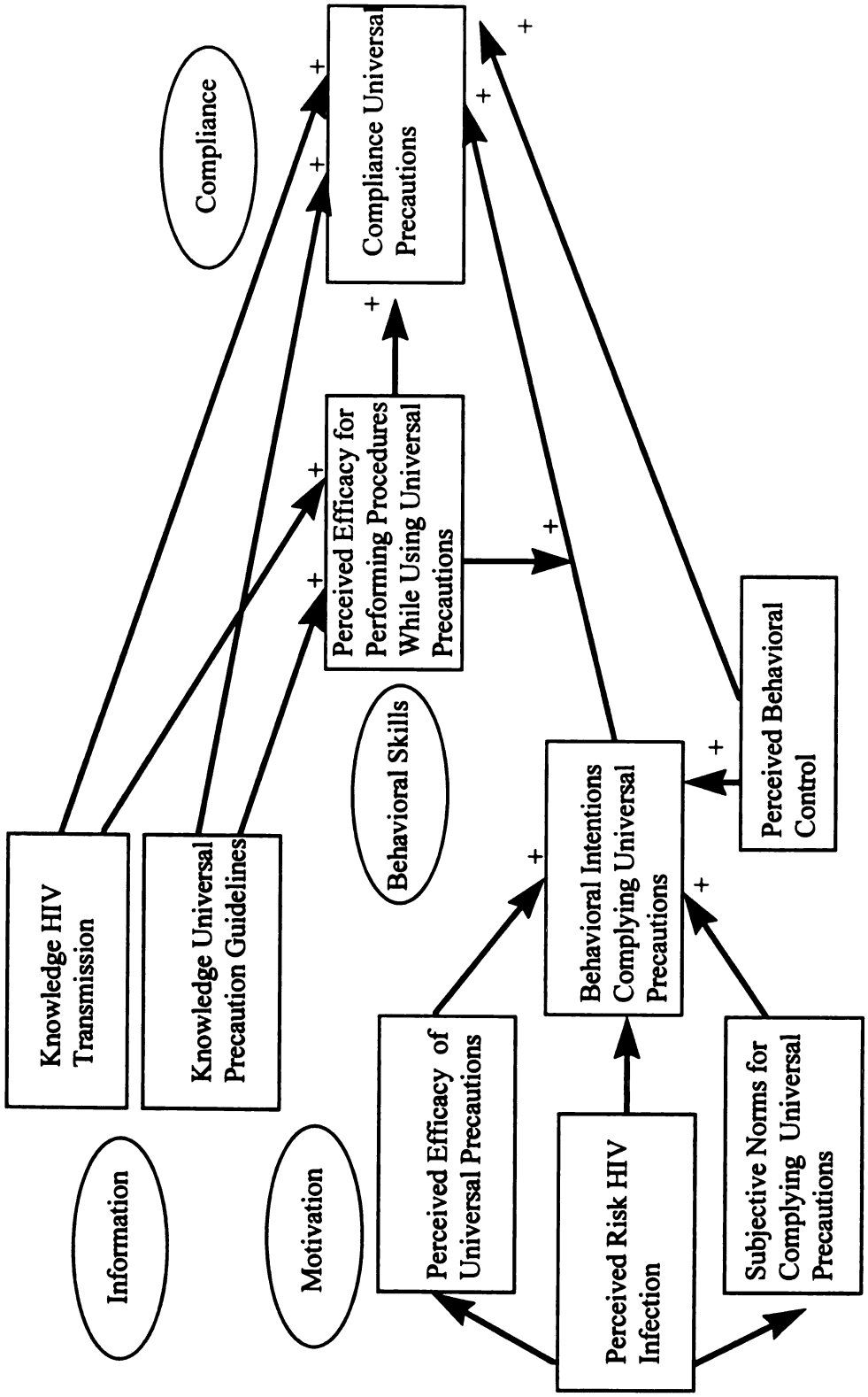

Figure 4. Observed IMB Model Framing Motivation Within the Theory of Planned Behavior

Chapter 2

METHODS

Study Design and Setting

This investigation into compliance with universal precautions was conducted as a point-in-time correlational study utilizing self-report data collection techniques. This research was conducted on 5 different acute-care units in a midsized (400-600 bed) teaching hospital. This hospital is located in a midsized city (population 100,000-300,000) in a state with annual rates of reported cases of AIDS less than half the national rate (CDC, 1995). Guidelines for universal precautions were implemented in this hospital in 1987 along with yearly in-house trainings. Continuing efforts have also been made to provide protective equipment, to implement an exposure control plan that includes the use of AZT, and to implement needleless systems and other engineering controls. The responsibility for ensuring compliance with the guidelines for universal precautions lies primarily with department managers and other supervisory staff. Employees who are observed to be noncompliant with guidelines are counseled with additional disciplinary actions taken by supervisory staff when deemed appropriate. Self-report data were collected anonymously from nursing and other direct care staff on the following units: 1) the neonatal intensive care unit (NICU); 2) the regular nursery; 3) the emergency department; 3) labor and delivery; and 4) the women's pavilion - a medical surgical unit serving women. These units were a convenience sample - chosen on the

basis of willingness on the part of deparment managers to participate and in part, by the need to ensure some degree of comparability of procedures across units.

Survey Procedures

Self-report questionnaires were distributed between at the end of August and beginning of September, 1995, to all eligible staff in the 5 study units. Professional staff who provide direct care (not including physicians) in each of the selected study units served as the participants for this investigation. This included nurses, physician assistants, and paramedics. Orderlies and nursing assistants were excluded from the sample; although they provide direct care, they are not licensed and therefore do not perform the same procedures as professional staff.

Questionnaires were distributed in staff mail boxes. Participation was solicited and the purpose of the survey was explained to staff at change of shift or during other regularly scheduled meeting times by the investigator and/or Department Managers. A cover letter accompanied each questionnaire explaining the purpose of the study and providing instructions for completing and returning the survey. Participants were informed that by completing the survey they were consenting to participate in the study. The cover letter (See Appendix A) also explained that the study was being conducted in cooperation with but independently of the hospital and that no one associated with the hospital would have access to individual-level data, that their participation was voluntary, and that all information would remain anonymous. Participants were asked to complete the survey on their own and were provided with a stamped, addressed envelope in which to return the survey. Follow-up letters were distributed 2 weeks following the original

distribution of questionnaires to all participants, urging those who have not yet returned their consent form to consider participating in the study.

Of the 328 surveys which were distributed, 160 were returned by November 15th, 1995 (this includes 8 pilot surveys which were included in the final sample). This represents a response rate of 49.0%. This final sample size met the requirement of 150 subjects needed to achieve statistical power of .80 in order to detect R^2 as small as .10. A significance level of $p<.05$ was adopted for all analyses. Rates of response were fairly consistent across five units. Four of the units had response rates ranging from 42.0-48.0%. Labor and delivery had the highest rate of response, with 69.0% of eligible staff participating. Sample sizes for the different analyses varied due to incomplete surveys and are clarified for all reported analyses.

Sample Characteristics

The final sample of 160 respondents included 141 registered nurses, 2 licensed practical nurses, 5 nurse practitioners, 5 paramedics, 1 physician assistant, and 3 nursing administrators. The unit breakout of the sample was as follows: 1) 23.8% of the sample was from the NICU; 2) 20.6% of the sample was from the regular nursery; 3) 21.3% of the sample was from emergency department; 4) 19.3% of the sample was from labor and delivery; and 5) 15.0% of the sample was from the women's pavilion.

In this study the average age of the sample was 40.1 (SD=7.26). Almost all of the respondents were female (91.0%). Approximately half of the respondents reported highest degree obtained (related to their medical profession) as an Associate Degree

(48.0%); 41.0% reported having obtained a Baccalaureate; 8.0% a Diploma; and 3.0% a Masters.

Analyses were done to investigate whether or not there were any demographic and employment differences between the respondents on the different units. There were no significant between-group differences in the age of respondents and the highest degree obtained. There were significant between-group differences in the sex of respondents (χ^2=17.2, p<.05) and current position (χ^2=47.5, p<.05). Over a quarter of the respondents (26.5%) in the emergency department were male, while less than 7.0% of respondents in the other four units were male. In the regular nursery, labor and delivery, and women's pavilion, over 93.0% of the respondents were nurses. In the NICU, 81.1% of respondents were nurses and 13.5% of respondents were nurse practitioners. In the emergency department, 82.4% of respondents were nurses and 14.7% of respondents were paramedics.

Measures

Successive drafts of the survey instrument were developed in collaboration with department managers and members of the hospital's Nursing Research Committee. In order to avoid the complexities of analyzing data with both random (procedures) and fixed (professionals) effects, the assessment of compliance with universal precautions was developed to force a more balanced design for this study. Based on input from nursing and medical staff, five broad categories of procedures commonly performed in the study units were identified: 1) patient assessment; 2) IV/puncture procedures; 3) airway/ respiratory procedures; 4) wound care/treatment; and 5) body fluid procedures.

Department managers from each unit were asked to identify commonly performed procedures within each of these 5 categories. Two to three procedures were chosen from each of the 5 categories to construct a list of 10-13 procedures for each of the 5 study units. Whenever possible, procedures that were common across units were chosen. When this was not possible, procedures were matched on the general level and type of precaution use required. These procedures were used to construct the measures of compliance with universal precautions, behavioral intentions, and behavioral skills. Thus, 5 different versions of the instrument were generated for each study unit with unit-specific measures of behavioral compliance, behavioral intentions, and behavioral skills reflecting medical procedures commonly performed by staff in that unit.

Eight nurses were asked to pilot test the different versions of the measure by completing and providing feedback on the questionnaire. Pilot respondents were asked: 1) if the procedures were defined in a way that would be uniformly understood by other health care workers they work with; 2) if the questions were technically accurate; 3) if the questions were objectionable, difficult or demanding; and 4) if the responses provided were appropriate for each question. Results of the pilot test were used to finalize the measure. Because the changes made on the basis of the pilot questionnaire were minor, the 8 pilot participants were included in the final sample, however, pilot data were excluded for any items which were significantly revised in finalizing the measure.

One of the versions of the final instrument (for Labor and Delivery) is presented in Appendix B. Unless otherwise specified, the items in this questionnaire were developed specifically for use in this study, although several of the items used to construct various scales have been borrowed or modified from instruments used in

previous research. Multi-item scales were developed following rational considerations regarding the primary constructs for this study. For each multi-item scale, an item mean score was computed for all respondents who had completed at least 67% of the scale items (sum of nonmissing item scores/number of nonmissing items). Table 2 outlines the measures contained in the self-reported questionnaire and the corresponding questionnaire item numbers.

A reliability analysis was conducted for each multi-item scale, yielding a measure of internal consistency for each scale. For scales which include items that must be assessed for multiple situations or for discrete behaviors, such as perceived barriers to the use of universal precautions, items may not be expected to be internally consistent. Nonetheless, an index of internal consistency was computed for the perceived barrier scales because there are not available data for computing other more appropriate indices of reliability (e.g. test-retest). In addition, item-responses which were tied to unit-specific procedures (and therefore represented different questions for different units) would not be expected to be internally consistent. The measures affected by this latter principle includes behavioral compliance, behavioral intentions, and behavioral skills. For these measures, unit-specific indices of internal consistency were calculated and the range of reliabilities are presented.

Compliance Behaviors

The first section of this self-report instrument contained 2 measures of self-reported compliance with universal precautions. The first measure was designed to assess compliance with precautions the last time the procedure was performed. Respondents

Table 2

Measures and Item Numbers for the Self-Report Questionnaire

Measure	Item Numbers
Section 1 - Compliance Behaviors	
Compliance with Universal Precautions - Last Time Procedure Performed	1 (a-l)
Compliance with Universal Precautions - Last 3 Months	3 (a-g) 5(a-b)
Section 2 - Perceived Barriers	
Individual Barriers	7(h-m) 8 (h-k)
Environmental Barriers	7 (a-g) 8 (a-g)
Barriers to the Use of Universal Precautions	7 (a-m) 8 (a-k)
Section 3 - Knowledge	
Knowledge of HIV Transmission	10 (a,c,d,g-m)
Knowledge of Universal Precautions	11 (c,g,j)
Section 4 - Motivation & Behavioral Skills	
Perceived Efficacy of Universal Precautions	12 (a-d,f)
Subjective Norms for Compliance with Universal Precautions	14 (a,b,d-g)
Perceived Risk of Occupational Transmission of HIV	15 (a-c, e,f)
Perceived Behavioral Control	13,17,19
Behavioral Intentions	18 (a-l)
Perceived Self-Efficacy for Performing Medical Procedures When Utilizing Universal Precautions	16 (a-l)
Social Desirability Scale	20 (a,c,g-k)

were asked to indicate the most recent period in which they performed specified medical procedures. Respondents who performed a procedure within the last year were asked to specify which precautions they used the last time they performed this procedure.

Several steps were taken to calculate scores for compliance during the last time a procedure was performed. Routine precautions - those precautions required during the routine performance of that procedure - were in general determined from hospital policies specifying which precautions are to be used for procedures under routine conditions. Input from department managers and infection control staff was also sought to account for departmental standards for each task and used in determining minimum required precautions for each of the procedures included in this measure. The use of precautions was calculated as all or none - the use of precautions was scored as compliant only if a respondent, at a minimum, indicated using all of the routine precautions for that procedure. Respondents who indicated the use of additional precautions, other than those called for under routine use, were also scored in compliance. (In this respect, the scoring of both compliance measures used in this study was not affected by respondents indicating that they engaged in precautions above and beyond what would be considered required, or routine, for that procedure.) Many respondents indicated that they had not performed airway/respiratory procedures within the last year, therefore procedures in this category were not included in the calculation of this measure of compliance. After calculating compliance at the level of procedure, mean compliance scale scores were calculated by summing across all procedures. A reliability analysis for these items by unit ranged from alpha = -1.10 - .42. In addition to this total compliance score, mean compliance scale scores were calculated separately for each of the procedure categories:

1) patient assessment (alpha=.00 - .46); 2) IV/puncture (alpha=.00 - .56); 3) airway/ respiratory (alpha=-1.71 - .44); 4) wound care/treatment (alpha= .00); and 4) body fluid (alpha=-.22 - .09). The lack of variance on items and the mixing of negative and positive correlations between items would appear to account for the observed reliabilities on the compliance measures. As a result, many of these reliabilities are difficult to interpret.

Section one also included an assessment of compliance with universal precautions during the last three months. Utilizing a series of skip-questions, this measure assessed whether or not participants were involved in situations with potential exposure to blood and body fluids and if so, assessed on a 5-point scale how often they followed guidelines for universal precautions. In addition to assessing compliance with precautions for barriers and needles/sharps, this measure also assessed compliance with reporting and follow-up for exposures. Mean scale scores for compliance (during the last 3 months) were calculated by using the items assessing compliance with barrier and needle/sharp precautions. Items assessing compliance with guidelines for reporting and following-up with exposures were not included in the scale since only a small percentage (17.5%) of respondents indicated having been exposed in the three month period prior to completing the survey. "Non-applicable" responses were recoded as missing. A reliability analysis for this 9-item scale yielded low internal consistency (alpha=.49).

Perceived Barriers

The second section of this instrument included an assessment of perceived barriers to the use of universal precautions. These measures were designed as checklists of various individual and environmental barriers to the use of barrier precautions,

precautions related to needles/sharps, and precautions for reporting and following-up exposures to blood and body fluids. Participants were asked to indicate which of these barriers made it difficult or prevented them from adhering to the guidelines for universal precautions within the last 3 months. Again, items assessing barriers to reporting and follow-up of exposures were not scaled because only a small percentage or participants reported being exposed in the 3 month period prior to filling out the questionnaire. These items were used to calculate 3 barrier scale scores. Ten items assessing perceived individual barriers (e.g., habit or carelessness, patient did not appear to be at risk for HIV, universal precautions are unnecessary/ineffective) were used to compute a scale of individual barriers (alpha=.50). Fourteen items assessing perceived environmental barriers (e.g., lack of time, protective equipment interferes with technical skills, materials poorly constructed) were used to compute a scale of environmental barriers (alpha=.59). All 24 items were used to compute a total scale assessing barriers to universal precaution (alpha=.62).

Knowledge

The third section of this instrument included two measures of HIV-related knowledge. The scale of knowledge of HIV transmission included items designed to assess knowledge of the ways in which HIV is transmitted in health care settings. Respondents were asked to indicate the relative probability of HIV transmission to a health care worker in different provider-patient scenarios. These scenarios represented both viable and nonviable routes of transmission. Item responses were recoded. For items representing situations in which there was a potential risk of HIV transmission,

responses indicating some degree of risk were scored as correct answers. For items representing situations in which there was no potential risk for transmission, responses indicating no risk were scored as correct answers. After recoding, there was little or no variance on the items representing viable routes of HIV transmission as nearly all respondents reported "correct" responses and these items were deleted from the scale. The final scale included 10 items, with a reliability analysis yielding satisfactory internal consistency (alpha=.81).

Several items asking participants to agree/disagree with a series of true/false questions related to guidelines for the use of universal precautions were included in the questionnaire as a measure of knowledge of universal precautions. Again, there was little variance on several of these items, with nearly all respondents indicating correct responses. The 3 items on which there was variance dealt with the perceived need for additional or special precautions that go beyond those called for under universal precaution guidelines. A reliability analysis for these 3 items revealed low internal consistency (alpha=.44).

Motivation and Behavioral Skills

The fourth section of this instrument included several measures designed to assess the constructs of motivation and behavioral skills. Participants were asked to respond on a four-point scale to a series of questions designed to assess perceived efficacy of universal precautions. These questions were designed to assess the degree to which participants believe that universal precautions provide them with adequate protection

against HIV infection. A final reliability analysis for this 5-item scale revealed low internal consistency (alpha=.61).

Respondents were also asked to respond on a 4-point scale to a series of questions designed to assess subjective norms for compliance with universal precautions. These questions were designed to assess the participants' perceptions that significant others in their work environment support and engage in compliance with universal precautions. A reliability analysis for this 7-item scale yielded satisfactory internal consistency (alpha=.73).

This section also included a measure designed to assess level of fear of becoming infected with HIV in the health care setting. Respondents were asked to respond on a 4-point scale to a series of statements designed to assess perceived risk of occupational transmission of HIV. A reliability analysis for this 5 item scale revealed satisfactory internal consistency (alpha=.71).

A measure of perceived behavioral control was included in this section. This measure was adapted from a scale used by Ajzen and Madden (1986) in their development and testing of the theory of planned behavior (alpha=.74). These 3 items, which were included at different points throughout this section of the questionnaire, were intended to judge the degree to which respondents feel in control of whether or not they use universal precautions. A reliability analysis for this 3-item scale revealed low internal consistency (alpha=.50).

Behavioral intentions for complying with universal precautions were assessed by asking respondents to indicate the degree of likelihood (extremely likely, somewhat likely, somewhat unlikely, extremely unlikely) that they would comply with universal

precautions when they perform specified medical procedures. A list of procedures identical to those used in the assessment of compliance (last time procedure was performed) was used to assess intentions. Respondents were asked to indicate the likelihood that they would use specific precautions for each procedure. An approach parallel to that used in the calculation of compliance scores was taken to calculate intention scores. Behavioral intention scale scores were calculated as the mean of responses for those precautions required for each of the procedures. The number of items included in this scale ranged from 8-10, as a result of the variation in the number of procedures between units. Required precautions matched those used in the calculation of procedure-specific compliance scores (i.e., routine precautions). In addition, responses for a particular procedure were included only if a respondent indicated performing that procedure in the section assessing compliance. A reliability analysis for these items by unit revealed indices of internal consistency ranging from alpha=.06 - .55.

