WALDEN UNIVERSITY
A higher degree. A higher purpose.

Walden University
ScholarWorks

Walden Dissertations and Doctoral Studies

Walden Dissertations and Doctoral Studies Collection

2015

Emergency Medical Service Worker Knowledge of and Compliance with Occupational Exposures to Infectious Diseases

Debra Ann Wrentz-Hudson
Walden University

Follow this and additional works at: https://scholarworks.waldenu.edu/dissertations


Part of the Epidemiology Commons, Occupational Health and Industrial Hygiene Commons, and the Public Health Education and Promotion Commons

This Dissertation is brought to you for free and open access by the Walden Dissertations and Doctoral Studies Collection at ScholarWorks. It has been accepted for inclusion in Walden Dissertations and Doctoral Studies by an authorized administrator of ScholarWorks. For more information, please contact ScholarWorks@waldenu.edu.

Walden University

College of Health Sciences

This is to certify that the doctoral dissertation by

Debra Wrentz-Hudson

has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

Review Committee
Dr. Swati Raychowdhury, Committee Chairperson, Public Health Faculty
Dr. Aaron Mendelsohn, Committee Member, Public Health Faculty
Dr. Mehdi Agha, University Reviewer, Public Health Faculty

Chief Academic Officer
Eric Riedel, Ph.D.

Walden University
2015

Abstract

Emergency Medical Service Worker Knowledge of and Compliance with Occupational Exposures to Infectious Diseases

by

Debra Ann Wrentz-Hudson

MSED, Florida International University, 2001

MPH, Florida International University, 1998

BSN, Florida International University, 1995

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Public Health

Walden University

December 2015

Abstract

Firefighter Emergency Medical Service (EMS) responder personnel are at a high risk for occupational exposures to bloodborne and airborne infectious pathogens due to their unpredictable work duties in the pre-hospital environment. Not much is known about the compliance with Universal Precautions (UP) among firefighter EMS responders' personnel with regards to occupational exposures to infectious diseases. The purpose of this cross-sectional research study was to determine the relationship between compliance with UP, knowledge of UP, attitudes towards UP, occupational practices, and occupational exposures to bloodborne and airborne pathogens to prevent transmission of infectious disease among firefighter EMS responder personnel in the pre-hospital environment. A convenience sample (n = 246, 99% response) was gathered from the 6 career fire service departments in Miami-Dade County Florida. The participants completed a 40-question, self-administered survey questionnaire. Research questions and related hypotheses were evaluated with Pearson's product moment correlation, t test, analysis of variance, and linear regression models. In this study, the correlation between knowledge and compliance with UP was statistically significant (p = 0.005). This suggest that the compliance with UP among firefighter EMS responder participants increased with increase in knowledge. However, firefighter EMS personnel are not consistently complying with UP to prevent exposures to infectious diseases in the pre-hospital work environment. This research contributed to positive social change by increasing innovative knowledge that will allow the firefighter EMS responders to improve occupational practices and compliance with universal precautions.

Emergency Medical Service Worker Knowledge of and Compliance with Occupational Exposures to Infectious Diseases

by

Debra Ann Wrentz-Hudson

MSED, Florida International University, 2001

MPH, Florida International University, 1998

BSN, Florida International University, 1995

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Public Health

Walden University

December 2015

Dedication

This dissertation is dedicated to my husband Alfredo, my mother Fannie, and my children; Darius, Sonia, and Tiffany. I would like to make a special dedication to my dad, the late Willis C. Albury, Sr., who has always encouraged me to be successful. Their love, support, encouragement and prayers were crucial to the completion of my dissertation.

I also wish to dedicate this dissertation to the women and men firefighters of Miami-Dade County Fire Rescue, City of Hialeah Fire Rescue, City of Miami Fire Rescue, City of Miami Beach Fire Rescue, Coral Gables Fire Rescue, and Village of Key Biscayne Fire Rescue Departments. Without their support and willingness to participate this dissertation would not have been possible.