The fourth section of the questionnaire also included a measure designed to assess behavioral skills, which were operationalized as perceived self-efficacy for performing medical procedures when utilizing universal precautions. This measure asked respondents to agree or disagree with a series of statements reflecting a level of confidence in performing a medical procedure while utilizing the appropriate precautions. The list of procedures identical to those used in the assessment of compliance (last time procedure was performed) and behavioral intentions was used to construct this measure and responses for a particular procedure were included only if a respondent indicated performing that procedure in the section assessing compliance. Again, the number of

items included in this scale ranged from 8-10. A reliability analysis for these items by unit revealed indices of internal consistency ranging from alpha=.76 - .87.

Finally, this section included a shortened version of the Crowne & Marlow (1960) scale of social desirability to assess method variance. This scale has been tested on several different samples with alphas ranging from .73-.88 (Paulhus, 1991). A random subset of the 33-item scale was included in the questionnaire, with items assessing either desirable but uncommon behaviors or undesirable but common behaviors. The reliability analysis for this 8-item scale revealed low internal consistency (alpha=.59).

The final section of the self-report instrument contained several items assessing demographics characteristics (age and sex) and employment characteristics (current position, degree, year degree obtained, primary clinical area of practice) of the participants.

Chapter 3

RESULTS

Data Analysis Strategy

A complete description of the analyses that were performed to examine and test each of the research questions and hypotheses is presented in Table 3. Descriptive analyses were conducted for items and multi-item scales in order to examine frequencies and measures of central tendencies. Methodological analyses were conducted to investigate issues of methodology which impact the current study. Finally, predictive analyses were generated to examine several research questions, including: 1) differences in the variables by type of medical procedure; 2) relationships between reported barriers to using precautions and compliance; and 3) several exploratory relationships among variables. Predictive analyses were used examine the relationships among the outcome and predictor variables and to test several variations of the model for predicting compliance with universal precautions, using LISREL VIII to test the models for goodness of fit.

Table 3

Planned Data Analyses

Analysis Category	Research Questions/Hypotheses	Analysis Variables	Data Analysis
Descriptive Analyses	What are current levels of compliance with UP?	Items Assessing Compliance with UP	Descriptive Statistics
	What are current patterns of knowledge and motivational constructs ?	Items Assessing: Barriers to UP Knowledge Motivation	Descriptive Statistics
Methodological Analyses	Is social desirability a significant source of method variance?	Social Desirability, Outcome & Predictor Variables	Correlations
	How do levels/patterns of compliance vary by type of instrument used?	Compliance - last shift & last 3 months.	Correlations
Predictive Analyses	Are there significant differences in compliance by medical procedure?	Compliance with UP - last shift & last three months.	ANOVA (within-subjects design)
	H1: Compliance will be lower during procedures involving a high degree dexterity.		
	H2: Compliance will be higher during procedures in which there is a greater likelihood for exposure.		
	H3: The likelihood of exposures will be stronger predictor of compliance than loss of dexterity.		
	Are environmental or individual barriers a stronger predictor of compliance?	Environmental & individual barriers; compliance with UP- last shift and last three months	Multiple Regression Analysis
	Exploratory relationships among variables.	Outcome and predictor variables.	ANOVA
	Testing the IMB model as applied to compliance with universal precautions.	All outcome and predictor variables.	Correlations LISREL

Assessment of Compliance, Knowledge, and Motivation Related to Universal Precautions

This study was designed to investigate current levels of compliance with universal precautions among health care workers who have not typically been represented in the research during this period following OSHA's final ruling on bloodborne pathogens. This investigation was also interested in looking at current levels of knowledge and motivational constructs in the context of how they relate to the assessment and prediction of compliance with universal precautions. The results of the descriptive analyses examining compliance are presented first, summarizing current findings regarding the use of universal precautions along with perceived barriers to the use of universal precautions. Following, is a summary of the descriptive results for items assessing knowledge and motivational constructs in relation to HIV in health care settings and to the use of universal precautions. Finally, results are presented which address the methodological issues of concern in the assessment of compliance.

Compliance With Universal Precautions

The percentage of participants for each of the 5 units who reported using each of the different precaution components (i.e., gloves, gowns, needle/sharp precautions) during the last time they performed that procedure are presented in Table 4-8. Also presented in these tables are the percentages of respondents in each of the units who were in compliance with use of precautions for each of the specific procedures by using at a minimum, all required, routine precautions called for during the performance of that procedure. At the procedural level, results reveal high levels of compliance with use of required or routine universal precautions. For many of the procedures, respondents

Table 4 - Number and Percentage of Health Care Workers in the Regular Nursery (n=33) Reporting the Use of Precautions

	Number (%) Reporting Use of Precautions									N (%) Compliance**
	Gloves	Hand washing	Mask	Eye wear	Gown	Foot wear	Resus Device	Needles	Dispose	
Patient Assessment Procedures										
Routine Newborn Exam	30 (93.8)	32 (100.0)*	1 (31.0)	6 (18.8)	2 (6.3)	0 (0.0)	1 (3.1)	16 (50.0)	30 (93.8)	32 (100.0)
Assessment of Mother	33 (100.0)	32 (97.0)*	0 (0.0)	6 (18.2)	2 (6.1)	1(3.0)	1 (3.0)	23 (69.7)	29 (87.9)	32 (97.0)
IV/Puncture Procedures										
IV Start	3 (100.0)*	3 (100.0)*	0 (0.0)	1 (33.3)	0 (0.0)	0 (0.0)	0 (0.0)	3 (100.0)*	3 (100.0)	3 (100.0)
Accucheck	33 (100.0)*	33 (100.0)*	0 (0.0)	6 (18.2)	1 (3.0)	0 (0.0)	0 (0.0)	32 (97.0)*	30 (90.9)	32 (97.0)
Immunizations	21 (87.5)*	24 (100.0)*	1 (4.2)	5 (20.8)	1 (4.2)	1 (4.2)	1 (4.2)	24 (100.0)*	13 (54.2)	21 (87.5)
Airway/Respitory Procedures										
Infant/Mother Oxygen Mask	18 (81.8)	22 (100.0)*	0 (0.0)	5 (22.7)	1 (4.5)	1 (4.5)	1 (4.5)	0 (0.0)	6 (27.3)	22 (100.0)
Spirometry	2 (50.0)	4 (100.0)*	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (25.0)	4 (100.0)
Wound Care Procedures										
Abdom. Staple Removal	21 (95.5)*	22 (100.0)*	0 (0.0)	2 (9.1)	0 (0.0)	0 (0.0)	0 (0.0)	9 (40.9)	15 (68.2)	21 (95.5)
Circumcision Care	32 (97.0)*	33 (100.0)*	0 (0.0)	6 (18.2)	0 (0.0)	0 (0.0)	0 (0.0)	4 (12.1)	31 (96.9)	32 (97.0)
Body Fluid Procedures										
Urinary Catheterization	33 (100.0)*	33 (100.0)*	0 (0.0)	6 (18.2)	1 (3.0)	0 (0.0)	0 (0.0)	3 (9.1)	33 (100.0)	33 (100.0)
Syringe Suctioning	23 (71.9)*	31 (96.9)*	0 (0.0)	6 (18.8)	0 (0.0)	0 (0.0)	0 (0.0)	1(3.1)	23 (71.9)	23 (71.9)

* Required precaution. ** In compliance with all required precautions.

Table 5 - Number and Percentage of Health Care Workers in the Labor & Delivery (n=31) Reporting the Use of Precautions

	Number (%) Reporting Use of Precautions									N (%) Compliance**
	Gloves	Handwash	Mask	Eyewear	Gown	Footwear	Res Device	Needles	Dispose	
Patient Assessment Procedures										
Assessment	27 (87.1)	30 (96.8)*	1 (3.2)	13 (41.9)	4 (12.9)	10 (32.3)	2 (6.5)	18 (58.1)	21 (67.7)	30 (96.8)
Vag. Exam	31 (100.0)*	31 (100.0)*	0 (0.0)	14 (45.2)	3 (10.0)	10(32.3)	0 (0.0)	4 (12.9)	25 (80.6)	31 (100.0)
IV/Puncture Procedures										
IV Start	31 (100.0)*	31 (100.0)*	0 (0.0)	15 (48.4)	2 (6.5)	9 (29.0)	0 (0.0)	31 (100.0)*	31 (100.0)*	31 (100.0)
Cord Blood	29 (100.0)*	28 (96.6)*	13 (44.8)	20 (69.0)*	17 (58.6)*	14 (50.0)	0 (0.0)	29 (100.0)*	29 (100.0)	13 (44.8)
Airway/Respitory Procedures										
Resusc.	31 (100.0)*	30 (96.8)*	12 (38.7)	20 (64.5)	17 (56.7)*	13 (41.9)	28 (90.3)*	10 (32.3)	26 (83.9)	14 (45.2)
Intubation	8 (88.9)*	9 (100.0)*	7 (77.8)	6 (66.7)	3 (33.3)	5 (55.6)	5 (55.6)	3 (33.3)	6 (66.7)	18 (88.9)
Wound Care Procedures										
Dressings	21 (100.0)*	21 (100.0)*	2 (9.5)	9 (42.9)	3 (14.3)	6 (28.6)	21 (100.0)	4 (19.0)	20 (95.2)	21 (100.0)
Peri Care	31 (100.0)*	31 (100.0)*	1 (3.2)	17 (56.7)	4 (12.9)	9 (29.0)	0 (0.0)	2 (6.5)	30 (96.8)	31 (100.0)
Body Fluid Procedures										
Urin. Cath	31 (100.0)*	31 (100.0)*	2 (6.5)	16 (51.6)	4 (12.9)	9 (29.0)	0 (0.0)	0 (0.0)	30 (96.8)	31 (100.0)
Amniot.	30 (96.8)*	30 (96.8)*	1 (3.2)	19 (61.3)*	5 (16.1)	8 (25.8)	0 (0.0)	4(13.3)	30 (96.8)*	18 (58.1)
Deliveries	31 (100.0)*	31 (100.0)*	7 (22.6)	21 (67.7)	21 (67.7)*	18 (58.1)*	6 (19.4)	30 (96.8)*	31 (100.0)	14 (45.2)
Suctioning	28 (100.0)*	28 (100.0)*	6 (21.4)	20 (71.4)	16 (57.1)	12 (42.9)	4 (14.3)	1 (3.6)	26 (92.9)	28 (100.0)

* Required precaution. ** In compliance with all required precautions.

Table 6 - Number and Percentage of Health Care Workers in the NICU (n=38) Reporting the Use of Precautions

	Number (%) Reporting Use of Precautions									N (%) Compliance**
	Gloves	Handwash	Mask	Eyewear	Gown	Footwear	Res Device	Needles	Dispose	
Patient Assessment Procedures										
Assessment	36 (100.0)*	36 (100.0)*	5 (13.9)	13 (36.1)	15 (41.7)	13 (36.1)	13 (37.1)	33 (91.7)	34 (94.4)	37 (100.0)
Feedings	24 (64.9)*	37 (100.0)*	0 (0.0)	11 (29.7)	17 (45.9)	0 (0.0)	0 (0.0)	10 (27.8)	24 (64.9)	24 (64.9)
IV/Puncture Procedures										
IV Start	33 (89.2)*	37 (100.0)*	0 (0.0)	11 (29.7)	1 (2.7)	1 (2.8)	0 (0.0)	36 (97.3)*	34 (94.4)	33 (89.2)
Blood Draws	35 (97.2)*	36 (100.0)*	0 (0.0)	12 (33.3)	3 (8.3)	0 (0.0)	0 (0.0)	36 (100.0)*	33 (91.7)	35 (97.2)
Airway/Respitory Procedures										
Resusc.	30 (88.2)*	33 (97.1)*	14 (41.2)	13 (38.2)	14 (41.2)	13 (38.2)	30 (88.2)*	24 (70.6)	22 (64.7)	28 (82.4)
Intubation	24 (68.6)*	35 (100.0)*	1 (2.9)	13 (37.1)	0 (0.0)	0 (0.0)	27 (79.4)	3 (9.1)	15 (44.1)	22 (62.9)
UAC-UVC	31 (100.0)*	31 (100.0)*	15 (48.4)	11 (35.5)	12 (38.7)	4 (12.9)	2 (6.7)	29 (93.5)	30 (96.8)	31 (100.0)
Wound Care Procedures										
IV Dressing	29 (96.7)*	30 (100.0)*	21 (70.0)*	12 (40.0)	5 (16.7)	0 (0.0)	0 (0.0)	10 (33.3)	26 (86.7)	28 (82.4)
Wound Care	30 (100.0)*	30 (100.0)*	11 (36.7)	12 (40.0)	6 (20.0)	0 (0.0)	0 (0.0)	12 (40.0)	29 (96.7)	30 (100.0)
Body Fluid Procedures										
Suctioning	38 (100.0)*	38 (100.0)*	1 (2.6)	12 (31.6)	2 (5.3)	1 (2.6)	4 (28.9)	17 (44.7)	32 (86.5)	38 (100.0)
Diaper Change	36 (94.7)*	38 (100.0)*	0 (0.0)	11 (28.9)	3 (7.9)	0 (0.0)	0 (0.0)	1 (2.7)	35 (92.1)	36 (94.7)
Deliveries	35 (100.0)*	35 (100.0)*	28 (80.0)*	13 (37.1)	35 (100.0)*	27 (77.1)	31 (88.6)*	12 (34.3)	20 (57.1)	25 (71.4)

*Required precaution. ** In compliance with all required precautions.

Table 7 - Number and Percentage of Health Care Workers in the Women's Pavilion (n=24) Reporting the Use of Precautions

	Number (%) Reporting Use of Precautions									N (%) Compliance**
	Gloves	Handwash	Mask	Eyewear	Gown	Footwear	Res Device	Needles	Dispose	
Patient Assessment Procedures										
Assessment	16 (66.7)	23 (95.8)*	7 (29.2)	4 (16.7)	3 (13.0)	0 (0.0)	1 (4.2)	17 (70.8)	16 (66.7)	23 (95.8)
Vaginal Exams	16 (100.0)*	16 (100.0)*	0 (0.0)	1 (6.3)	0 (0.0)	0(0.0)	0 (0.0)	7 (46.7)	15 (93.8)	16 (100.0)
IV/Puncture Procedures										
IV Start	23 (100.0)*	23 (100.0)*	0 (0.0)	2 (8.7)	0 (0.0)	0 (0.0)	0 (0.0)	23 (100.0)*	22 (95.7)	23 (100.0)
IM Meds	15 (62.5)*	24 (100.0)*	0 (0.0)	2 (8.3)	0 (0.0)	0 (0.0)	0 (0.0)	24 (100.0)*	14 (58.3)	15 (62.5)
Airway/Respiratory Procedures										
Chest Tube	11 (100.0)*	11 (100.0)*	6 (54.5)	5 (45.5)	3 (27.3)	11 (100.0)	0 (0.0)	10 (90.9)*	11 (100.0)	10 (90.9)
Intubation	1 (100.0)*	0 (0.0)*	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (100.0)*	0 (0.0)	1 (100.0)	0 (0.0)
Wound Care Procedures										
Irrigate Wound	23 (100.0)*	23 (100.0)*	5 (21.7)	9 (39.1)	5 (21.7)	0 (0.0)	0 (0.0)	13 (56.5)	23 (100.0)	23 (100.0)
Surg Dressings	23 (95.8)*	24 (100.0)*	1 (4.2)	2 (8.3)	1 (4.2)	0 (0.0)	0 (0.0)	5 (20.8)	20 (83.3)	23 (95.8)
Body Fluid Procedures										
Urin. Cath	24 (100.0)*	24 (100.0)*	0 (0.0)	4 (16.7)	0 (0.0)	0 (0.0)	0 (0.0)	5 (20.8)	23 (95.8)	24 (100.0)*
Suctioning	22 (100.0)*	22 (100.0)*	0 (0.0)	4 (18.2)	0 (0.0)	0 (0.0)	0 (0.0)	2 (9.1)	20 (90.9)	22 (100.0)
NG Tube	18 (100.0)*	18 (100.0)*	0 (0.0)	5 (27.8)	0 (0.0)	0 (0.0)	0 (0.0)	4 (22.2)	18 (100.0)	18 (100.0)

* Required precaution. ** In compliance with all required precautions.

Table 8 -Number and Percentage of Health Care Workers in the Emergency Department (n=34) Reporting the Use of Precautions

	Number (%) Reporting Use of Precautions									N (%) Compliance **
	Gloves	Handwash	Mask	Eyewear	Gown	Footwear	Res Device	Needles	Dispose	
Patient Assessment Procedures										
Primary Survey	27 (87.1)*	29 (93.5)*	6 (20.2)	12 (40.0)	7 (23.3)	4 (13.3)	2 (6.7)	23 (74.2)	21 (67.7)	26 (83.9)
Oximetry	3 (9.1)	22 (66.7)*	0 (0.0)	7 (21.2)	0 (0.0)	1 (3.0)	0 (0.0)	4 (12.1)	5 (15.2)	22 (66.7)
Vaginal Exams	24 (100.0)*	23 (95.8)*	1 (4.2)	6 (25.0)	24 (100.0)	1 (4.2)	1 (4.2)	6 (25.0)	23 (95.8)	23 (95.8)
IV/Puncture Procedures										
IV Start	34 (100.0)*	34 (100.0)*	0 (0.0)	11 (32.4)	0 (0.0)	1 (2.9)	0 (0.0)	33 (97.1*)	32 (94.1)	33 (97.1)*
IM Medications	21 (61.8)*	32 (94.1)*	0 (0.0)	8 (23.5)	0 (0.0)	1 (2.9)	0 (0.0)	33 (97.1)*	24 (70.6)	21 (61.8)
Airway/Respitory Procedures										
Assist Intubation	27 (96.4)*	27 (96.4)*	13 (46.4)	20 (71.4)	15 (53.6)	5 (17.9)	17 (63.0)	16 (57.1)	23 (82.1)	27 (96.4)
Ventilation	23 (95.8)*	24 (100.0)*	5 (20.8)	14 (58.3)	14 (16.7)	3 (12.5)	15 (62.5)*	8 (33.3)	16 (66.7)	24 (70.6)
Wound Care Procedures										
Open Wounds	32 (97.0)*	33 (100.0)*	1 (3.0)	12 (36.4)	3 (9.1)	1 (3.0)	0 (0.0)	14 (42.4)	29 (87.9)	32 (97.0)
Assist Amputations	16 (100.0)*	16 (100.0)*	4 (25.0)	6 (37.5)	4 (25.0)	1 (6.3)	1 (6.3)	11 (68.8)	14 (87.5)	16 (100.0)
Laceration Repairs	24 (100.0)*	24 (100.0)*	4 (16.7)	12 (50.0)*	3 (12.5)	2 (8.3)	0 (0.0)	17 (70.8)	22 (91.7)	12 (50.0)
Body Fluid Procedures										
Urin. Cath	34 (100.0)*	34 (100.0)*	1 (2.9)	12 (35.3)	0 (0.0)	1 (2.9)	0 (0.0)	9 (26.5)	31 (91.2)	34 (100.0)
Suctioning	32 (100.0)*	31 (96.9)*	6 (18.8)	18 (56.3)*	5 (15.6)	1 (3.1)	4 (12.5)	7 (21.9)	30 (93.8)	17 (53.1)

*Required precaution. ** In compliance with all required precautions.

indicated complete compliance with all required precautions. The use of handwashing was nearly universal and over 90.0% of respondents reported complying with precautions for the handling and disposal of needles and sharps. Overall, levels of glove use were high as well, with a few exceptions. Over one quarter of respondents in the regular nursery indicated not using gloves as required when performing suctioning. Nearly 40% in the emergency department and women's pavilion reported not using gloves as required when administering IM medications; and in the NICU when performing feedings and assisting with intubations. Thus, there appear to be procedures for which health care workers are exercising some degree of discretion in deciding whether or not to wear gloves. Procedures with lower levels of compliance include those that call for the use of barrier precautions beyond the use of gloves (i.e., mask, eyewear, gowns, footwear). In these procedures, compliance frequently drops below 50.0%, largely due to the failure to use these additional barrier precautions.

Overutilization, or unnecessary use of precautions is another aspect of compliance that is important, with excessive use having implications for quality of care and the use of resources. It was intended that the self-report measure assessing compliance at the procedural level be used to calculate overutilization, by identifying the use of precautions not required for a specific procedure. Use of precautions beyond those required in routine situations, however, depends on the likelihood of exposure to blood and body fluids anticipated by the health care worker. Determining overutilization, therefore, would require knowledge of any special circumstances which might account for the use of precautions beyond those required in routine situations, a measurement aspect beyond the scope of the self-report methodology employed in the current study. With an

understanding of these limitations, an examination of frequency data for patterns of precaution use beyond routine use remains useful at a preliminary level of investigation. An examination of the frequency data for compliance at the procedural level (See Tables 4-8), does indicate some level of use of gloves and other barrier precautions (mask, footwear, etc.) during procedures in which these precautions are not required under routine conditions. Further investigation will be necessary to determine if these patterns of use are accounted for by special circumstances surrounding the situations in which these procedures were performed which would warrant the use of additional precautions or if they represent over use of precautions..

Overall, degree of compliance appears to vary by type of procedure. Mean compliance scores were calculated for each of the 5 procedure categories (range=1.00 - 2.00). Mean scores were highest for wound care/treatment procedures (M=1.91, SD=.22) and patient assessment procedures (M=1.91, SD=.21,), followed by body fluid procedures (M=1.85, SD=.21), IV/puncture procedures (M=1.85, SD=.24), and airway/respitory procedures (M=1.72, SD=.36). The lower level of compliance during the performance of IV/puncture and airway/respitory procedures is explained largely by the failure on the part of some health care workers to wear gloves or use resuscitation devices during these procedures.

In addition to assessing patterns of compliance during the performance of specific procedures, the current study assessed compliance for universal precautions during the 3 month period prior to completion of the survey instrument. Results revealed slightly lower levels of compliance than those assessed for the last time a specific procedure was performed, however, the general pattern of results was similar. The percentages of those

who indicated "almost always" in response to items assessing use of barrier precautions are presented in Table 9. The use of handwashing and gloves was again nearly universal. Compliance, however, was considerably lower in the use of other barrier precautions, including the use of face/eyewear, gowns or aprons, and protective footwear.

Levels of compliance were relatively high for the handling and disposal of sharps and needles, with the majority of respondents (71.4%) reporting compliance with universal precaution guidelines that prohibit the recapping of a needle after it had been used on a patient. Results indicate, however, that a significant proportion of the respondents, on occasion, are recapping needles, with 14.9% reporting that they recap needles "about 25%" of the time and 13.6% reporting recapping from "50-75%" of the time. The majority of respondents (90.3%), however, are reporting that they are properly disposing of needles or sharps in a puncture proof container. Of the 41.9% who reported resuscitation in last 3 months, 87.5% were complying with guidelines for universal precautions by almost never resuscitating without a protective device.

Despite relatively high levels of overall compliance with universal precautions, 28 of the 160 respondents (17.5%) reported that they had experienced an accidental needlestick or unprotected body fluid contact from a patient in the 3 months prior to completing the survey. Due to little data in this area, this study sought to explore current levels of compliance with the established protocol for exposure incidents. Compliance with guidelines for reporting these exposures to occupational health services was low, with only 9 (32.1%) of these 28 respondents indicating that they had reported this accidental needlestick or unprotected body fluid contact from this patient to occupational

Table 9

Responses to Items Assessing Compliance with Universal Precautions in the Last 3 Months (n=146-157)

	Almost Always	
Items	N	Percent
Worn gloves when potential for exposure to blood and body fluids.	139	88.5
Worn gloves when handling contaminated blood access equipment.	138	87.9
Worn protective eyewear/face shield when potential for body fluid splash.	66	44.5
Worn gown or leak proof apron when potential for body fluid splash.	38	25.9
Worn protective footwear when body fluid soiling anticipated.	23	15.8
Washed hands immediately when contaminated with blood or body fluids.	147	94.8
Washed hands after removing gloves/gown and before leaving the work area.	139	88.5

health services for risk assessment and follow-up. Five of these 9 respondents indicated that they had requested HIV antibody testing because of the exposure.

Barriers to the Use of Universal Precautions

Despite overall high levels of self-reported compliance, an important aspect of this study remains the investigation into possible factors that may explain why some health care workers are not using universal precautions or in other cases find it more difficult to use universal precautions. The percentage of participants reporting perceived barriers to the use of universal precautions for: 1) the use of barrier precautions; 2) the use of precautions for needles and sharps; and 3) precautions for the reporting and follow up for exposures to blood and body fluids, is presented in Table 10. Aspects of the environment such as lack of time, protective equipment not being available or accessible, and barrier equipment interfering with technical skills were the most frequently reported environmental barriers for the use of barrier precautions. At the individual level, over 40% of respondents were willing to admit that their own habit and carelessness serves as a barrier to the adherence of guidelines for barrier precautions.

Environmental barriers also emerged as important perceived barriers to the adherence of universal guidelines for the handling of needles/sharps, with over one-third of the sample indicating inconvenient disposal, recapping for safe storage, to transport, or to protect self/patient during the disassembly of equipment, as barriers. Lack of time and habit or carelessness were less frequently reported perceived barriers for the handling of needles/sharps compared to barriers for the use of barrier precautions.

Table 10

Reported Barriers to Using Universal Precautions

Items	N	Percent
Barriers to Using Barrier Precautions (n=156-160)		
Lack of Time	85	54.1
Habit or Carelessness	64	40.8
Interferes with Technical Skills	63	40.1
Equipment Not Accessible	57	36.3
Materials Poorly Constructed	40	25.5
Equipment Not the Right Size	30	19.1
Interferes With Patient Relationship	22	14.1
Patient Did Not Appear to Be At Risk	20	12.7
Lack of Standards	13	8.3
Allergic Latex and Hypoallergenic Materials Not Available	11	7.1
Patient/Family Uncomfortable	8	5.1
Knew Patient Tested Negative	7	4.5
Universal Precautions Unnecessary	7	4.5
Barrier Precautions Too Hot/Uncomfortable	4	1.9
Barriers to Using Sharp Precautions (n=156-158)		
Disposal Inconvenient	52	33.1
Recap for Safe Storage	50	31.6
Recap to Transport	50	31.6
Recap to Protect During Disassembly	38	24.4
Habit or Carelessness	37	23.4
Lack of Time	14	8.9

(table continues)

Items	N	Percent
Complexity of Equipment	5	3.2
Patient Did Not Appear to Be At Risk	3	1.9
Knew Patient Had Tested Negative	1	0.6
Universal Precautions Unnecessary	1	0.6
Lack of Standards	1	0.6
Barriers to Reporting/Following-Up Exposures (n=15)		
Lack of Time	11	73.3
Complicated	5	33.3
Reporting Invasive	4	26.7
Unnecessary	3	20.0
Forgot	2	13.3
Fear of Disciplinary Action	2	13.3
Patient Did Not Appear to Be At Risk	2	13.3
Knew Patient Had Tested Negative	1	6.7
Fear of Testing Positive	0	0.0

Perceived barriers to adhering to guidelines for reporting and following up with exposures are important in light of the fact that only 9 of the 28 respondents who experienced an accidental needlestick or unprotected body fluid contact from a patient reported these incidents to occupational health services. In this case, lack of time stands out as the strongest perceived barrier. Over 20% of those who reported exposures reported that the procedures were too complicated, invasive, or unnecessary.

Knowledge

Responses to items assessing knowledge of HIV transmission are presented in Table 11. Viable routes are methods of transmission of HIV that have been officially documented through surveillance efforts (CDC, 1992; CDC 1995). Nonviable routes represent methods of transmission that, although they may be commonly perceived as possible means of transmission of HIV, have never been officially verified as actual routes of transmission. Respondents demonstrated high levels of knowledge of viable routes of HIV transmission in the health care setting, with all of the respondents correctly indicating that HIV can be transmitted via needlestick and from HIV-infected blood splashed on non-intact skin, in eyes, or in mucous membranes. While health care workers are clearly aware of the major routes of transmission from infected patient to provider, there was less agreement concerning risk for HIV infection from activities that represent nonviable routes of HIV transmission. The majority of respondents indicated that health care workers are at risk for HIV infection by being bitten, coughed, or sneezing upon by an HIV-infected patient or by coming into contact with a small amount

Table 11

Responses to Items Assessing Knowledge of HIV Transmission in Health Care Settings (n=158-160)

Items	Risk	
Viable Routes of HIV Transmission	N	Percent
A needlestick injury with a sharp used on HIV-infected patient.	160	100.0
HIV-infected blood splashed in eyes or mucous membranes.	160	100.0
HIV-infected blood splashed on non-intact skin.	159	99.4
Nonviable Routes of HIV Transmission		
While feeding HIV-infected patient, small amount of saliva comes in contact with the worker's intact skin.	97	60.6
While changing sheets on an HIV-infected patient's bed, intact skin comes in contact with dried blood stains.	125	78.1
A patient infected with HIV uncontrollably coughs or sneezes on a unprotected face.	143	89.4
Performing mouth-to-mouth resuscitation with a protective device on a patient infected with HIV.	112	70.0
While irrigating a wound, an HIV-infected patient's blood and body fluids splash onto intact skin.	143	89.4
Intact skin in contact with vomit of HIV-infected patient.	128	80.0
While inserting a urinary catheter into an HIV-infected patient, a large amount of urine spills onto intact skin.	134	83.7
While performing an admission assessment on an HIV-infected patient, a worker touches a scab-covered wound without wearing gloves.	122	76.2
In the course of restraining a combative patient infected with HIV, a health care worker is bitten and the skin is broken.	158	8.7
A health care worker conducts daily massages with HIV-infected patient without wearing gloves (provider has no open cuts or sores and never touches open cuts or sores.)	58	36.7

of saliva while feeding an HIV-infected patient. Over one-third indicated a risk from massaging an HIV-infected patient's skin.

The majority of respondents clearly demonstrated knowledge of the major components of universal precautions. Correct responses to these items are presented in Table 12. There is some variation in the interpretation of universal precautions along some dimensions. Substantial percentages of respondents indicated that special precautions are needed when treating HIV-seropositive patients, including the use of gloves for all contact and the placement of HIV-seropositive patients in single rooms. These results suggest that while the majority of respondents understand the fundamentals of universal precautions, there is a sizable percentage of respondents who believe that the current set of required precautions are not sufficient to prevent the transmission of HIV in health care settings and that additional precautions that are not required are necessary.

Motivation

The pattern of results for responses to items assessing knowledge of universal precaution guidelines matches closely with those found for the assessment of perceived efficacy of universal precautions, with the majority of participants agreeing with the concept of universal precautions in principle. The majority of respondents agreed that: 1) dropping uncapped needles and syringes directly in a sharps box reduces their risk of contracting bloodborne diseases, including HIV (98.7%); 2) that infection control precautions taken at this hospital are sufficient with respect to HIV transmission (89.2%); 3) that universal precautions are more effective at preventing the transmission of HIV in

Table 12

Responses to Items Assessing Knowledge of Universal Precaution Guidelines (n=160)

	Agree*	
Items	N	Percent
Protective eyewear worn when anticipate splash body fluids.	158	98.8*
If exposed to blood or body fluids, report to supervisor at end of shift.	56	35.0
Special precautions needed when treating HIV-positive patients.	102	65.0
Wearing gloves reduces times handwashing is necessary.	2	1.3
Every patient should be considered to be potentially HIV positive.	152	95.0*
Health care workers must consider the procedure and type of exposure before selecting barriers.	152	95.0*
Gloves should be worn for all contact with HIV-positive patients.	90	56.6
More severe infection control measures required for HIV than Hepatitis B.	11	6.9
All needles should be placed in puncture-resistant containers.	160	100.0*
HIV-positive patients should be placed in single rooms.	81	51.6

* Agreement with the item represents a correct response.

health care settings than testing all patients for HIV (87.4%); and 4) the precautions they take while working are adequate to prevent me from becoming infected with HIV (86.8%). Responses to other items, however, again reveal a desire on the part of health care workers for alternative or additional precautions. Over half of the participants agreed or strongly agreed that disease-specific isolation room signs are more effective than universal precautions in promoting barrier protection (55.0%). An even greater percentage indicated that knowing the HIV-status of a patient is more effective in preventing the transmission of HIV than the use of universal precautions (74.9%). Thus, while participants confirm that universal precautions are effective in preventing the transmission of HIV, many of these respondents also believe that knowledge of patient's HIV status and action based on this knowledge (i.e., use of disease-specific isolation precautions) would be more effective than the use of universal precautions.

Responses to items assessing subjective norms for compliance - participants' perceptions that significant others in their work environment support and comply with universal precautions - also varied. At the policy level, most respondents reported high levels of support for the use of universal precautions. The majority of respondents indicated that the administration and supervisory staff of this hospital provide necessary equipment and training for health care workers to protect themselves from exposures (92.5%); that health care workers in their unit are expected to comply with universal precautions (95.6%) and that staff are encouraged to use barrier protection during patient care (91.2%). In their day-to-day practice, however, it appears that participants perceive less support for complying with universal precautions. Significant percentages of respondents disagreed that coworkers are consistent in their use of universal precautions

(37.1%) and that coworkers remind each other to practice universal precautions (37.1%). Over one-quarter (26.1%) of participants agreed or strongly agreed that their supervisors are inconsistent in their use of universal precautions.

Responses to items assessing perceived risk of occupational transmission of HIV reveal that a significant proportion of participants perceive themselves to be at real risk of contracting HIV infection from the patients they care for. Significant percentages of respondents disagreed or strongly disagreed with the following statements: 1) the majority of my patients present little or no risk for transmitting HIV to myself and my coworkers (56.4%); 2) I seldom worry that I may become infected with HIV as a result of my job (44.1%); and 3) I consider the chance of myself becoming infected with HIV in the health care setting to be highly unlikely (39.3%). Likewise, 40.2% of respondents agreed or strongly agreed that they are highly susceptible to contracting HIV in the health care setting. Smaller percentages indicated that they become anxious when performing procedures or caring for patients because of fear that they may become HIV-infected (15.7%). Over twenty percent (20.8%) of respondents indicated that they have little confidence in the information about HIV and AIDS that the medical and scientific communities present.

Despite the substantial percentages of respondents reporting perceived barriers to the use of universal precautions, participants reported a high level of perceived behavioral control. The majority of respondents indicated that is was "extremely likely" or "quite likely" that if they want to use universal precautions, their working conditions would enable them to properly use precautions (89.9%). Nearly half (45.2%) of participants responded that they have complete control over whether or not they use universal

precautions. The remaining respondents indicated lesser degrees of control, however, few indicated having very little control over whether or not they use precautions (1.3%). Over sixty percent (61.0%) of respondents indicated that using precautions that they are required to use all the time is easy.

Methodological Analyses Related to the Assessment of Compliance with Universal Precautions

The current study was designed to contribute knowledge to methodological issues apparent in the research literature. Social desirability as a response bias is a serious concern in this field of study due to a heavy reliance on self-report methodologies. Therefore, a scale of social desirability was included in this study to assess method variance - in this case the degree to which social desirability influences self-report assessments of compliance with universal precautions and other variables thought to predict compliance. Marlow-Crowne social desirability scale scores were computed. A score of 1.00 represents low social desirability while a score of 2.00 represents high social desirability. The social desirability scale had a normal distribution (skewness=-0.13) and the sample mean was M=1.60 (range=1.13 to 2.00, n=160) with a standard deviation SD=0.29.

Pearson correlations between social desirability and the assessment of compliance and the predictor variables reveal an overall lack of significance in these relationships (See Table 13). There was a significant negative relationship between social desirability and the scale for individual barriers to the use of precautions (r=-.20), that is higher levels of social desirability were associated with lower levels of reported individual barriers

Table 13

Pearson Correlations Between Social Desirability and Outcome and Predictor Variables

	Social Desirability	
Variables	N	Pearson's r
Compliance with Universal Precautions - Last Time Procedure Performed	151	.06
Compliance with Universal Precautions - Last 3 Months	156	.20*
Individual Barriers	155	-.20*
Environmental Barriers	156	.01
Barriers to the Use of Universal Precautions	156	-.08
Knowledge of HIV Transmission	160	-.13
Knowledge of Universal Precautions	160	-.04
Perceived Efficacy of Universal Precautions	159	.04
Subjective Norms for Compliance with Universal Precautions	159	.03
Perceived Risk of Occupational Transmission of HIV	158	.14
Perceived Behavioral Control	159	-.00
Behavioral Intentions	148	.07
Perceived Self-Efficacy for Performing Medical Procedures While Using Universal Precautions	158	-.03

*$p<.05$

to the use of universal precautions. The relationship between social desirability and the scale for environmental barriers to the use of precautions was not significant. There was also a significant relationship between social desirability and the more general of the two compliance measures assessing compliance during the last 3 months ($r=.20$); higher levels of social desirability were associated with higher levels of reported compliance. While this finding might suggest that this measure is more susceptible to response bias than the procedure-specific assessment of compliance for the last time the procedure was performed, overall levels of compliance on the 3 month measure were actually lower than those reported for the last time a procedure was performed. While the correlation was significant, social desirability accounts for only a relatively small portion of the variance in this compliance measure. In general, social desirability does not appear to be a significant threat to the validity of the self-report assessments of compliance and the predictor variables in the current study.

This study was also interested in developing a measure that was specific to both procedures and precautions in an effort to develop a more valid methodology for assessing compliance than those used in previous research. Both types of measures were included in the current study so that results could be compared to examine if these different approaches yield different results. The measure of compliance during the last 3 months, similar to self-report measures used in previous research, asked respondents to indicate their overall degree of compliance in using precautions during the last 3 months and the scenarios presented in which compliance is assessed were not specific to procedures. The other measure used to assess compliance asked respondents to indicate which precautions they used during a specific medical procedure during the last time they

performed that procedure. This measure, therefore, was specific to both task and precaution and also limited the period of recall to the last time that procedure was performed. Results presented earlier illustrate the same general pattern of results obtained from the two measures, with overall levels of self-reported compliance lower on the more general measure of compliance during the last 3 months. A two-tailed Pearson correlation reveals that the two measures are moderately correlated with each other ($r=.22$, $p<.05$).

Aside from differences in significance levels, the pattern of correlations between these two measures of compliance and the predictor variables (See Table 14) were similar with two exceptions: 1) compliance the last time procedure was performed was significantly negatively correlated with knowledge of universal precautions while the correlation between compliance for the last 3 months and knowledge of universal precautions was positive but nonsignificant; and 2) compliance for the last 3 months was significantly positively correlated with perceived efficacy of universal precautions while the correlation between compliance the last time the procedure was performed was negative but nonsignificant. While the general findings between the two measures were similar, the correlation between the two measures, although significant, was moderate. This suggests that these two measures are to some degree measuring different constructs and should be viewed not as interchangeable, rather as distinct approaches for the assessment of compliance.