Acknowledgments

The writing of this dissertation has been one of the most meaningful and adventurous academic challenges I have ever had to endure. No dissertation is possible without support. Without the continuous prayers, support, and encouragement of my husband, Alfredo, my children, Sonia, Darius, and Tiffany, my mother, Fannie, and my father, Willis, this study would not have been possible.

Secondly, I would like to thank and acknowledge my Chair, Dr. Swati Raychowdhury, my Committee members Dr. Aaron Mendelsohn, and Dr. Mehdi Agha. I am so grateful for their support and constructive feedback. I am also privileged to have had them as mentors as they guided me through my dissertation process as well as for keeping me on the right track, encouraging me not to give up nor get discouraged, and to know that the speed bumps in research are lessons learned.

Finally, I would like to acknowledge those in the career fire service departments throughout Miami-Dade County Florida that were supportive and willing to participate throughout my data collection process. I would like to acknowledge and thank my co-workers and friends at Miami-Dade Fire Rescue; Captain Armando Pesaturo, Lieutenant Alicia Williams, Lieutenant Willie Williams, Firefighter Keisha Wilson, Dr. Donald Rosenberg (Assistant Medical Director), Dr. Ana Lausell (EMS Quality Assurance Administrator), and Ms. Sandra Brown (EMS Compliance Coordinator). I would like to give a special thank you to my Fire Chief at Miami-Dade Fire Rescue, Chief David Downey. Also, thank you Chief Frank Betancourt and EMS Coordinator Mr. Salvatore Frosceno at City of Miami Beach Fire Department; Fire Chief Kemp, Retired Chief

Freddie Fernandez, Chief David Duenas, and Captain Daisy Spira at City of Miami Fire Department; Chief Patrick Flynn, Lieutenant Urbano Menendez, and Lieutenant Edward J. Hernandez at City of Hialeah Fire Rescue Department; Chief Marco De La Rosa, Chief Marc Stolvenburg, Captain John Curry, and Lieutenant Jack Kerns at City of Coral Gables Fire Rescue Department; and Chief Eric Lang, Captain Daniel Feeney, and Lieutenant Justin Connors at Village of Key Biscayne Fire Rescue Department.

TABLE OF CONTENTS

List of Tables v

List of Figures vii

Chapter 1: Introduction to the Study 1

Introduction 1

Background 3

Problem Statement 5

Purpose of the Study 6

Research Questions 7

Hypotheses 8

Theoretical Foundation 9

Nature of the Study 11

Definitions 11

Assumptions 16

Scope of Delimitations 17

Limitations 17

Significance 18

Summary 19

Chapter 2: Literature Review 20

Introduction 20

Overview 22

Theoretical Perspective 24

Risk of an Occupational Exposure / Transmission 34
Knowledge of Compliance 39
Factors Influencing Decision Making 44
Variables Impacting Compliance 48
Summary 49
Chapter 3: Research Method 51
Introduction 51
Research Design and Rationale 52
Population and Sample 54
Sampling Procedures and Recruitment 56
Sample Size 57
Participation 57
Setting 58
Exclusion Criteria 59
Inclusion Criteria 59
Data Collection 60
Instrumentation and Materials 60
Survey Instrument 63
Validitiy 63
Reliability 64
Variables 65
Definition of Variables 65

Data Analysis 68
Threats to Validity 68
Internal Validity 68
External Validity 71
Construct Validity 73
Statistical Conclusion Validity 74
Ethical Procedures 75
Summary 75
Chapter 4: Results 77
Introduction 77
Research Questions 77
Hypotheses 78
Pilot Study 79
Results of Pilot Study 81
Data Collection 94
Descriptive Social-Demographic Characteristics of the Sample 96
Treatment and / or Intervention Fidelity 100
Results 100
Summary of Findings 125
Chapter 5: Discussion 127
Introduction 127
Interpretation of Findings 128