Table 14

Pearson Correlations Between Compliance Measures and Predictor Variables

Variables	Compliance - Last Time Procedure Performed		Compliance - Last 3 Months	
	N	Pearson's r	N	Pearson's r
Individual Barriers	147	-.24*	153	-.36*
Environmental Barriers	148	-.16	154	-.10
Barriers to the Use of Universal Precautions	148	-.24*	153	-.24*
Knowledge of HIV Transmission	151	.23*	156	.13
Knowledge of Universal Precautions	151	-.20*	156	.10
Perceived Efficacy of Universal Precautions	150	-.00	155	.23*
Subjective Norms for Compliance with Universal Precautions	150	.10	156	.19*
Perceived Risk of Occupational Transmission of HIV	149	.13	155	.07
Perceived Behavioral Control	150	.18*	155	.16*
Behavioral Intentions	148	.63*	145	.10
Perceived Self-Efficacy for Performing Medical Procedures When Utilizing Universal Precautions	151	.29	154	.18*

*$p<.05$

Summary of Findings

Health care workers reported levels of compliance with the guidelines for barrier precautions and the handling and disposal of needles and sharps much higher than those substantiated in previous research. Compliance with guidelines for the reporting and follow up of exposures to blood and body fluids, however, was relatively low. While compliance was high overall, substantial numbers of participants reported perceived barriers to the use of universal precautions. The relative importance of these perceived barriers varied for barrier precautions, needle/sharp precautions, and for the reporting and follow-up of exposures. In addition to these reported barriers, many respondents indicated that at a practical day-to-day level, they did not experience strong subjective norms from their coworkers or supervisors for complying with universal precautions. Despite perceived barriers and lack of subjective norms for complying with universal precautions, the majority of respondents did report a high degree of perceived control over whether or not they use precautions.

The emotional component identified in prior research is also evident in the current study, with substantial numbers of respondents indicating that they perceive themselves to be at real risk of becoming infected with HIV in the health care setting. Relatedly, responses to items assessing knowledge of HIV transmission, knowledge of universal precautions, and perceived efficacy of universal precautions indicate that many participants believe that HIV can be transmitted through nonviable routes of transmission and that universal precautions alone are insufficient to protect them against HIV infection. In terms of methodology, social desirability does not appear to be a significant

threat to the validity of the assessment of the variables included in this study with the exception of the general assessment measure of compliance.

Predicting Compliance with Universal Precautions

Multivariate analyses were conducted to investigate the relationships between compliance and the other variables. First presented in this section are the results of multivariate analyses examining differences in variables by medical procedure, the relationships between reported barriers and compliance with universal precautions, and exploratory analyses examining differences in compliance along several dimensions. Next, the intercorrelations among constructs in the path models are examined. Finally, the results of structural equation analyses testing the models are presented.

Levels of Compliance by Procedure Type

This study was designed to investigate the degree to which characteristics of procedures - dexterity involved in performing a procedure and the likelihood of exposure to blood and body fluids when performing a procedure - impact compliance with universal precautions. Department managers and other key nursing personnel were asked to rate each of the procedures as high dexterity or low dexterity and as high likelihood of exposure or low likelihood of exposure. Four separate compliance scores were generated for each participant: 1) compliance for high dexterity procedures; 2) compliance for low dexterity procedures; 3) compliance for high exposure procedures; and 4) compliance for low exposure procedures. A within-subjects analysis of variance (ANOVA) was computed to test for differences in these compliance scores. The original hypotheses

were designed to test for differences in compliance with glove use specifically along these procedure dimensions, however, given the limited variance in glove use, compliance for the purpose of testing the following hypotheses was expanded to include all components (gloves and other barrier precautions, needles/sharps).

Hypothesis 1: Compliance will be lower during procedures involving a high degree of dexterity compared to other procedures. There were no significant differences in compliance during high dexterity procedures compared to low dexterity procedures.

Hypothesis 2: Compliance with be higher during procedures in which there is a greater likelihood for exposure to patients' blood and body fluids compared to procedures with a lower level of risk for exposure. There were no significant differences in compliance during high exposure procedures compared to low exposure procedures.

Hypothesis 3: The likelihood of exposure to blood and body fluids will be a stronger predictor than loss of dexterity in predicting compliance. The selection of procedures in this study did not adequately account for the demands of analyzing the potential interaction effect of dexterity and exposure on compliance - that is too few respondents engaged in procedures which could be classified as both high in dexterity and low in exposure.

Barriers to Using Precautions as Predictors of Compliance

Although several previous studies have assessed perceived self-reported barriers to the use of universal precautions, there has been little systematic investigation into the barriers related to levels and patterns of compliance with universal precautions. As a result, it is currently unknown to what extent these behaviors are influenced by environmental-level barriers relative to individual-level barriers. Regression analyses were conducted to examine whether environmental barriers scale scores (14 items, alpha=.59, M=1.23, SD=.16, skewness=.41, range=1.00-2.00, n=156) or individual-level barrier scale scores (10 items, alpha=.50, M=1.11, SD=.12, skewness=1.14, range=1.00-2.00, n=155) are a stronger predictor of compliance. Scale scores for individual barriers were significantly negatively correlated with the measure of compliance for the last time the procedure was performed ($r=-.24$, $p<.05$, n=147) and compliance for the last 3 months ($r=-.35$, $p<.05$, n=153). Respondents reporting lower levels of individual barriers were more likely to report higher levels of compliance with universal precautions. The correlations between environmental barriers and the two compliance measures were not significant. In hierarchical regression analyses, individual and environmental barrier scores were entered into the regression analyses. Beta-values for individual level barriers were significant for compliance the last time a procedure was performed ($\beta=-.22$, $t=-2.64$, $p<.05$) and compliance for the last 3 months ($\beta=-.35$, $t=-4.53$, $p<.05$). Beta-values for environmental level barriers were not significant for either measure of compliance. Overall, perceived barriers accounted for 7% of the variance ($F=5.38$, $df=2,144$, $p<.05$) for compliance scores for the last time procedure was performed and 13% of the variance ($F=11.22$, $df=2,150$, $p<.05$) for compliance scores for the last 3 months.

Descriptive results presented earlier suggest differing levels of importance for environmental versus individual barriers depending on the category of precaution, with fewer respondents reporting individual barriers such as habit or carelessness as factors that prevent or make difficult the use of precautions for the handling and disposal of needles and sharps. Further analyses examining the relationship between perceived self-reported barriers and compliance were conducted to explore these differences. Scales of perceived individual-level barriers for barrier precautions (6 items, alpha=.25, M=1.14, SD=.16, skewness=1.09, range=1.00-2.00, n=157), perceived environmental-level barriers for barrier precautions (7 items, alpha=.55, M=1.27, SD=.20, skewness=.63, range=1.00-2.00, n=157), perceived individual-level barriers for needle/sharp precautions (4 items, alpha=.39, M=1.07, SD=.13, skewness=2.06, range 1.00-2.00, n=158), and perceived environmental-level barriers for needle/sharp precautions (7 items, alpha=.40, M=1.19, SD=.19, skewness=.71, range 1.00-2.00, n=158) were computed separately from items assessing perceived barriers. Likewise, separate scales were computed for compliance with barrier precautions during the last 3 months (7 items, alpha=.47, M=3.98, SD=.55, skewness=-.08, range=1.00-5.00, n=151) and compliance with needles/sharp precautions during the last 3 months (2 items, alpha=.22, M=4.69, SD=.55, skewness=-1.65, range=3.00-5.00, n=154).

Again, scale scores for individual barriers for barrier precautions were negatively correlated with compliance for barrier precautions ($r=-.22$, $p<.01$, n=150) and individual barriers scale scores for needle/sharp precautions were negatively correlated with compliance for needle/sharp precautions ($r=-.26$, $p<.001$, n=153). Environmental scale scores for barrier precautions were not significantly correlated with barrier

compliance scale scores, however environmental scale scores for needle/sharp precautions were negatively correlated with needles/sharp compliance scores.

A hierarchical regression analysis predicting compliance with barrier precautions reveals findings similar to those for overall compliance, with Beta-values for individual barriers significant (β=-.21, t=-2.51, p<.05) and both sets of perceived barriers accounting for 5% of the variance (F=3.69, df=2,147, p<.05) for barrier compliance scores for the last 3 months. A hierarchical regression analysis predicting compliance with needle/sharp precautions, however, revealed a different pattern of results. In this equation, Beta-values for both individual (β=-.20, t=-2.68, p<.05) and environmental (β=-.37, t=-5.01, p<.05) barriers for compliance with needles/sharp precautions were significant, with environmental barriers the stronger predictor of the two. Both predictor variables accounted for 21% of the variance in this equation (F=19.76, df=2,150, p<.05)

In summary, while greater percentages or respondents report perceived environmental barriers relative to individual barriers, it is actually individual barriers overall that account for a greater degree of the variance in overall compliance scores. Further analyses, however, reveal differences in this pattern of finding dependent upon the category of compliance behaviors and corresponding precautions. While the above pattern holds true for compliance with barrier precautions, environmental rather than individual barriers emerge as the stronger factor when predicting compliance with needle/sharp precautions and both sets of predictors accounted for a significant and substantial degree of variance in these compliance scores.

Exploratory Relationships

Between-unit differences. Several exploratory analyses were conducted to identify between-unit differences on the outcome and predictor variables. An ANOVA was conducted to test whether respondents working in the 5 different units had different levels of compliance using the mean item scale scores for compliance the last time the procedure was performed, the 4 procedure categories, and compliance for the last 3 months. A statistically significant ANOVA revealed between group differences among participants in the 5 different units on all the measures of compliance with universal precautions (See Table 15). Generally, compliance scores were highest in the regular nursery and women's pavilion and lowest in the emergency department.

Between-unit differences were also examined for variables assessing knowledge, motivation, and behavioral skills. Significant results from one-way ANOVAs are presented in Table 16. There were significant between-group differences among participants on the 5 units on perceived barriers to using universal precautions. Health care workers in the regular nursery reported the lowest mean number of perceived barriers - both individual and environmental. The highest means for perceived barriers were reported by participants in labor and delivery and NICU. There were also significant between-group differences on the measure of subjective norms for complying with universal precautions. Respondents in the women's pavilion reported the highest means for perceived subjective norms while those in the NICU reported the lowest. Finally, significant between-unit differences were also found on the measure of perceived risk of HIV infection. Those in labor and delivery reported the highest means for perceived risk

Table 15

Means and (and Standard Deviations) for Compliance Variables for Different Units

	Unit						
	1 Regular Nursery n=33	2 Labor and Delivery n=31	3 NICU n=38	4 Women's Pavilion n=24	5 Emergency Department n=34	F, df	η^2
Compliance Measure	Mean SD	Mean SD	Mean SD	Mean SD	Mean SD		
Compliance Last Time Procedure Was Performed	1.93 .09	1.84 .12	1.88 .10	1.94 .07	1.81 .14	7.45* (4,146)	.17
Patient Assessment Procedure Category	1.98 .09	1.98 .09	1.82 .24	1.98 .10	1.80 .29	8.04* (4,154)	.17
IV/Punctures Procedure Category	1.94 .17	1.74 .25	1.93 .21	1.81 .25	1.79 .28	4.68* (4,154)	.11
Airway/Respitory Procedure Category	2.00 .00	1.53 .45	1.78 .33	1.83 .39	1.55 .24	9.91* (4,127)	.24
Wound Care/Treatment Procedure Category	1.96 .19	2.00 .00	1.84 .31	1.98 .10	1.82 .24	4.69* (4,153)	.11
Body Fluid Procedure Category	1.86 .23	1.74 .21	1.89 .16	2.00 .00	1.78 .25	7.42* (4,155)	.14
Compliance Last 3 months	4.08 .54	4.38 .42	4.02 .50	4.03 .44	4.23 .43	3.34* (4,151)	.081

Table 16

Means and (and Standard Deviations) for Knowledge and Motivation Variables for Different Units

	Unit						
	1 Regular Nursery n=33	2 Labor and Delivery n=31	3 NICU n=38	4 Women's Pavilion n=24	5 Emergency Department n=34	F, df	η^2
Measure	Mean SD	Mean SD	Mean SD	Mean SD	Mean SD		
Perceived Barriers	1.12 .09	1.19 .11	1.19 .11	1.21 .13	1.19 .12	2.99* (4,155)	.07
Perceived Individual Barriers	1.05 .07	1.14 .15	1.14 .13	1.12 .12	1.10 .12	3.01* (4,150)	.07
Subjective Norms	2.88 .37	2.88 .36	2.86 .36	3.16 .41	3.07 .36	3.98* (4,154)	.09
Perceived Risk of HIV Infection	2.50 .54	2.66 .47	2.20 .37	2.27 .44	2.28 .50	5.47* (4,153)	.13

*$p<.05$

of HIV infection in the health care setting; respondents in the emergency department reported the lowest.

In summary, several significant between unit-differences were identified although no uniform pattern of results emerged for the 5 units across these measures. These findings do suggest, however, that the dynamics of some of the dimensions that were investigated in this study differ from unit to unit. Respondents in the regular nursery appear to perform in an environment with fewer perceived barriers and correspondingly have high rates of compliance. Likewise respondents in the women's pavilion have higher rates of compliance. Those in the emergency department, however, have lower rates of compliance. Participants in the NICU have higher levels of perceived barriers and lower levels of subjective norms while those in labor and delivery reported high levels of perceived barriers and high levels of subjective norms. Those in labor and delivery had the highest levels of perceived risk of HIV infection, while interestingly, those in the emergency department had the lowest levels of perceived risk.

Reported exposures. Given the number of individuals reporting exposures to blood and body fluids, this variable was subjected to further analysis. The relationship between reported exposures and compliance scale scores was nonsignificant, as was the relationship between needle recapping and reported exposures. Participants who reported exposures were not significantly different from other respondents along the dimensions of age, sex, or current position. Although not significant, there were differences in the proportion of respondents reporting exposures in the different units. Only 3.0% of respondents in the regular nursery reported exposures while 29.0% of respondents in labor and delivery reported exposures. Percentages reporting exposures

ranged from 17.6%-20.8% in the remaining units. These results suggest that to some degree, the risk of exposure to blood and body fluids through an accidental exposure is spread across all types of respondents, with some differences in percentages of respondents reporting exposure between units.

Number of years worked. An additional question explored is whether or not health care workers who have recently graduated, and therefore were indoctrinated from the start of their professional careers with universal precautions as the prevailing guidelines for infection control, would be more compliant than veteran health care workers who were expected to alter previous behaviors and adopt universal precautions as a new set of guidelines mid-way through their professional careers. This hypothesis was explored by examining the relationship between years worked and compliance scale scores. Recency of training was calculated as the number of years since respondents' highest-level degree was obtained. The correlations with recency of training and compliance with universal precautions (both measures) were nonsignificant. In this sample, those who recently had obtained degrees were no more likely to comply with universal precautions than those who had been practicing their professions for a number of years.

Testing Theoretically-Based Models

The current study was designed to test the utility of framing universal precautions as AIDS-preventive behaviors in understanding the factors that predict compliance, using a modified version of the Information-Motivation-Behavioral Skills Model of AIDS Risk-Behavior Change (Fisher & Fisher, 1993). Three different versions of the model were

tested using path analysis in LISREL VIII. The first model tested was the theoretical model proposed by Fisher and Fisher (1993). Path analysis was used to examine the relationships between the latent variables within the IMB model as applied to this study to determine the overall utility of this theoretical framework in understanding the factors that predict compliance.

The second and third models examined the relationships between the observed variables within the theoretical model. The second version of the model assessed motivation using the conceptual framework of the Theory of Reasoned Action as originally proposed by Fisher and Fisher (1993). The third version of the model assessed motivation using the conceptual framework of the Theory of Planned Behavior. These models served to test the utility of framing motivation within these two theoretical frameworks. These models were generated following the framework of the IMB model with perceived risk of HIV infection added to the model as a motivational variable. These models were tested at the level of observed rather than latent variables to allow for an examination of the specific relationships between observed variables.

Descriptive statistics for each of the variables in the model are presented in Table 17. Following, are the intercorrelations among all the variables in the path models. The results are then presented for the test of each of the three models.

Intercorrelations among variables in the path model. Intercorrelations among each of the constructs in the path model were examined to assess the relationships among the different scales. Table 18 presents the uncorrected correlation matrix for all the constructs. Correlations were corrected for attenuation, however, as discussed earlier there were a number of scales for which no appropriate indices for reliability were

Table 17

Descriptive Statistics for Outcome and Predictor Variables

	N	M[1]	Range	SD	Skewness
Compliance With Universal Precautions- Last Time Procedure Performed	151	1.87	1.00-2.00	.12	-.78
Compliance With Universal Precautions - Last 3 Months	156	4.15	1.00-5.00	.48	-.07
Perceived Barriers	156	1.18	1.00-2.00	.11	.23
Knowledge of HIV Transmission	160	1.76	1.00-2.00	.24	.-1.06
Knowledge of Universal Precautions	160	1.42	1.00-2.00	.34	.27
Perceived Efficacy of Universal Precautions	159	2.93	1.00-4.00	.45	-.05
Subjective Norms for Compliance with Universal Precautions	159	2.96	1.00-4.00	.38	.15
Perceived Risk of Occupational HIV Transmission	158	2.34	1.00-4.00	.49	.27
Perceived Behavioral Control	159	5.63	1.00-7.00	.94	-.80
Behavioral Intentions	148	3.86	1.00-4.00	.16	-1.37
Perceived Efficacy for Performing Medical Procedures While Using Universal Precautions	158	3.77	1.00-4.00	.31	-1.56

[1] Low scale scores represent low degrees of variable dimensions.

Table 18

Uncorrected Intercorrelations Among Constructs in the Path Model (n=144)

	Compliance	Know Trans	Know UP	Perc Eff UP	Sub Norms	Perc Risk	Perc Control	Intent	Perc Eff Using UP
Compliance	1.00								
Know Trans	.21*	1.00							
Know UP	-.18*	-.20*	1.00						
Per Eff UP	-.01	-.09	.23*	1.00					
Sub Norms	.12	.02	.04	.16	1.00				
Perc Risk	.12	.27*	-.25*	-.32*	-.22*	1.00			
Perc Control	.21*	.06	.05	.26*	.32*	-.09	1.00		
Intent	.62*	.14	-.17*	-.06	.14	.05	.32*	1.00	
Per Eff Using UP	.29*	-.02	.03	.24*	.19*	.02	.43*	.35*	1.00

* $p < .05$

available and could therefore not be corrected for attenuation. The path analyses were conducted in LISREL VIII using both the corrected and uncorrected correlations. These analyses yielded similar results. Given these findings and the inability to correct the entire correlation matrix, all final path analyses were conducted using the uncorrected correlation matrix. Compliance the last time a procedure was the behavioral measure chosen to examine the intercorrelations and test the path model. One-tailed tests of significance were applied to all correlations in which the direction of the relationship was predicted, while two-tailed tests of significance were applied to all other correlations in which the nature of the relationship was exploratory.

Generally, the relationships between the two knowledge measures and the other constructs were not consistent with the predicted relationships. Neither knowledge of HIV transmission or knowledge of universal precaution guidelines were associated with perceived efficacy for performing procedures when using universal precautions as hypothesized. The prediction between knowledge of HIV transmission and compliance with universal precautions was supported (r=.21), however, knowledge of universal precaution guidelines was negatively correlated with compliance with specified procedures (r=-.18), opposite to the predicted relationship. An examination of the intercorrelation between the two knowledge measures reveals a negative correlation (r=-.20). Knowledge of HIV transmission was significantly correlated with perceived risk of HIV transmission (r=.27), however, those who had lower levels of knowledge of universal precaution guidelines had higher levels of perceived risk (r=-.25). Finally, those with lower levels of knowledge of universal precaution guidelines had lower levels

of perceived efficacy of universal precautions (r=.23) and higher levels of behavioral intentions for compliance (r=-.17).

As hypothesized, perceived risk of occupational transmission was associated with perceived efficacy of universal precautions (r=-.32) and subjective norms for compliance with universal precautions (r=-.22). Many of the other predicted relationships between the motivational constructs, however, were not supported. The relationship between perceived risk and behavioral intentions was not supported and neither perceived risk, perceived efficacy, or subjective norms were significantly correlated with behavioral intentions as predicted. Behavioral intentions was significantly correlated with compliance with universal precautions (r=.62).

The intercorrelations between perceived behavioral control and behavioral intentions and compliance with universal precautions were examined as part of the model. Those who perceived a low degree of control over compliance behaviors reported lower levels of behavioral intentions to comply with universal precautions (r=.32). Likewise, those with lower perceived control were less likely to actually comply with universal precautions (r=.21). Although not predicted in the model, perceived behavioral control was significantly correlated with several other constructs in the model. Respondents with low levels of perceived behavioral control reported lower levels of perceived self-efficacy of universal precautions (r=.26), subjective norms for complying with universal precautions (r=.32) and perceived efficacy for performing procedures when utilizing universal precautions (r=.43).

There were additional unpredicted relationships identified. Health care workers with lower levels of perceived efficacy reported lower levels of perceived efficacy for

performing procedures when utilizing universal precautions (r=.24). Likewise, respondents with lower levels of subjective norms for complying with universal precautions reported lower levels of perceived efficacy for performing procedures when utilizing universal precautions (r=.19). Health care workers reporting lower levels of behavioral intentions for complying with universal precautions reported lower levels of perceived efficacy for performing procedures when utilizing universal precautions (r=.35).

Behavioral skills were operationalized as perceived efficacy for performing procedures when utilizing universal precautions. As predicted in the model, behavioral skills were significantly associated with compliance last time procedure was performed (r=.29).

Although not included in the model, the relationships between perceived barriers to the use of universal precautions and the constructs in the model were explored. There were significant negative correlations between perceived barriers and many of the major variables (n=141). High levels of perceived barriers were associated with low levels of compliance with universal precautions (r=-.23), perceived efficacy of universal precautions (r=-.26), subjective norms for complying with universal precautions (r=.21), perceived behavioral control (r=- .44), behavioral intentions for complying with universal precautions (r=-.28), and perceived efficacy for performing procedures when utilizing universal precautions (r=-.41).

Tests of the interaction effect. As discussed earlier, the original IMB Model was modified for the current study to predict that behavioral skills would have a moderating effect on the relationship between intentions and compliance. This relationship between

intentions and compliance was examined prior to testing the models. Multiple regression was used to test for this moderating relationship. The main effects including behavioral intentions and behavioral skills were entered at Step One and the product terms were entered at Step Two. The product terms did not contribute significantly to the prediction of compliance with universal precautions - that is behavioral skills did not moderate the relationship between behavioral intentions and compliance with universal precautions. Therefore, this moderating relationship was removed before testing the path model.

Path analysis of the IMB Model. This path analysis tested the relationship between the theoretical or latent variables in order to determine the fit of the data to the relationships between the latent variables of knowledge, motivation, behavioral skills, and behavior. The latent construct of motivation was measured by the observed variables of perceived efficacy of universal precautions, subjective norms for complying with universal precautions, and behavioral intentions for complying with universal precautions. The latent construct of knowledge was assessed by the observed variables of knowledge of HIV transmission and knowledge of universal precaution guidelines. The latent construct of behavioral skills was assessed by the observed variable of perceived efficacy for performing procedures while using universal precautions and the latent construct of behavior was measured by the observed variable of the compliance with universal precautions.

The initial LISREL solution for the model was found non-admissible after 20 iterations, however, further analysis of the model failed to achieve an admissible solution after 60 iterations. Therefore, results from the preliminary model are provided. The

results of this analysis are presented in Figure 5. The results of the predicted hypothesis were as follows:

Hypothesis 4: Results did not support the predicted indirect effect of information on behavior, as mediated through behavioral skills. Counter to what was predicted, information had a direct, positive relationship to behavior (r=.40; t=2.66). Higher levels of HIV-related knowledge were correlated with higher levels of compliance with universal precautions.

Hypothesis 5: Results failed to provide support for the predicted relationship between motivation and behavior.

Hypothesis 6: Results of this path analysis did support the predicted relationship between behavioral skills and behavior (r=.30; t=3.76). Higher levels of perceived efficacy for performing procedures while using universal precautions were predicted higher levels of compliance with universal precautions.

Hypothesis 7: Results did not support the prediction that information and motivation would be statistically independent factors, and therefore not be highly correlated (r=-.42; t=-3.59). The correlation between information and motivation was significant, and negative; those with higher levels of information had lower levels of motivation.

The Chi-Square for goodness of fit with 8 degrees if freedom was equal to 86.89 (p<.05), suggesting poor model fit. The Goodness of Fit Index (GFI) was equal to .88, while the Adjusted Goodness of Fit Index (AGFI) was equal to .57. Both of the GFI and

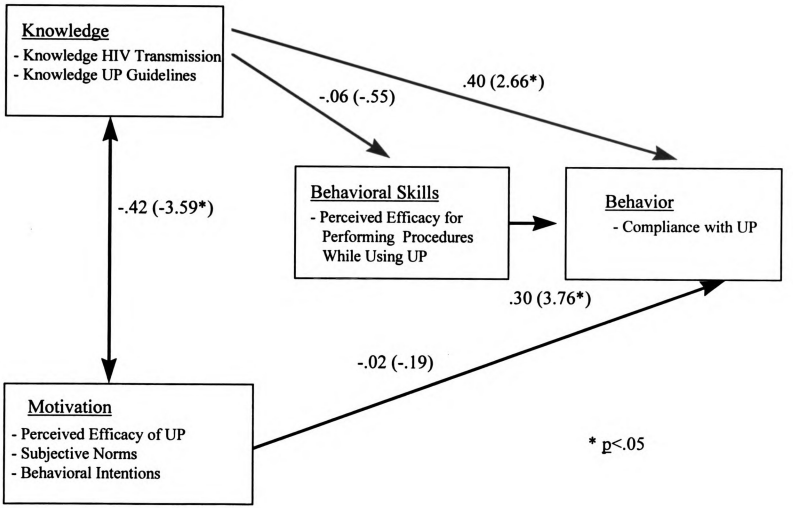

Figure 5. Path Analysis of Information-Motivation-Behavioral Skills Model (n=144)

AGFI values were less than the traditionally accepted cutoff. (GFI and AGFI values should be at least .90 to conclude that there is good model fit.). The standardized Root Mean Square Residual (RMR) was .15, which was slightly above the traditionally accepted cutoff of .10 for this index. The Normed Fit Index (NFI) was .36, which again is below the traditionally accepted cutoff of .90 for this index. Taken together, these indices, along with the lack of support for many of the predicted relationships in the model in terms of sign and statistical significance, indicate a significant discrepancy between the observed and reproduced correlation matrices, suggesting poor model fit.

Path analysis with the Theory of Reasoned Action. Results from the path analysis (standardized path coefficients and t values) of this model are presented in Figure 6. The results of the predicted hypothesis were as follows:

Hypothesis 8: Consistent with earlier results, the results for this path analysis did not support the predicted indirect relationships between the knowledge measures and compliance with universal precautions, as mediated by perceived efficacy for performing procedures while using universal precautions. Results supported a direct relationship between knowledge of HIV transmission and compliance with universal precautions (standardized path coefficient=.13; t=1.91) but not with knowledge of universal precaution guidelines.

Hypothesis 9: Subjective norms for complying with universal precautions was positively correlated with behavioral intentions for complying with universal precautions (standardized path coefficient=.16; t=1.87), however perceived efficacy for universal precautions was not.

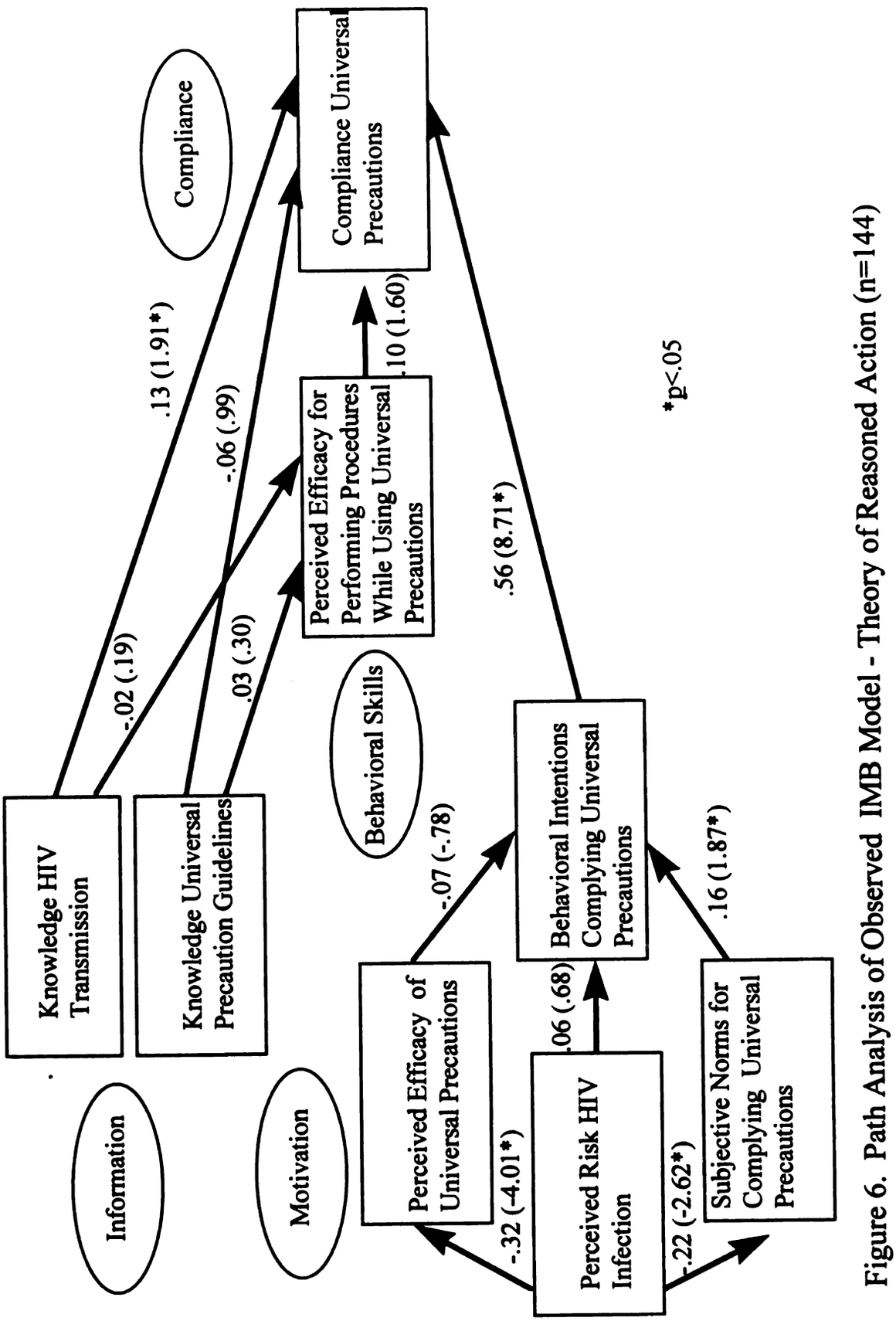

Figure 6. Path Analysis of Observed IMB Model - Theory of Reasoned Action (n=144)

Perceived risk of occupational HIV infection was not correlated with behavioral intentions, but was negatively correlated with perceived efficacy of universal precautions (standardized path coefficient=-.32; t=-4.01) and subjective norms for complying universal precautions (standardized path coefficient=-.22; t=-2.61). Those with lower levels of perceived risk reported higher levels of perceived efficacy of universal precautions and higher levels of subjective norms for complying with universal precautions.

Hypothesis 10: Results supported the predicted relationship between behavioral intentions and compliance with universal precautions. Those with higher levels of behavioral intentions for complying with universal precautions reported higher levels of compliance with universal precautions (standardized path coefficient=.56; t=8.71).

Hypothesis 11: The results did not support the predicted relationship between perceived efficacy for performing procedures while using universal precautions and compliance with universal precautions.

Test of goodness of fit suggest poor model fit. The Chi-Square for goodness of fit with 14 degrees if freedom was equal to 46.80 (p<.05), suggesting poor model fit. The Goodness of Fit Index (GFI) was equal to .93, while the Adjusted Goodness of Fit Index (AGFI) was equal to .82. The GFI value suggests good model fit, while the AGFI value is less than the traditionally accepted cutoff. The standardized Root Mean Square Residual (RMR) was .10, which is right at the traditionally accepted cutoff of .10 for this index.

The Normed Fit Index (NFI) was .73, which again is below the traditionally accepted cutoff of .90 for this index.

Path analysis with the Theory of Planned Behavior. Results from the path analysis of this model are presented in Figure 7. The results from the path model are consistent with those presented for Figure 6 with a few exceptions: 1) the relationship between perceived efficacy of universal precautions and behavioral intentions was significant, with lower levels of perceived efficacy predictive of higher levels of behavioral intentions (standardized path coefficient=-.15; t=-1.76); 2) the predictive relationship between subjective norms for complying with universal precautions and behavioral intentions for complying with universal precautions was not significant in this model; and 3) the predictive relationship between perceived efficacy for performing procedures while using universal precautions and compliance with universal precautions was significant (standardized path coefficient=.11; t=1.71), with those reporting higher behavioral skills for using precautions reporting higher levels of compliance.

The relationship between perceived behavioral control and compliance was examined in this model. The following results were found:

Hypothesis 12: The model supported a significant, positive relationship between perceived behavioral control and behavioral intentions for complying with universal precautions (standardized path coefficient=.34; t=4.27), but did support a direct effect of perceived behavioral control on compliance with universal precautions.

Again, test of goodness of fit suggest overall poor model fit. The Chi-Square for goodness of fit with 17 degrees if freedom was equal to 80.33 (p<.05), suggesting poor

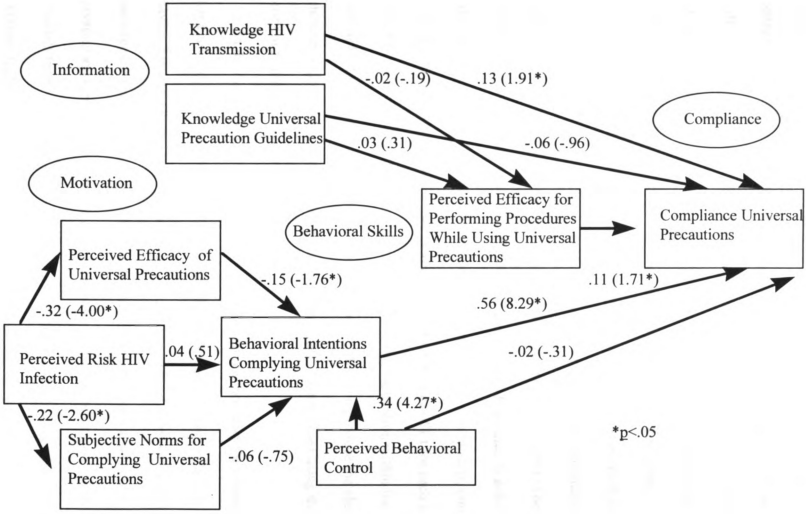

Figure 7. Path Analysis of Observed IMB Model - Theory of Planned Behavior (n=144)

model fit. The Goodness of Fit Index (GFI) was equal to .88, while the Adjusted Goodness of Fit Index (AGFI) was equal to .70, both less than the traditionally accepted cutoff. The standardized Root Mean Square Residual (RMR) was .13, which is above the traditionally accepted cutoff of .10 for this index. The Normed Fit Index (NFI) was .64, which again is below the traditionally accepted cutoff of .90 for this index.

Summary of path findings. Results of analyses testing the various path models provide relatively little support for the proposed models for predicting compliance. Results also did not provide support for either of the observed models tested (Theory of Reasoned Action and Theory of Planned Behavior), as both models failed to achieve good model fit. There was a significant difference in fit between these two models, confirmed statistically by assessing the difference of the chi-square measures of fit for each model, which was $\chi^2(3)=33.53$, $p<.05$. The model conceptualizing motivation within the framework of the Theory of Reasoned Action was better able to reproduce the elements of the correlation matrix than the model in which motivation was framed using the Theory of Planned Behavior.

In the current study, levels of behavioral skills did not moderate the effects of either knowledge and motivation. Overall, knowledge did have a direct effect on behavior, however, knowledge appears to be a multi-dimensional construct, with the two knowledge measures in this study operating differently in the model. Likewise motivation appears to have complex dimensions which were not accurately captured in the models tested and the relationship between motivation and compliance is not clear in the current findings. Finally, knowledge and motivation appear to be complexly interrelated, rather than independent factors in predicting compliance.

Chapter 4

DISCUSSION

Introduction

This study was undertaken to investigate current levels of compliance with universal precautions among health care workers and examine the specific factors thought to influence levels of behavioral compliance with these infection-control guidelines. The results of this study - in particular the findings related to levels of compliance use, knowledge, and motivation - provide important findings that have relevance for future research, intervention, and policy. In framing compliance with universal precautions as preventative, health behaviors, this study attempted to build a connection between theory and behavior. Although the findings from the tests of predictive models were inconclusive and therefore conclusions are limited, these findings provide some insight and direction for continuing research which examines these behaviors within a theoretical framework.

The results of the study are examined and discussed in this section. A summary and discussion of the major descriptive and multivariate findings are presented first. A discussion of results related to the investigation of methodological issues is presented next, followed by the results of analyses testing theoretical models for predicting compliance with universal precautions. The methodological limitations of the research

are then presented. This section concludes with a discussion of the current study's implications for future research, intervention, and policy.

Compliance with Universal Precautions

Nearly a decade following the introduction of universal precautions (CDC, 1987) and 5 years following OSHA's final-ruling on bloodborne pathogens (Department of Labor, 1991), this study establishes high overall rates of compliance with these infection control guidelines among a sample of health care workers. Results reveal nearly unanimous levels of compliance with guidelines for handwashing and glove use. Results suggest, however, that health care workers are exercising some discretion in the use of gloves during particular procedures, such as IM medications and other IV/puncture procedures, feedings, and suctioning. It may be that health care workers perceive less of a risk for HIV infection during these procedures and as a result fail to use required precautions. Lack of compliance may also be a carryover from earlier universal precaution guidelines in which some level of discretion in the use of gloves was allowed during select procedures such as phlebotomy. Future research will be necessary to examine the level of discretion that occurs in the use of gloves during these procedures and to identify the reasons why variance in levels of glove use occurs. While these procedures may indeed present little risk for HIV transmission in the health care setting, addressing these gaps may be critical in ensuring high levels of compliance across all medical interventions.

Although overall rates of compliance were high, this study did document relatively lower rates of compliance centering around the use of barrier precautions other

than the use of gloves. Similar to previous studies (Baraff & Talan, 1989; Hammond et al., 1990; Kelen et al., 1989), breaks in compliance were generally the result of failure to use barriers precautions such as gowns, masks, eyewear and footwear, with compliance falling below 50% in the current study during procedures in which these additional barriers were required. The current findings, therefore, reinforce the need to target improvements in the use of barrier precautions beyond the use of gloves. While the number of situations which demand additional levels of protection may be relatively smaller than those requiring gloves only, these medical situations pose a greater risk for transmission of HIV and heighten the need for compliance.