Research Question#1 129

Hypotheses #1 130

Research Question #2 131

Hypotheses #2 131

Research Question #3 132

Hypotheses #3 133

Limitations of the Study 134

Recommendations 136

Implications for Positive Social Change 138

Conclusion 140

References 144

Appendix A: Dissertation Research Survey 173

Appendix B: Dissertation Pilot Study Survey 179

List of Tables

Table 1. Groups of EMS Workers (fire and non-fire service) in Miami-Dade County Florida 56

Table 2. Description of Variables Considered in Analysis 66

Table 3. Distribution of Valid Responses during Pilot Study 82

Table 4. Social-Demographic Characteristics of the Pilot Tested Sample Population 87

Table 5. Knowledge of Universal Precautions Overall and Among each Certification Level 88

Table 6. Alpha Method Reliability Statistics 89

Table 7. Split-Half Method Reliability Statistics 90

Table 8. Item-Total Statistics 90

Table 9. Social-Demographic Characteristics of Studied Population 98

Table 10. Representative Sample of the Population 100

Table 11. Distribution of Total Compliance Score by Attitude, Related Questions, Level of Experience and Years of Experience 103

Table 12. Results of Simple and Multivariate Linear Regression for Research Question #1 108

Table 13. Occupational Exposures to Bloodborne and Airborne Pathogens vs Compliance with Universal Precautions 110

Table 14. Results o Simple and Multivariate Linear Regression Model for Research Question #2 116

Table 15. Results of Simple and Multivariate Linear Regression for Research Question #3..... 120

List of Figures

Figure 1. Modified Protection Motivation Theory Model for Occupational Exposures of EMS Workers and Compliance with Universal Precautions 26

Figure 2. Relationship between Total Knowledge Score and Total Compliance Score ..104

Figure 3. Distribution of Total Compliance Score by Reason of not Using Gloves 104

Figure 4. Distribution of Total Compliance Score by Satisfaction at Current EMS Position 105

Figure 5. Relationship between Ps-PS Score and Total Compliance Score 119

Figure 6. Relationship between PRS-PSE Score and Total Compliance Score 119

Figure 7. Diagnostic Plots for Linear Regression Model (unadjusted) for Research Question #1 121

Figure 8. Diagnostic Plots for Linear Regression Model (adjusted) for Research Question #1.....121

Figure 9. Diagnostic Plots for Linear Regression Model (unadjusted) for (PRE-PSE) Research Question #3 122

Figure 10. Diagnostic Plots for Linear Regression Model (adjusted) for (PRE-PSE) Research Question #3 123

Figure 11. Diagnostic Plots for Linear Regression Model (unadjusted) for (PS-PS) Research Question #3 124

Figure 12. Diagnostic Plots for Linear Regression Model (adjusted) for (PS-PS) Research Question #3 125

Chapter 1: Introduction to the Study

Introduction

Emergency medical services (EMS) workers are at a high risk of bloodborne and airborne infections such as Hepatitis B virus (HBV), Hepatitis C virus (HCV), human immunodeficiency virus (HIV), and tuberculosis (TB) because of their occupational duties and exposure to patients' blood and body fluids. EMS workers most likely encounter occupational exposure to these viruses through needle stick injuries; blood or body fluids splashing onto broken skin, into eyes, nose, mouth, or mucous membrane; and inadequate Hepatitis B vaccination. The Centers for Disease Control and Prevention (CDC) estimated that 19% of injuries and illnesses among EMS workers who were treated in hospital emergency departments were a result of exposures to potentially infectious materials (CDC, 2012). These occupational hazards confront over 11 million health care workers in the United States today (Harris & Nicolai, 2010). According to Harris and Nicolai (2010), approximately 80% of participants did not have complete knowledge of universal precaution compliance. EMS workers at higher levels of training and certification had a better understanding of compliance with universal precautions. Interacting with patients, handling needles, and not wearing their personal protective equipment puts EMS workers at a higher risk of occupational exposure to bloodborne and airborne pathogens.

EMS workers provide emergency medical treatment to roughly 22 million patients per year in the United States (Maguire et al., 2005; Maguire & Walz, 2004). They provide medical care in prehospital environments including trauma centers and

transportation to local hospitals. EMS workers include first responders, emergency medical technicians (EMTs), paramedics, fire fighters, and public service workers crossed trained in EMS (CDC, 2012). The Association for Professionals in Infection Control and Epidemiology, Inc. (APIC) documented nearly 1.5 million EMS workers and fire fighters who are at risk for an occupational exposure to percutaneous injuries (i.e., needlesticks, cuts, punctures and other injuries with sharp objects) and infectious diseases (APIC,2013; CDC, 2013). EMS workers may not be adhering to universal precautions nor properly wearing their personal protective equipment in order to avoid unnecessary occupational exposures to bloodborne pathogens.

As the number of persons infected with HIV, HCV, and other bloodborne infections increases, EMS workers' risk for occupational exposure and transmission of bloodborne pathogens increase. An estimated 1-1.2 million persons are living with HIV and approximately 21% of them are undiagnosed (CDC, 2011; Lashley, 2007). HCV is considered one of the most chronic bloodborne infections in the United States (Jafari et al., 2012). In 2012, approximately 10,000 cases of TB were reported in the United States (CDC, 2013). Because individuals with TB may not display signs and symptoms of the disease, TB is still a concern to EMS workers regardless of its declining rates of incidence.

EMS workers may be prone to unintentional needlesticks because of the emergent nature of patient care, high number of trauma cases, rapidly moving rescue vehicles, limited visibility, cramped spaces, and unpredictable /unstable work environment (Harris et al., 2010; Peate, 2001). Additionally, EMS workers frequently use uncontained

glucometer lancets while performing glucose measurements and are therefore a greater risk for an exposure (Peate, 2001). The Occupational Safety and Health Administration (OSHA) and CDC (2001) reported that there are approximately 590,164 percutaneous injuries to health care workers in the hospital setting involving contaminated sharps annually: 385,000 included non-hospital health care workers (OSHA, 2001; Perry & Jagger, 2003). In the United States, nearly 600,000 to 800,000 needlesticks and other sharps related injuries occur annually to health care workers; of these injuries, an estimated 50% go unreported (Harris et al., 2010; National Institute of Occupational Safety & Health [NIOSH], 1999).

Background

EMS workers are at a high risk for an occupational exposure to blood, body fluids, and airborne diseases. Occupational exposure of EMS workers to bloodborne and airborne pathogens is a health concern. Bloodborne exposure can occur through percutaneous injuries, non-intact skin, contact of mucous membranes through blood or body fluid splash, and human bite (CDC, 2001; CDC, 2005; Harris & Nicolai, 2010; International Association of Fire Fighters [IAFF], 2001; NFPA, 2010; NIOSH, 2010). EMS workers are at risk of becoming infected with bloodborne pathogens such as HBV, HCV, and HIV; including airborne pathogens such as TB. These are among the most serious infectious diseases worldwide among health care workers (Wilburn & Elijkemans, 2004; Yassi & Warshaw, 2011).

Avoiding occupational exposure to bloodborne and airborne pathogens is the primary way to prevent the transmission of infectious diseases. The CDC, OSHA,

NIOSH, and other international, federal, and state agencies have designed guidelines to prevent occupational exposures to health care workers at risk for contact with blood and body fluids (Godin et al., 2000; McGovern et al., 2005). These guidelines are designed to keep health care workers safe from exposures (Rinnert, O'Connor, & Delbridge, 1998). According to current guidelines, all blood and body fluids should be handled as though they are infected (CDC, 2001; CDC, 2005; CDC, 2008; Mathews et al., 2008; OSHA, 2001; OSHA, 2003; OSHA, 2008). Failure to comply with recommended universal precautions may lead to the transmission of an infectious disease.