Compliance with guidelines that prohibit the recapping of needles after use on a patient were high, with over 90% of respondents reporting that they had not recapped needles at the procedural level and over 70% reporting that they had "almost never" recapped needles in the 3 month period prior to completing the survey. These results can be compared directly to those of an earlier study which found only 33% of Michigan nurses complying with this guideline (Schillo & Reischl, 1993). The current self-reported rates of compliance are also higher than others previously reported in the literature (Gruber et al., 1989; Smyser, et al., 1990; Willy et al., 1990). Clearly, health care workers have become knowledgeable of the proper guidelines for the handling of needles/sharps in the period since these earlier studies and in the current sample have altered their behavior accordingly. This remains, however, an important area to target for further intervention. Given the prevalence of needlestick injuries in the workplace and the risk these injuries represent for transmission of HIV and other bloodborne pathogens, even these relatively low rates of recapping remain an unacceptable and unnecessary risk.

While compliance with guidelines for barrier precautions and the handling of needles/sharps was high, health care workers in this study were much less likely to comply with the guidelines for reporting exposure incidents. Only 9 of the 28 (32.1%) health care workers who had experienced an accidental needlestick or unprotected body fluid contact from a patient in the 3 month period prior to completing the survey reported this exposure to occupational health services for risk assessment and follow-up. This finding is consistent with the few other studies documenting compliance with exposures, in which only 30% of needlesticks (Mangione et al., 1991) and 10% of all exposure events were reported (Williams, Campbell, Henry, & Collier, 1994). The low rates of compliance for reporting exposures is a critical area of concern, as responding adequately to a situation in which there is a possibility of transmission of HIV requires adequate documentation, and if warranted, testing, the prescription of AZT, and appropriate counseling and follow-up.

Additional research is needed to understand why substantial proportions of health care workers (in this study over 15%) experienced an accidental needlestick or exposure to blood and body fluids, given the overall high rates of compliance with universal precaution guidelines. In the current study, risk of exposure to blood and body fluids through an accidental exposure was spread across all types of respondents, making this a salient point of further investigation among all health care workers. Understanding the etiology of these exposures will be necessary in determining what changes in behavior, engineering controls, and policy are needed to reduce the number of exposures which put health care workers at risk for occupational infection.

Attention then must turn to addressing the barriers for reporting these exposures when they do occur. This study identified lack of time as the most frequently reported perceived barrier to reporting exposures to occupational health services. One respondent indicated that "it happens so often - it would become absolutely time consuming to report". Health care workers also perceive the process as being too complicated, invasive, or unnecessary. These barriers are similar to those identified by Mangione et al. (1991), which included time constraints, perception that the percutaneous injury did not represent a significant exposure, lack of knowledge about the reporting mechanism, and concern about confidentiality and professional discrimination. Based on these results, it appears that health care facilities would increase rates of reporting of exposures by developing programs that are easy to access and strictly confidential. Additional efforts at educating staff about the importance of reporting these exposures is also warranted.

Perceived Barriers to the Use of Barrier and Needle/Sharp Precautions

By systematically investigating perceived barriers to the use of universal precautions, this study provides critical understanding into the reasons why some health care workers are not complying with universal precautions during particular procedures. Beyond barriers for reporting exposures, relatively high numbers of health care workers reported perceived barriers for compliance with both barrier precautions and precautions for needles/sharps. Results of this study confirm differences in the relative importance of perceived barriers for different types of precautions. In this study, health care workers perceive that lack of time, interference with technical skills, and carelessness prevent or make it more difficult for them to comply with guidelines for barrier precautions. The

most frequently reported barriers for complying with guidelines for the handling and disposal of needles/sharps, however, include inconvenient disposal, recapping for safe storage, and recapping to transport. These findings demonstrate that health care workers perceive competing interests for safety when handling needles/sharps. Health care workers may perceive the need to protect themselves, their patients, or others based on the design of their immediate environment or the nature of the patient care procedure. Based on these perceptions, health care workers may decide that recapping poses less of a danger than the alternative.

In addition to identifying the frequency of perceived barriers, the current study also examined the relative importance of these barriers in predicting compliance. Results demonstrate that while greater percentages of respondents report perceived environmental barriers relative to individual barriers, it is actually individual barriers overall that account for a greater degree of the variance in overall compliance scores. Further analyses, however, reveal differences in this pattern of findings dependent upon the category of compliance behaviors and corresponding precautions. While the above pattern holds true for compliance with barrier precautions, environmental rather than individual barriers emerge as the stronger factor when predicting compliance with needle/sharp precautions.

These results related to perceived barriers for guidelines for barrier precautions and for needles/sharp precautions point to the need for multifaceted solutions. Results of this study suggest that strategies for addressing perceived barriers to compliance with barrier precautions should target individual-level barriers, in particular habit and carelessness. This need is expressed in the words of one respondent who wrote, "Twenty-five years of recapping is a hard habit to break." Over 12% of respondents in

the current study indicated that a patient not appearing to be at risk for HIV was a barrier to using barrier precautions. This finding highlights the need to address the erroneous assumption on the part of some health care workers that they can tell by appearances whether or not a patient is at risk for HIV, and use this as a basis for their decision to use or not use precautions. Further investigation is needed to identify the source of this misconception. Whether it be stereotyping of persons with HIV or gaps in knowledge, this misconception is diametrically opposed to the concept of universal precautions and must be addressed as part of continuing efforts to ensure compliance with these guidelines. Research has clearly established that the majority of HIV-infected patients are unknown to health care workers at the time precautions are needed (Marcus et al., 1990), and that attempts to base the use of precautions on the basis of an assumption regarding a patient's HIV status, place health care workers in danger.

While addressing individual-level barriers appears key to increasing compliance with barrier precautions, environmental-level barriers should not be overlooked. In regards to barrier precautions specifically, health care facilities need to examine strategies for making barrier precautions accessible, thereby reducing to the lowest level possible the amount of time needed to comply with barrier precautions. Simultaneously, facilities need to communicate to health care workers that the time spent putting on barrier precautions will be viewed as a necessary and valued part of any medical procedure, rather than as a detraction or obstacle to initiating a procedure. This message becomes particularity relevant in emergency situations in which time is a critical factor in regards to patient outcomes. Even in these situations, health care workers should not be forced into situations in which they must sacrifice their own safety for that of their patients.

Framing the issue in terms of cost-benefit, with a few extra minutes to apply appropriate precautions as the trade-off against the time and anxiety involved when an exposure occurs, may assist in reducing the perception of time as a barrier to compliance.

Other strategies to address perceived barriers to barrier precautions include the development of gloves and other materials that increase the level of tactile sensation and reduce the degree to which barrier equipment interferes with technical skills. The development of such materials may also be instrumental in increasing compliance with gloves during IV/puncture procedures. In addition, the quality of materials - in particular gloves - must be improved. In the current study, many of the respondents provided written comments regarding the poor quality of gloves, indicating that they are prone to frequent ripping and tearing.

Current findings suggest that the best use of resources for addressing perceived barriers to compliance with guidelines for the handling of needles/sharps are those methods which would reduce environmental barriers. This includes the development of new technologies and re-engineering of the environment that would serve to decrease overall use and exposure to needles/sharps in the health care setting as well as eliminating competing safety interests. It is important to note, however, that these technologies still require some degree of human compliance to operate, thereby maintaining a need to examine the behavioral elements involved in compliance with universal precautions.

These findings represent the first in-depth, systematic investigation of the relationships and contribution of perceived barriers to universal precautions. Consistent with previous findings (Williams et al., 1994), the current study found that health care workers who report more perceived obstacles are less likely to comply with guidelines.

In this study, respondents who indicated high levels of perceived barriers also reported lower levels of perceived efficacy of universal precautions, subjective norms for complying with universal precautions, perceived behavioral control, behavioral intentions for complying with universal precautions, and perceived efficacy for performing procedures when utilizing universal precautions. These findings suggest that addressing these perceived barriers is key in closing the remaining gaps in compliance.

Knowledge and Motivation

Although the assessment of knowledge and motivational constructs was included in this study primarily for use in testing the predictive models, responses at the item-level yielded important information for understanding the impact of HIV on health care workers. Findings from the current study are fairly consistent with earlier results presented by Schillo & Reischl (1993) which demonstrate that health care workers are knowledgeable of the major routes of HIV transmission in health care setting, but greatly overestimate the risk of becoming infected from nonviable transmission routes. Comparisons to previous research, in fact, suggest that levels of knowledge on nonviable routes have actually decreased. Schillo & Reischl (1993) report 56% of nurses indicating a risk present when feeding a patient compared to 61% in the current study; 44% of nurses indicating a risk present when changing sheets on a patient's bed compared to 78% in the current study; and 80% of nurses indicating a risk present from being coughed or sneezed on by a patient compared to 89% in the current study.

Results from the assessment of knowledge of universal precaution guidelines also suggest that while the majority of respondents understand the fundamentals of universal

precautions, there is a sizable percentage of respondents who believe that additional precautions are necessary to prevent HIV infection in health care settings. This sentiment is also reflected in responses to items assessing perceived efficacy, with the majority of respondents generally agreeing that precautions are effective in preventing HIV transmission, but a sizable minority expressing a desire for alternative or additional precautions. Thus, while participants are knowledgeable of the guidelines for universal precautions and confirm that universal precautions are effective in preventing transmission of HIV, results of the current study suggest that some respondents also believe that knowledge of patient's HIV status and action based on this knowledge (i.e., use of disease-specific isolation procedures, placing HIV-positive patients in single rooms) would be more effective than the use of universal precautions.

The current study provides key insights into several other motivational constructs. Nearly 4 out of 10 respondents in the current study indicated that they perceive their patients to present a risk to them for HIV infection, that they worry about becoming infected in the health care setting, and think it is likely that they may actually become infected. This level of perceived risk is actually higher than previously documented levels of perceived risk (Schillo & Reischl, 1993; van Servellen, Lewis, & Leake, 1988). In a national survey conducted in the early 1990's, 21% of physicians and 36% of nurses reported a high or moderate risk of health care workers being infected with HIV as a result of caring for patient who are HIV positive (Colombotos et al., 1995). On a rational level, it could be argued that levels of perceived risk should be decreasing over time, as the issues related to HIV in the health care setting become incorporated into normal routines and increasing numbers of health care workers have direct experience in dealing

with these issues. Findings from the current study suggest the opposite - that many health care workers are operating in a climate of fear that has escalated over time.

The current study also assessed motivational constructs related to the environment - subjective norms and perceived behavioral control for complying with universal precautions. Study findings reveal that at the policy level, most respondents perceive norms for compliance among administrative and supervisory staff. In day-to-day practice, however, participants perceive less support for complying with universal precautions. Health care workers in the current study, however, did report high levels of perceived behavioral control over whether or not they use precautions. These findings suggest that even though health care workers perceive gaps in subjective norms for compliance and report perceived barriers, they do perceive that they have control over whether or not they use precautions.

Summary of Findings Related to Compliance, Knowledge, and Motivation

In summary, the current study establishes high levels of compliance in a sample of health care workers in an area of relatively low prevalence of AIDS and by identifying perceived barriers provides insight into why a minority of health care workers are not complying or why compliance is lower during some specific procedures. This investigation also reveals a need to address the underreporting of exposures, the level of fear surrounding HIV transmission, and the expressed desire for additional precautions. It should also be noted that the current study identified significant differences in several variables among the 5 different units. Differences were identified on the measures of compliance, perceived barriers, subjective norms, and perceived risk, however, no

consistent pattern or ready explanation of these results emerges. These results suggest that the dynamics that impact motivation and behavior differ in each of the unit environments and point to the need for further investigation to identify these factors and examine the mechanisms by which these factors differentially impact behavior.

Discussion of Methodological Issues

The current study was designed to address several gaps in the methodology of assessing and predicting compliance with universal precautions. The potential threat of social desirability to the validity of self-report findings was addressed in this research study. Findings reveal that overall, social desirability does not pose a significant threat to the validity of self-report assessments of compliance with universal precautions and other variables thought to predict compliance. Results do reveal, however, that the general measure assessing compliance with universal precautions during the previous 3 months may be somewhat susceptible to social desirability, as the correlation between these 2 measures was statistically significant.

This research study included 2 measures of compliance with universal precautions, allowing for a comparison in measurement approaches. Both approaches yielded similar patterns of findings, however, the 2 measures were only moderately correlated, and therefore should be viewed as distinct rather than interchangeable measures. The results of this study however do not provide clear evidence for supporting one measurement approach over the other. The procedural measure was not correlated with social desirability while the general measure was, however, this finding is difficult to interpret given that reported rates of compliance were actually lower on the general

measure, not higher as would be expected if respondents were providing socially desirable responses. At a broader level, the procedural measure proved advantageous in providing information about compliance during a defined situation - in this study a specified medical procedure. The importance of identifying compliance at the procedural level is underscored by the differences in the current study in compliance for the different categories of procedures. The results of this study point to several improvements to this approach, however, that must be made before further used to assess compliance. These improvements include generating a greater number of procedures to provide a picture of compliance across a wider range of behavior. The addition of procedures must account, however, for the need to match different versions of the measure for different types of units or professionals by selecting similar categories of procedures that require similar types of precautions.

Due to limitations of the procedural measure of compliance, the degree of overutilization among health care workers was not resolved in the current study. It should also be noted that the high levels of compliance documented in this study may be partly a function of assessing compliance during routine conditions. This measure, therefore, would also be improved by assessing the specific conditions surrounding procedures to determine if the procedure calls for the routine use of procedures or if there are additional circumstances that warrant the use of additional precautions. The need for this improvement was reinforced by the frequency of comments written in on the survey instrument to qualify specific conditions surrounding procedures and explain a particular respondent's use or non use of precautions. Assessing the conditions surrounding the performance of a procedure would allow for a determination of overutilization of

precaution use and a more valid assessment of compliance with guidelines for universal precautions.

To summarize, this examination of methodological issues provides findings which can be used to advance the methodology of this research. The findings of this study validate the use of self-report to assess compliance and other HIV-related constructs, having ruled out social desirability as a significant sources of response bias. Despite current limitations and needed improvements, development of the procedural-level measure used in this study is an important step forward in the assessment of compliance.

Discussion of Analyses of Predictive Models

The current study was designed to examine compliance with universal precautions as AIDS-preventive behaviors and examine the predictive relationships between knowledge, motivation, behavioral skills, and behaviors, using a modified version of the Information-Motivation-Behavioral-Skills Models of AIDS Risk Behavior Change (Fisher & Fisher, 1993). As discussed earlier, the results of the analyses testing the predictive models were relatively inconclusive, due in part to problems with some of the measures. Therefore, the discussion of these results centers on the insights provided by these findings for future research, rather than as conclusive findings.

Results of the analysis of the relationships between the latent variables in the predictive model reveal that knowledge does have some impact on behavior, although the results support a direct effect between the two, not the predicted indirect effect of knowledge on behavior as mediated through behavioral skills. Results also failed to support the predicted relationship between motivation and behavior as well as the

predicted relationship between behavioral skills and behavior. Counter to predictions, information and motivation were strongly correlated with each other in the model (r=-.42) with a negative, rather than expected positive relationship between these two variables.

An examination of results from the analyses of the observed models provides some insight into the above relationships between the latent variables. In these observed models, higher levels of knowledge of HIV transmission predict compliance while knowledge of universal precautions has no relationship with compliance. The zero-order correlation between the two knowledge measures was negative - those with higher levels of knowledge of HIV transmission had lower levels of knowledge of universal precautions. This pattern of findings suggest that the items that were intended to measure knowledge of universal precaution guidelines were likely assessing a different construct. Given the lack of variance on many of the items used to assess knowledge of universal precaution guidelines, only those items with sufficient variance were used to construct this scale. This resulted in a subset of items related primarily to the perceived need for additional or alternative precautions to those called for in universal guidelines. While indicating the need for unnecessary precuations could be argued to represent lack of knowledge of universal precautions, it most likely has more to do with perceived risk of HIV infection or other related attitudes. In this study, those with lower levels of knowledge of universal precautions reported higher levels of perceived risk and lower levels of perceived efficacy of universal precautions. These findings suggest that respondents who perceive themselves to be at risk of contracting HIV in the health care setting perceive that universal precautions alone are insufficient to protect them against infection and that additional measures should be taken to ensure protection. These

observed relationships between this knowledge measure and motivational constructs may assist in explaining the negative relationship between the latent variables of knowledge and motivation.

An examination of the observed relationships among the motivational variables provides insight into the lack of a significant relationship between the latent variables of motivation and behavior. In this study, subjective norms is predictive of behavioral intentions, however perceived efficacy of universal precautions and perceived risk of HIV infection is not. Thus, while behavioral intentions clearly predict compliance with universal precautions, the motivational constructs included in this study, were not particularly useful in predicting behavioral intentions.

Results of the analyses of the observed models provide some support for the use of the Theory of Reasoned Action for framing motivation over the use of the Theory of Planned Behavior, although neither of the two models tested provide a good fit to the data. Results of the model using the Theory of Planned Behavior to frame motivation identify a strong relationship between perceived behavioral control and compliance as mediated through behavioral intentions. The model, however, does not support a direct relationship between perceived behavioral control and compliance and the addition of perceived behavioral control does not improve the model's predictive power.

In conclusion, the current study provides little support for the predictive models, failing to support many of the models' central propositions. However, given the limitations of many of the measures included in these models, it seems likely that the failure to confirm many of the predicted results were due to measurement error. Marginal reliabilities, lack of variance, and skewness associated with some the variables in the

model, in particular with the outcome variable of compliance, underscore the need for caution in drawing definitive conclusions for the modeling results. Given these limitations, it is premature to dismiss the proposed models entirely.

If future research efforts that address measurement limitations still fail to provide support for the predictive models included in this investigation, current findings do offer insight for revising these models. The relationships identified in this study suggest that knowledge of HIV transmission and behavioral skills (as measured by perceived efficacy for performing procedures while using universal precautions) predict intentions which in turn predict compliance. Findings also suggest that knowledge and skills also directly influence behavior. Finally, given the role of barriers in impacting compliance, any revised model should include an examination of the impact of barriers on the relationship between intentions and barriers - that is once an individual has formed the intention to comply (based on knowledge and skills), do barriers then serve to moderate the relationship with actual behavior?

While the results of the current study do not rule out of the usefulness of the tested models, further investigation should also look at the use of alternative theoretical approaches in attempting to identify useful models for predicting compliance. The relationships identified in this study appear to fit within the theoretical context of another cognitive decision-making model - the Health Belief Model (Janz & Becker, 1984). In this study, health care workers who perceive themselves as susceptible to occupationally-acquired HIV infection and perceive few costs or barriers to the use of precautions were more likely to use precautions, findings consistent with the Health Belief Model. The role of perceived efficacy and perceived seriousness of the threat, the other two major

constructs in this model would need to be accounted for in investigations within this theoretical context.

It may be, however, that rational decision-making models are less appropriate for predicting well-learned skills such as those involved in using universal precautions. Given the current high levels of perceived risk for HIV infection, theories of fear arousal may be more useful in predicting compliance. Research in the area of risk perception has documented that people perceive a greater danger from a risk, such as HIV, that is both unknown and dreaded (Slovic, 1987). Thus, cognitive distortion of risk probabilities may explain why interventions that attempt to persuade health care workers that their risk is low on the basis of epidemiological data have failed (Gerbert, 1988).

Methodological Limitations

Several innovative methods were incorporated into the current investigation in an attempt to advance the methodology of this field of research. Overall, the current strategies proved effective in assessing compliance while elucidating areas for further improvement. Although this research effort made some important methodological achievements, there are several methodological limitations to this research which must be noted. Concerns which threaten the external validity of results may limit their generalizability. In this study, confidence in the ability to generalize findings is supported by a response rate of 49%, which is satisfactory for an anonymous survey. Generalizability of results of this survey, however, are limited to similar groups of health care workers (i.e, nurses in a hospital setting, in a geographical area with relatively low prevalence of AIDS/HIV). In addition, generalizability may be further limited if

nonresponders systematically differed from those who responded. In this study, it is probable that individuals who are more compliant with guidelines for universal precautions may have been more compliant in responding to the survey. If this is true, the estimates for compliance in the current study would represent upper limits, that is actual levels of compliance among all health care workers surveyed may actually be lower than those reported.