OSHA (1991) issued a standard regulating occupational exposure guidelines to bloodborne pathogens, including HBV, HCV, and HIV. This new guideline changed health care workers' and EMS workers' training techniques, which would potentially protect them from occupational exposure to bloodborne pathogens (OSHA, 1991). The Needlestick Safety and Prevention Act was signed into law in 2001 to mandate engineering controls for needlestick injuries that could result in an occupational exposure to an infectious disease. OSHA revised the bloodborne standard in 2002 to coincide with the Needlestick Safety and Prevention Act (OSHA, 2001). As per OSHA's Code of Federal Regulations (CFR) at 29 CFR 1910.132, employers are responsible for: (a) providing appropriate persona protective equipment (PPE) for employees, (b) train employees on the use and care of PPEs, and (c) maintain employees' PPEs, as well as replacing worn or damaged PPEs (OSHA, 2003).

In 1992, the CDC drafted new guidelines to prevent the transmission of TB in health care facilities (CDC, 2005). These updated guidelines included EMS workers as

healthcare workers (IAFF, 2001). In 1999, NIOSH published a compliance directive to eliminate needles if other measures were available (NIOSH, 1999). While EMS workers are at a higher risk of occupational exposures to bloodborne and airborne pathogens in the prehospital environment, there is limited research on compliance with universal precautions in preventing exposures and transmission of infectious diseases to EMS workers.

Several researchers have evaluated compliance of universal precautions among nurses, particularly the use of personal protective equipment, proper disposal of sharps/ needles, and proper hand washing (Sadoh, Fawole, Sadoh, Oladimeji, & Sotiloye, 2006). However, there are a lack of studies on EMS workers and their compliance with universal precautions in their hazardous work environment. Harris and Nicolai (2010) examined the compliance and knowledge of universal precautions among several different types and levels of EMTs. They found that, even though most EMTs understood risk for occupational exposure to an infectious disease, universal precautions were not always used (Harris & Nicolai, 2010). Level of training and work experience was a factor in determining the knowledge of compliance with universal precautions.

Problem Statement

Regardless of infection control guidelines, compliance requirements, and recommendations in the prevention of occupational exposures to infectious diseases, compliance with universal precautions remains inadequate for health care workers and EMS workers (Gaston et al., 2000). Improving EMS workers', as well as other health care workers', knowledge of transmission, postexposure management, and adherence to

universal precautions through teaching of guidelines is one way of increasing compliance and reducing occupational exposures.

EMS workers have the responsibility to care for the public and respond to emergency calls such as motor vehicle accidents, fires (buildings and wild land), medical emergencies, crimes, natural or human disasters, public disturbances, shootings, and search and rescue incidents (Reichard & Jackson, 2010). While providing prehospital emergency medical care, EMS workers' are at a high risk for occupational exposures to bloodborne pathogens as well as other communicable illnesses, injuries, and hazards.

Although there is documented research on occupational exposures and the transmission of bloodborne and airborne pathogens in health care workers with regards to compliance with universal precautions, there is limited or outdated research for precautions for EMS workers. In this study, I assessed EMS workers' compliance with universal precautions in preventing the transmission of infectious diseases using the protection motivation theory (PMT). PMT expounds on the effects of fear appeals on health attitudes and decisions to implement protective health behaviors (Rogers, 1975). Fear appeals are persuasive messages using scare tactics intended to motivate the individuals to engage in preventive health behaviors (Boer & Seydel, 1995). Furthermore, PMT involves adaptive and maladaptive coping with a health threat as the result of a risk assessment (vulnerability) and a coping process (Floyd, Prentice-Dunn, & Rogers, 2000; Prentice-Dunn & Rogers, 1986).