Threats to internal validity in the current study include measurement error resulting from the limitations of using self-report questionnaires. The sensitive and controversial nature of these questions contributes to the possibility of response bias. Generally, this study was able to rule out social desirability as a source of response bias. Future research, however, should incorporate multiple methods for assessing compliance and other related constructs such as observations, daily logs, videotaping, examination of occupational exposure data, and needlestick counts. Given the current findings, qualitative data, such as those generated by focus groups comprised of health care workers, may also be useful in providing insight into the nature of observed relationships and for framing a future research agenda.

Efforts were taken to reduce other sources of measurement error. Professional review and piloting were used to develop a clear concise measure. Results of this study, however, suggest several future efforts which can be taken to increase the validity and reliability of the measures. The study was also limited in that it was cross-sectional in nature, limiting the ability to make causal statements or draw strong conclusions about causality. Future research should address this limitation by incorporating longitudinal designs that assess and compare compliance behaviors over time. In conclusion, the

current study served to advance the methodology of the field while pointing to several potential areas for further improvement.

Study Implications

Implications for Research

The current study has several important implications for the continued investigation of the issues that surround health care workers and HIV. The high compliance rates documented in the current study suggest a need to frame a new research agenda. This agenda includes the need to identify and profile the minority of health care workers who are not complying with guidelines for universal precautions. The current study suggests that this group includes both new and "veteran" professionals. This finding demonstrates that the problem of noncompliance will not correct itself with the emergence of new professionals who have been trained only in the use of universal precautions. Clearly, once these new professionals are in the field, they too are susceptible to forces which result in noncompliance. Research will therefore be essential in identifying noncompliers and strategies that are effective for changing their behavior.

Continuing research efforts are also needed to address those remaining areas in which the majority of health care workers remain noncompliant, including the handling of needles/sharps, the use of barrier precautions beyond the use of gloves, and the reporting and follow-up of occupational exposures. Continued assessment along with the evaluation of strategies for addressing these critical gaps in compliance are needed. In addition, further research is needed to examine the critical elements which contribute to the between-unit differences noted in the current survey. Understanding the role that

unit-specific procedures, supervisors, norms, and policies have on compliance and other variables which impact compliance will be key to tailoring intervention strategies to different types of units, settings, and professionals. Given the current climate of fear, a new research agenda must also include an investigation of perceived risk of occupational infection. Understanding the sources of this perceived risk and its impact appears critical to understanding the psychology of compliance. A new research agenda should include further exploration of theoretical contexts in which to study compliance with universal precautions, thereby continuing the advancement of the this field of investigation from one that has been primarily atheoretical, to one in which theory provides a solid base for testing and explaining key relationships among variables.

Implications for Training and Intervention Strategies

While in-service training has been the standard for intervention, the current findings suggest the need for innovative and active approaches to changing, reinforcing, and maintaining compliance behaviors. Intervention strategies must be customized to address issues that differ for procedures, settings, and individuals. Findings from the current study, in particular those related to perceived barriers, support the need for different strategies for addressing different types of barriers.

In addition, the degree of fear that exists among health care workers reinforces that training programs that present information alone will not be adequate in addressing compliance. It has been argued that nonrational factors involved in the perception of risk actually interfere with the success of training programs based solely on knowledge about HIV transmission (Colombotos et al., 1995). Therefore, the climate of fear identified in

the current study lends support for interventions that encourage staff who are being trained in universal precautions and infection control procedures to talk about their beliefs so they can confront their fear and misconceptions regarding HIV transmission. This investigation suggests that redesigning interventions to target perceived risk along with behaviors may be a critical step in ensuring truely universal levels of compliance.

Implications for Policy

The current study provides further evidence for universal precaution guidelines as sound infection-control policy against HIV and the other bloodborne pathogens that pose an occupational risk to health care workers. While universal precautions are cost effective and when used correctly are effective in preventing the transmission of HIV, some continue to argue that achieving universal levels of compliance with these guidelines is not an attainable goal. Results from the current demonstate, however, that the efforts and polices implemented in the study hospital have proven extremely effective in achieving high overall levels of compliance. While areas for improvement remain, the current findings provide strong support for the policies in place which support the CDC's current guidelines for universal precautions.

There is a continued need to pay close attention to the occupational threat of HIV infection to health care workers. After a decade of awareness of HIV, interest in the issued related to this virus has generally declined. Efforts to assist workers in protecting themselves from this threat, however, are more salient than ever. As both the prevalence and incidence of HIV infection increases, increasing numbers of health care workers will come into contact with HIV-infected individuals. Colomobotos et al. (1995) reported

that nationally, 74% of physicians and 71% of nurses had provided care for at least one HIV-infected patient. Unless infection control efforts remain effective, the cumulative risk of HIV to health care workers will increase.

At the same time, health care is currently undergoing dramatic changes, resulting in greater potential for workers to be distracted, discouraged, exhausted, and undertrained (Clever & Leguyader, 1995). In addition, as we move from traditional hospital settings to ambulatory and home settings, ever expanding numbers of individuals (students, volunteers, and family members) will move into the role of "health care provider". These critical factors must be accounted for in ongoing efforts to protect all individuals from becoming infected with HIV as the result of caring for another individual.

It should also be noted that the findings of the current study have policy implications for infection control efforts worldwide. Having proven effective in the United States and other developed countries, there remains a need to disseminate these infection control policies to developing areas of the world. Assistance in implementing universal precautions in these countries with the highest prevalence rates for HIV infection and AIDS, is critical in stopping the unnecessary transmission of HIV in health care settings. While acknowledging the differences in systems and levels of resources, basic efforts at educating health care workers in these areas is an important area for further policy development on the part of the key international agencies and organizations.

Efforts to ensure compliance with universal precautions, both locally and globally, remain a key strategy for preventing the spread of HIV transmission in the health care setting. There are currently 8.5 million individuals in the U.S. classified as health care

workers (Clever & Leguyader, 1995). Protecting the safety of providers and patients alike and ensuring quality care - care free from the risk of infection and discrimination based on HIV status - remains a central challenge in addressing AIDS and HIV in the health care setting.

APPENDICES

APPENDIX A

APPENDIX A

MICHIGAN STATE UNIVERSITY

Department of Psychology
Psychology Research Building

East Lansing • Michigan • 48824-1117

Dear Sparrow Associate:

You and your colleagues in Labor & Delivery have been selected to participate in an important research effort being conducted through the Department of Psychology at Michigan State University. We have enclosed a questionnaire with this letter and would like to request that you complete and return it at your earliest convenience.

This study is being conducted through the Department of Psychology at Michigan State University to learn more about the wide range of issues related to the human immunodeficiency virus (HIV) as they impact health care professionals, with a focus on universal precautions. Participation in this study represents an opportunity to have input into issues that directly affect you. This information can be used to inform decisions about where to invest and target resources in order to further minimize the risks associated with HIV (and other blood borne pathogens) in health care settings and provide a safer working environment for you and your colleagues.

While the importance of your response cannot be understated, your participation in this survey is absolutely voluntary and anonymous. You indicate your voluntary agreement to participate by completing and returning this questionnaire. Refusal to participate will involve no penalty or loss of benefits to which you are otherwise entitled and no associate of Sparrow Hospital will know whether or not you participate in this study. All participants who return completed questionnaires will be entered into a lottery. (Enclosed is a lottery ticket which includes a list of prizes and instructions for completing and returning.) In addition, a final report of the findings of this study will be made available to Sparrow Associates.

INSTRUCTIONS: When you have completed the questionnaire, please place it in the stamped envelope provided along with your lottery ticket and mail it directly to Michigan State University.

Again, all responses to the self-report questionnaire are totally anonymous and will be seen only by the research staff. **Do not include your name or any other identifying marks on any of the enclosed materials.** Only MSU researchers, not associates of Sparrow, will have access to individual-level data. All analyses and written reports of results will contain only aggregate data so that reports of the research will not permit associating participants with specific responses or findings.

If you have concerns related to HIV or desire more information about HIV as a result of participating in this study, please feel free to call the toll-free HIV Hotline provided for health care workers by the Michigan State Medical Society at 1-800-522-0399. If you have any questions or concerns regarding this study, please call Barbara Schillo at (517) 346-2626 or (517) 482-9798. Your willingness to complete this survey as soon as possible is greatly appreciated. Thank you for your help.

Sincerely,

Barbara Schillo, M.A.
Department of Psychology
Michigan State University

Mary Sue Marz, Ph.D, R.N.
Assistant Vice President, Nursing Education & Research
Sparrow Health System

APPENDIX B

APPENDIX B

INSTRUCTIONS TO RESPONDENTS: This survey should take between 20 and 30 minutes to complete. In the questions that follow, it is important for us to obtain honest and complete answers. Remember that all of your answers are completely anonymous. No one will ever be able to connect your questionnaire with you. Do not place your name or any other identifying marks on this questionnaire.

It is really important that you answer all of the questions even if you are not absolutely sure of your responses. When you have completed the questionnaire, please place it in the enclosed stamped, self-addressed envelope and mail it at your earliest convenience. Your willingness to complete this survey as soon as possible is greatly appreciated. Thank you for your participation.

Please record the date that you completed this survey:_____/_____/ 95

SECTION I

This section of the questionnaire includes questions that ask about your use of protective equipment and procedures when performing certain medical procedures.

1.a **ADMISSION ASSESSMENT** When was the most recent period of time in which you have performed this procedure? *(Check one response)*

_____Within the last 2-3 days.

_____Within the last week.

_____Within the last month.

_____Within the last year.

Skip To _____I have not performed this procedure within the last year.

1.b _____I do not remember the last time that I performed this procedure.

Thinking back to the LAST TIME that you performed an ADMISSION ASSESSMENT, indicate which of the following precautions you used when performing this procedure. If you did not use a specific precaution(s) because it did not apply to performing an ADMISSION ASSESSMENT, respond "NO" for that particular precaution(s).

	Check One Box Per Statement	
	YES	NO
Gloves		
Handwashing		
Mask		
Protective Eyewear (includes eyeglasses)/Face Shield		
Gown		
Protective Footwear		
Resuscitation Device		
Needle/Sharp Precautions (not recapping, disposal of needles in puncture proof containers)		
Disposal of Waste Materials Contaminated with Blood and/or Body Fluids		

APPENDIX B

→1.b VAGINAL EXAM When was the most recent period of time in which you have performed this procedure? *(Check one response)*

_____Within the last 2-3 days.

_____Within the last week.

_____Within the last month.

_____Within the last year.

Skip To 1.c _____I have not performed this procedure within the last year.

_____I do not remember the last time that I performed this procedure.

Thinking back to the LAST TIME that you performed a VAGINAL EXAM, indicate which of the following precautions you used when performing this procedure. If you did not use a specific precaution(s) because it did not apply to performing a VAGINAL EXAM, respond "NO" for that particular precaution(s).

	Check One Box Per Statement	
	YES	NO
Gloves		
Handwashing		
Mask		
Protective Eyewear (includes eyeglasses)/Face Shield		
Gowns		
Protective Footwear		
Resuscitation Device		
Needle/Sharp Precautions (not recapping, disposal of needles in puncture proof containers)		
Disposal of Waste Materials Contaminated with Blood and/or Body Fluids		

→1.c STARTING AN IV When was the most recent period of time in which you have performed this procedure? *(Check one response)*

_____Within the last 2-3 days.

_____Within the last week.

_____Within the last month.

_____Within the last year.

Skip To 1.d _____I have not performed this procedure within the last year.

_____I do not remember the last time that I performed this procedure.

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APPENDIX B

Thinking back to the LAST TIME that you STARTED AN IV, indicate which of the following precautions you used when performing this procedure. If you did not use a specific precaution(s) because it did not apply to STARTING AN IV, respond "NO" for that particular precaution(s).

	Check One Box Per Statement	
	YES	**NO**
Gloves		
Handwashing		
Mask		
Protective Eyewear (includes eyeglasses)/Face Shield		
Gowns		
Protective Footwear		
Resuscitation Device		
Needle/Sharp Precautions (not recapping, disposal of needles in puncture proof containers)		
Disposal of Waste Materials Contaminated with Blood and/or Body Fluids		

→ 1.d **DRAWING CORD BLOOD** When was the most recent period of time in which you have performed this procedure? *(Check one response)*

_____Within the last 2-3 days.

_____Within the last week.

_____Within the last month.

_____Within the last year.

Skip To 1.e _____I have not performed this procedure within the last year.

_____I do not remember the last time that I performed this procedure.

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APPENDIX B

Thinking back to the LAST TIME that you DREW CORD BLOOD, indicate which of the following precautions you used when performing this procedure. If you did not use a specific precaution(s) because it did not apply to DRAWING CORD BLOOD, respond "NO" for that particular precaution(s).

	Check One Box Per Statement	
	YES	NO
Gloves		
Handwashing		
Mask		
Protective Eyewear (includes eyeglasses)/Face Shield		
Gowns		
Protective Footwear		
Resuscitation Device		
Needle/Sharp Precautions (not recapping, disposal of needles in puncture proof containers)		
Disposal of Waste Materials Contaminated with Blood and/or Body Fluids		

→1.e **NEONATAL RESUSCITATION** When was the most recent period of time in which you have performed this procedure? *(Check one response)*

_____Within the last 2-3 days.

_____Within the last week.

_____Within the last month.

_____Within the last year.

Skip To 1.f _____I have not performed this procedure within the last year.

_____I do not remember the last time that I performed this procedure.

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APPENDIX B

***Thinking back to the LAST TIME** that you performed **NEONATAL RESUSCITATION**, indicate which of the following precautions you used when performing this procedure. If you did not use a specific precaution(s) because it did not apply performing NEONATAL RESUSCITATION, respond "NO" for that particular precaution(s).*

	Check One Box Per Statement	
	YES	NO
Gloves		
Handwashing		
Mask		
Protective Eyewear (includes eyeglasses)/Face Shield		
Gowns		
Protective Footwear		
Resuscitation Device		
Needle/Sharp Precautions (not recapping, disposal of needles in puncture proof containers)		
Disposal of Waste Materials Contaminated with Blood and/or Body Fluids		

→ 1.f **ASSISTING WITH ADULT INTUBATION** When was the most recent period of time in which you have performed this procedure? *(Check one response)*

_____Within the last 2-3 days.

_____Within the last week.

_____Within the last month.

_____Within the last year.

Skip To 1.g _____I have not performed this procedure within the last year.

_____I do not remember the last time that I performed this procedure.

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APPENDIX B

Thinking back to the LAST TIME that you assisted with an ADULT INTUBATION, indicate which of the following precautions you used when performing this procedure. If you did not use a specific precaution(s) because it did not apply to assisting with an ADULT INTUBATION, please respond "NO" for that particular precaution(s).

	Check One Box Per Statement	
	YES	NO
Gloves		
Handwashing		
Mask		
Protective Eyewear (includes eyeglasses)/Face Shield		
Gowns		
Protective Footwear		
Resuscitation Device		
Needle/Sharp Precautions (not recapping, disposal of needles in puncture proof containers)		
Disposal of Waste Materials Contaminated with Blood and/or Body Fluids		

→ 1.g **CHANGING SURGICAL DRESSINGS** When was the most recent period of time in which you have performed this procedure? *(Check one response)*

_____Within the last 2-3 days.
_____Within the last week.
_____Within the last month.
_____Within the last year.
_____I have not performed this procedure within the last year.
_____I do not remember the last time that I performed this procedure.

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APPENDIX B

Thinking back to the LAST TIME that you CHANGED SURGICAL DRESSINGS, indicate which of the following precautions you used when performing this procedure. If you did not use a specific precaution(s) because it did not apply to CHANGING SURGICAL DRESSINGS, please respond "NO" for that particular precaution(s).

	Check One Box Per Statement	
	YES	NO
Gloves		
Handwashing		
Mask		
Protective Eyewear (includes eyeglasses)/Face Shield		
Gowns		
Protective Footwear		
Resuscitation Device		
Needle/Sharp Precautions (not recapping, disposal of needles in puncture proof containers)		
Disposal of Waste Materials Contaminated with Blood and/or Body Fluids		

→1.h **PERI CARE** When was the most recent period of time in which you have performed this procedure? *(Check one response)*

_____Within the last 2-3 days.

_____Within the last week.

_____Within the last month.

_____Within the last year.

Skip To 1.i _____I have not performed this procedure within the last year.

_____I do not remember the last time that I performed this procedure.

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APPENDIX B

Thinking back to the LAST TIME that you provided PERI CARE, indicate which of the following precautions you used when performing this procedure. If you did not use a specific precaution(s) because it did not apply to providing PERI CARE, please respond "NO" for that particular precaution(s).

	Check One Box Per Statement	
	YES	NO
Gloves		
Handwashing		
Mask		
Protective Eyewear (includes eyeglasses)/Face Shield		
Gowns		
Protective Footwear		
Resuscitation Device		
Needle/Sharp Precautions (not recapping, disposal of needles in puncture proof containers)		
Disposal of Waste Materials Contaminated with Blood and/or Body Fluids		

→1.i **URINARY CATHETERIZATION** When was the most recent period of time in which you have performed this procedure? *(Check one response)*

_____Within the last 2-3 days.

_____Within the last week.

_____Within the last month.

_____Within the last year.

Skip To 1.j _____I have not performed this procedure within the last year.

_____I do not remember the last time that I performed this procedure.

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APPENDIX B

Thinking back to the LAST TIME that you performed a URINARY CATHETERIZATION, indicate which of the following precautions you used when performing this procedure. If you did not use a specific precaution(s) because it did not apply to performing a URINARY CATHETERIZATION, respond "NO" for that particular precaution(s).

	Check One Box Per Statement	
	YES	**NO**
Gloves		
Handwashing		
Mask		
Protective Eyewear (includes eyeglasses)/Face Shield		
Gowns		
Protective Footwear		
Resuscitation Device		
Needle/Sharp Precautions (not recapping, disposal of needles in puncture proof containers)		
Disposal of Waste Materials Contaminated with Blood and/or Body Fluids		

→1.j **ASSISTING WITH AMNIOTOMY** When was the most recent period of time in which you have performed this procedure? *(Check one response)*

_____Within the last 2-3 days.

_____Within the last week.

_____Within the last month.

_____Within the last year.

Skip To 1.k _____I have not performed this procedure within the last year.

_____I do not remember the last time that I performed this procedure.

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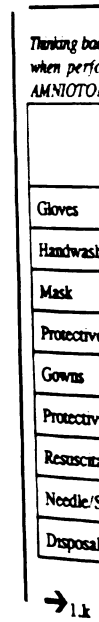
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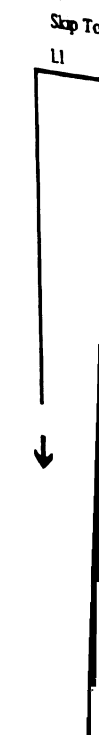
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APPENDIX B

Thinking back to the LAST TIME that you assisted with an AMNIOTOMY, indicate which of the following precautions you used when performing this procedure. If you did not use a specific precaution(s) because it did not apply to assisting with an AMNIOTOMY, respond "NO" for that particular precaution(s).

	Check One Box Per Statement	
	YES	**NO**
Gloves		
Handwashing		
Mask		
Protective Eyewear (includes eyeglasses)/Face Shield		
Gowns		
Protective Footwear		
Resuscitation Device		
Needle/Sharp Precautions (not recapping, disposal of needles in puncture proof containers)		
Disposal of Waste Materials Contaminated with Blood and/or Body Fluids		

→1.k **ATTENDING DELIVERIES** When was the most recent period of time in which you have performed this procedure? *(Check one response)*

_____Within the last 2-3 days.

_____Within the last week.

_____Within the last month.

_____Within the last year.

Skip To 1.l _____I have not performed this procedure within the last year.

_____I do not remember the last time that I performed this procedure.

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APPENDIX B

Thinking back to the LAST TIME that you ATTENDED A DELIVERY, indicate which of the following precautions you used when performing this procedure. If you did not use a specific precaution(s) because it did not apply to ATTENDING A DELIVERY, respond "NO" for that particular precaution(s).

	Check One Box Per Statement	
	YES	NO
Gloves		
Handwashing		
Mask		
Protective Eyewear (includes eyeglasses)/Face Shield		
Gowns		
Protective Footwear		
Resuscitation Device		
Needle/Sharp Precautions (not recapping, disposal of needles in puncture proof containers)		
Disposal of Waste Materials Contaminated with Blood and/or Body Fluids		

→1.1 **SUCTIONING** When was the most recent period of time in which you have performed this procedure? *(Check one response)*

_____Within the last 2-3 days.

_____Within the last week.

_____Within the last month.

_____Within the last year.

Skip To 2 _____I have not performed this procedure within the last year.

_____I do not remember the last time that I performed this procedure.

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APPENDIX B

Thinking back to the LAST TIME that you performed SUCTIONING, indicate which of the following precautions you used when performing this procedure. If you did not use a specific precaution(s) because it did not apply to performing SUCTIONING, respond "NO" for that particular precaution(s).

	Check One Box Per Statement	
	YES	**NO**
Gloves		
Handwashing		
Mask		
Protective Eyewear (includes eyeglasses)/Face Shield		
Gowns		
Protective Footwear		
Resuscitation Device		
Needle/Sharp Precautions (not recapping, disposal of needles in puncture proof containers)		
Disposal of Waste Materials Contaminated with Blood and/or Body Fluids		

→ **2. Is the above pattern typical of your use of protective equipment and procedures?**

_____YES [IF YES, SKIP TO QUESTION 3]

_____NO

IF NO: Please describe any unusual circumstances that may have impacted your use of precautionary equipment and procedures the last time you performed any of the above procedures:

_____

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APPENDIX B

Please think about the medical procedures you have performed in the LAST 3 MONTHS when answering the following questions. Most of these questions refer to your use of precautions during very specific types of medical procedures. Please mark the NOT APPLICABLE response only if you have not conducted this type of procedure in the last 3 months.

→3. In the LAST 3 MONTHS, have you handled blood or body fluids or cared for a bleeding patient?

[_____NO [IF NO, SKIP TO QUESTION 4]

_____YES

IF YES: *Please answer the following questions.*

	Check One Box Per Statement					
	ALMOST ALWAYS	ABOUT 75% OF THE TIME	ABOUT 50% OF THE TIME	ABOUT 25% OF THE TIME	ALMOST NEVER	Not Applicable
a. When you have conducted procedures in which there was potential for exposure to blood or body fluids, how often have you worn gloves?						
b. When you have handled contaminated sharps, needles, IV insertion apparatus or other blood access equipment, how often have you worn gloves?						
c. When you have conducted procedures in which there was potential for a body fluid splash, how often have you worn protective eyewear (includes personal eyeglasses) and/or a face shield?						
d. When you have conducted procedures in which body fluid soiling was anticipated, how often have you worn a gown or leak proof apron?						
e. When you have conducted procedures in which body fluid soiling was anticipated, how often have you worn protective footwear?						
f. When you have conducted procedures in which contamination with blood or body fluids occurred, how often have you washed your hands immediately?						
g. How often have you washed hands after removing gloves and/or gown and before leaving the work area?						

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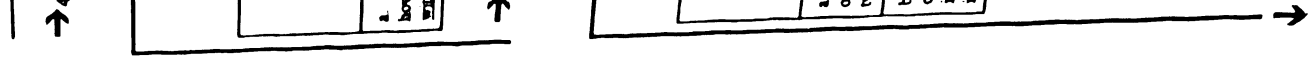

APPENDIX B

→4. In the LAST 3 MONTHS have you attempted to resuscitate a patient?

[_____NO [IF NO, SKIP TO QUESTION 5]

_____YES

IF YES: *Please answer the following question.*

	Check One Box Per Statement					
	ALMOST ALWAYS	ABOUT 75% OF THE TIME	ABOUT 50% OF THE TIME	ABOUT 25% OF THE TIME	ALMOST NEVER	Not Applicable
a. When you have resuscitated a patient, how often have you performed resuscitation without using a protective device?						

→5. In the LAST 3 MONTHS have you used a needle or other sharp instrument in caring for a patient?

[_____NO [IF NO, SKIP TO QUESTION 6]

_____YES

IF YES: *Please answer the following questions.*

	Check One Box Per Statement					
	ALMOST ALWAYS	ABOUT 75% OF THE TIME	ABOUT 50% OF THE TIME	ABOUT 25% OF THE TIME	ALMOST NEVER	Not Applicable
a. After using a needle on a patient, how often have you recapped the needle (using a two-handed procedure)?						
b. After using a disposable needle or sharp on a patient, how often have you immediately disposed of the needle or sharp in a puncture resistant container?						

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APPENDIX B

→6. In the LAST 3 MONTHS have you experienced an accidental needlestick or unprotected body fluid contact from a patient?

_____NO [IF NO, SKIP TO QUESTION 7]

_____YES

IF YES:
a. Did you report this accidental needlestick or unprotected body fluid contact from this patient to occupational health services for risk assessment and follow-up?

_____NO [IF NO, SKIP TO QUESTION 7]

_____YES

IF YES:
b. Did you request HIV antibody testing for yourself because you believed that you were exposed to a patient that you knew or suspected to be infected with HIV?

_____ NO [IF NO, SKIP TO QUESTION 7]

_____YES

IF YES:
c. Did you follow-up with occupational health services at (*check all that apply*):
_____3 WEEKS?
_____6 WEEKS?
_____6 MONTHS?
_____ 12 MONTHS?

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APPENDIX B

SECTION II
In the past, health care professionals have reported several barriers, or obstacles, that make it difficult or prevent them from using universal precautions. The questions in this section ask you to indicate barriers/obstacles to using universal precautions that you have experienced in the **LAST 3 MONTHS.**

→7. In the **LAST 3 MONTHS**, have you handled blood or body fluids or cared for a bleeding patient?

_____NO [IF NO, SKIP TO QUESTION 8]

_____YES

IF YES: Within the **LAST 3 MONTHS**, which of the following have made it more difficult or prevented you from adhering to the guidelines for the use of barrier precautions (gloves, gowns, masks, protective footwear, etc.)?

	Check One Box Per Statement	
	YES	NO
a. Lack of time.		
b. Protective equipment interferes with technical skills.		
c. Protective equipment not available/readily accessible.		
d. Protective equipment not the right size.		
e. Allergic to latex/nylon gloves and hypoallergenic gloves, liners, or powderless gloves not available.		
f. Materials poorly constructed.		
g. Lack of clear-cut standards for infection-control procedures.		
h. Habit or carelessness.		
I. Patient(s) did not appear to be at high risk for HIV.		
j. Knew that patient(s) had tested negative for HIV.		
k. Universal precautions for the use of barrier precautions are unnecessary/ineffective.		
l. Barrier precautions interfere with patient relationship/prevent therapeutic touch.		
m. Patients, family members, and other visitors seem offended or uncomfortable when I use barrier precautions.		
n. Other (*please describe*):		

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APPENDIX B

→8. In the LAST 3 MONTHS, have you used a needle or other sharp instrument in caring for a patient?

_____NO [IF NO, SKIP TO QUESTION 9]

_____YES

IF YES: Within the LAST 3 MONTHS, which of the following have made it more difficult or prevented you from adhering to the guidelines for the handling of needles/sharps (not recapping needles, disposal of needles in puncture proof containers)?

	Check One Box Per Statement	
	YES	NO
a. Lack of time.		
b. Sharps boxes not conveniently located for easy disposal..		
c. Lack of clear-cut standards for infection-control procedures.		
d. Complexity of equipment.		
e. Need to recap needle for safe storage because the contents of the syringe are administered in 2 or more doses.		
f. Recap to protect self during the disassembly of devices with an exposed, contaminated needle.		
g. Recap to transport a used needle to a disposal box.		
h. Habit or carelessness.		
I. Patient(s) did not appear to be at high risk for HIV.		
j. Knew that patient(s) had tested negative for HIV.		
k. Universal precautions for needles/sharps are unnecessary/ineffective.		
l. Other (*please describe*):		

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APPENDIX B

→9. In the LAST 3 MONTHS, have you experienced an accidental needlestick or unprotected body fluid contact from a patient that required medical follow-up?

_____NO [IF NO, SKIP TO QUESTION 10]

_____YES

IF YES: Within the LAST 3 MONTHS, which of the following have made it more difficult or prevented you from adhering to guidelines for reporting and following up with these exposures?

	Check One Box Per Statement	
	YES	NO
a. Lack of time.		
b. Reporting/follow-up of exposures is invasive.		
c. Reporting/follow-up of exposures is complicated.		
d. Reporting/follow-up of exposures is unnecessary.		
e. Forgot.		
f. Knew that patient(s) had tested negative for HIV.		
g. Fear of testing positive for HIV.		
h. Fear of disciplinary action due to failure to follow proper procedure.		
I. Patient(s) did not appear to be at high risk for HIV/hepatitis.		
j. Other (*please describe*):		

APPENDIX B

SECTION III
This next section includes several questions about HIV transmission and guidelines for the use of universal precautions designed to prevent HIV transmission.

→10. Please indicate the relative probability of HIV transmission to a health care provider in the following situations:

	Check one box per statement			
	HIGH RISK OF HIV TRANSMISSION	MODERATE RISK OF HIV TRANSMISSION	LOW RISK OF HIV TRANSMISSION	NO RISK OF HIV TRANSMISSION
a. While feeding a patient infected with HIV, a small amount of the patient's saliva comes in contact with the health care worker's intact skin.				
b. While performing a patient procedure, HIV-infected blood is splashed on a health care worker's non-intact skin.				
c. While changing sheets on an HIV-infected patient's bed, a health care worker's intact skin comes in contact with dried blood stains.				
d. A patient infected with HIV uncontrollably coughs or sneezes on a health care worker's unprotected face.				
e. A health care worker experiences a needlestick or injury with a sharp object that has been used on a patient infected with HIV.				
f. HIV-infected blood is splashed in the eyes or mucous membranes of a health care worker.				
g. A health care worker performs mouth-to-mouth resuscitation with a protective device on a patient infected with HIV.				
h. While irrigating a wound, an HIV-infected patient's blood and body fluids splash on to a health care worker's intact skin.				
i. A health care worker's intact skin comes in contact with the vomit of a patient infected with HIV.				
j. While inserting a urinary catheter into an HIV-infected patient, a large amount of urine spills onto the intact skin of a health care worker.				

APPENDIX B

	Check one box per statement			
	HIGH RISK OF HIV TRANSMISSION	MODERATE RISK OF HIV TRANSMISSION	LOW RISK OF HIV TRANSMISSION	NO RISK OF HIV TRANSMISSION
k. In the course of performing an admission assessment on an HIV-infected patient, a health care worker touches a scab-covered wound without wearing protective gloves.				
l. In the course of restraining a combative patient infected with HIV, a health care worker is bitten and the skin is broken.				
m. A health care worker conducts daily massages with a patient infected with HIV without wearing protective gloves (assume the provider has no open cuts or sores and the provider never touches any open cuts or sores).				

11. Do you agree or disagree with the following statements?

	Check one box per statement	
	AGREE	DISAGREE
a. Protective eyewear should be worn when there may be an anticipated splash of body fluids.		
b. If exposed to blood or body fluids, you should report to your immediate supervisor at the end of your shift.		
c. Special precautions are needed when treating HIV-seropositive patients.		
d. Wearing gloves is a way to reduce the number of times handwashing is necessary.		
e. Health care professionals should consider every patient to be potentially HIV seropositive.		
f. The health care worker must consider the procedure being performed and the type of exposure anticipated before deciding what protective barriers to wear.		
g. Gloves should be worn for all contact with HIV-seropositive patients.		
h. More severe infection control measures are required to prevent HIV transmission than to prevent transmission of the hepatitis B virus.		
i. All used needles should immediately be placed in puncture-resistant containers		
j. Patients who are HIV-seropositive should be placed in single rooms.		

APPENDIX B

SECTION IV
HIV has had a significant impact on the occupational behaviors of health care professionals. An important aspect of this study is to assess your personal feelings regarding HIV-related issues as they affect you in your role as a health care professional.

12. Do you agree or disagree with the following statements?

	Check one Box Per Statement			
	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
a. Disease-specific isolation room signs are more effective than universal precautions in promoting barrier protection.				
b. Infection control precautions taken at this hospital are sufficient with respect to HIV transmission.				
c. The precautions I take while working are adequate to prevent me from becoming infected with HIV.				
d. Universal precautions are more effective at preventing the transmission of HIV in health care settings than testing all patients for HIV.				
e. Dropping uncapped needles and syringes directly into a sharps box reduces my risk of contracting bloodborne diseases, including HIV.				
f. Knowing the HIV-status of a patient is more effective in preventing the transmission of HIV than the use of universal precautions.				

In this section of the questionnaire, there are several questions which make use of rating scales; please circle the number that best describes your opinion. Do not circle more than one number on a single scale.

13.

a. If you want to use universal precautions, how likely is it that your working conditions will enable you to properly use universal precautions:

LIKELY	1	2	3	4	5	6	7	UNLIKELY
	Extremely	Quite	Slightly	Neither	Slightly	Quite	Extremely	

APPENDIX B

14. Do you agree or disagree with the following statements? *(In the following questions, universal precautions refer to the use of barrier precautions, the proper handling and disposal of needles and sharps, and procedures for reporting needlesticks or unprotected body fluid contact from a patient.)*

	Check one box per statement			
	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
a. My coworkers are consistent in their use of universal precautions.				
b. My coworkers remind each other to practice universal precautions.				
c. My supervisors are inconsistent in their use of universal precautions.				
d. The administration and supervisory staff of this hospital provide me with the necessary equipment and training to protect myself from exposure to body fluids.				
e. My coworkers suggest barrier protection to coworkers who are observed not using universal precautions.				
f. All health care professionals in my unit are expected to comply with universal precautions.				
g. Staff are not encouraged to use barrier protection during patient care.				

15. Do you agree or disagree with the following statements?

	Check one box per statement			
	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
a. I seldom worry that I may become infected with HIV as a result of my job.				
b. I am highly susceptible to contracting HIV in the health care setting.				
c. I become anxious when performing procedures or caring for patients because I am afraid that I may become infected with HIV as a result of my job.				
d. I have little confidence in the information about HIV and AIDS that the medical and scientific communities present.				
e. I consider the chance of myself becoming infected with HIV in the health care setting to be highly unlikely.				
f. The majority of my patients present little or no risk for transmitting HIV to myself and my coworkers.				

APPENDIX B

16. Some health care professionals have reported that the use of universal precautions interferes with their abilities to perform medical procedures. Please indicate the degree to which you believe that you can effectively perform the following medical procedures while using the specific universal precautions that are required for each procedure.

(In the following questions, universal precautions refer to the use of barrier precautions, the proper handling and disposal of needles and sharps, and procedures for reporting needlesticks or unprotected body fluid contact from a patient.)

	Check One Box Per Statement			
	VERY EFFECTIVE	SOMEWHAT EFFECTIVE	SOMEWHAT INEFFECTIVE	VERY INEFFECTIVE
a. How effectively can you perform admission assessments while using universal precautions?				
b. How effectively can you perform vaginal exams while using universal precautions?				
c. How effectively can you start an IV while using universal precautions?				
d. How effectively can you draw cord blood while using universal precautions?				
e. How effectively can you perform neonatal resuscitations while using universal precautions?				
f. How effectively can you you assist with an adult intubation while using universal precautions?				
g. How effectively can you change surgical dressings while using universal precautions?				
h. How effectively can you provide peri care while using universal precautions?				
I. How effectively can you perform urinary catheterizations while using universal precautions?				
j. How effectively can you assist in performing an amniotomy while using universal precautions?				
k. How effectively can attend deliveries while using universal precautions?				
l. How effectively can you perform suctioning while using universal precautions?				

APPENDIX B

17. For me to use all the precautions that I am required to use all the time is:

DIFFICULT	1	2	3	4	5	6	7	EASY
	Extremely	Quite	Slightly	Neither	Slightly	Quite	Extremely	

18. For each of the procedures listed below, please indicate the likelihood that you will use each of the precautions listed when you perform the following medical procedures. If you will not use a specific precaution(s) because it did not apply to a particular procedure, respond "NA".

Please use the following numbers when responding to these questions:
1= EXTREMELY LIKELY
2=SOMEWHAT LIKELY
3=SOMEWHAT UNLIKELY
4=EXTREMELY UNLIKELY
NA=NOT APPLICABLE

	Gloves	Handwashing	Mask	Protective Eyewear /Face Shield	Gown	Protective Footwear	Resuscitation Device	Needle/Sharp Precautions	Disposal Waste Materials
a. Admission Assessment									
b. Vaginal Exam									
c. Start IV									
d. Drawing Cord Blood									
e. Neonatal Resuscitation									
f. Assist with Adult Intubation									
g. Changing Surgical Dressings									
h. Peri Care									
i. Urinary Catheritizations									
j. Assisting with Amniotomy									
k. Attending Deliveries									
l. Suctioning									

APPENDIX B

19. How much control do you have over whether or not to use universal precautions?

VERY LITTLE CONTROL	1	2	3	4	5	6	7	COMPLETE CONTROL

20. Listed below are a number of statements concerning personal attitudes and traits. Read each item and decide whether the statement is true or false as it applies to you.

	Check One Box Per Statement	
	TRUE	FALSE
a. I sometimes feel resentful when I don't get my way.		
b. I don't find it particularly difficult to get along with loud-mouthed obnoxious people.		
c. There have been occasions when I took advantage of someone.		
d. On a few occasions, I have given up doing something because I thought too little of my ability.		
e. I never make a long trip without checking the safety of my car.		
f. I have almost never felt the urge to tell someone off.		
g. I always try to practice what I preach.		
h. I never resent being asked to return a favor.		
I. When I don't know something I don't at all mind admitting it.		
j. I have never deliberately said something that hurt someone's feelings.		
k. There have been times when I felt like rebelling against people in authority even though I knew they were right.		

APPENDIX B

SECTION V

Finally, we would like to ask some questions about yourself to help interpret the results of this survey. Again, please remember that this information is anonymous and will not be seen by anyone other than research staff at Michigan State University except in aggregate form.

21. What is your age?_____ YEARS

22. What is your sex?_____ FEMALE _____ MALE

23. What is your current position and/or professional title?

_____RN
_____LPN
_____Clinical Nurse Specialist
_____Nurse Practitioner
_____ Other (please describe:)

24. What is the highest-level degree related to your medical profession that you have obtained?

_____Associate
_____Baccalaureate
_____Masters
_____Doctorate
_____Other (*please describe*):

25. What year did you obtain this degree? 19_____

26. What is your primary clinical/specialty area of practice?

_____Obstetrics
_____Mother/Baby
_____Emergency
_____Medical/Surgical
_____Neonatal Intensive Care

THANK YOU FOR YOUR PARTICIPATION. PLEASE REMEMBER TO RETURN YOUR TICKET WITH YOUR COMPLETED SURVEY TO BE ENTERED INTO THE DRAWING. UPON COMPLETION OF THIS STUDY, A PRINTED VERSION OF THE AGGREGATE RESULTS WILL BE MADE AVAILABLE TO ALL HEALTH CARE PROFESSIONALS ON EACH OF THE STUDY UNITS.

Chapter 5

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