Purpose of Study

I investigated the reasons for noncompliance with universal precautions among EMS workers. One of the most important defenses for preventing occupational exposure to bloodborne and airborne pathogens in EMS workers is adherence to OSHA and CDC universal precuations, as well as NIOSH and IAFF infection control guidelines. The purpose of this questionairre survey study was to assess the: (a) knowledge of universal precautions, and (b) levels of compliance with universal precautions among EMS workers in the prehospital environment.

I used PMT as a theoretical framework for determining if there was a relationship between: (a) knowledge of universal precautions, (b) risks of an occupational exposures, and (c) compliance with universal precautions to prevent transmission of infectious diseases in EMS workers.The information collected from this study provided data to EMS departments to encourage and improve compliance with universal precautions among EMS workers. Information gathered from this study was also used to change the work behavior of EMS workers in South Florida by increasing adherence to universal precautions in the EMS population and thus decreasing the number of occupational exposures to bloodborne and airborne pathogens and transmission of infectious diseases.

Research Questions

Research questions that guided this study were the following:

1. Does an EMS worker's knowledge, attitude, certification level and years of experience predict their levels of compliance with universal precautions?

2. Does awareness concerning occurrence rates of occupational exposure to bloodborne and airborne pathogens result in compliance with universal precautions?
3. Is there a relationship between perceived severity, susceptibility, response-efficacy, self-efficacy, and compliance with the utilization of universal precautions to prevent occupational exposures in the EMS workers population in Miami-Dade County?

Hypotheses

The following hypotheses were addressed in relation to the research questions proposed above:

H_o1: There is no significant difference in compliance with universal precautions among EMS workers based upon the following factors:

H_o1A: Knowledge,

H_o1B: Attitude,

H_o1C: Certification level, and

H_o1D: Years of experience as an EMS worker.

Ha1: There is a significant difference in compliance with universal precautions among EMS workers based upon the following factors:

Ha1A: Knowledge,

Ha1B: Attitude,

Ha1C: Certification level, and

Ha1D: Years of experience as an EMS worker.

H_o 2: Awareness concerning occupational exposure to bloodborne and airborne pathogens does not result in compliance with universal precautions among EMS workers.

Ha2: Awareness concerning occupational exposure to bloodborne and airborne pathogens does result in compliance with universal precautions among EMS workers.

H_o3: There is no significant change in compliance with the utilization of universal precautions to prevent occupational exposures among EMS workers in Miami-Dade County based upon the following:

H_o3A: Perceived severity,

H_o3B: Susceptibility,

H_o3C: Response-efficacy, and

H_o3D: Self-efficacy.

Ha3: There is a significant relationship in compliance with the utilization of universal precautions to prevent occupational exposures among EMS workers in Miami-Dade County based upon the following:

Ha3A: Perceived severity,

Ha3B: Susceptibility,

Ha3C: Response-efficacy, and

Ha3D: Self-efficacy.

Theoretical Foundation

The theoretical framework for this study was PMT, which was used to guide questionnaire development and differentiated the variables associated with EMS workers' knowledge of universal precautions and which variables had the greatest influence on the

health behaviors and intentions to comply with universal precautions in preventing the transmission of bloodborne and airborne infectious diseases.

According to PMT, specific variables influence the motivation of an individual to protect himself or herself against a health threats and affects health attitudes and behaviors. It also explains health behavior motivation from a disease prevention perspective (Courneya, & Hellsten, 2001; McClendon & Prentice-Dunn, 2001; Milne, Sheeran, & Orbell, 2000; Plotnikoff & Higginbotham, 2002; Sutton, 2002). The variables that influence the motivation of an individual to protect themselves include: (a) perceived severity of the illness due to an occupational exposure, (b) perceived susceptibility to the illness, (c) perceived response-efficacy that a change in behavior can be effective in reducing the chance of an occupational exposure, and (d) perceived self-efficacy of the belief that EMS workers can successfully perform the recommended universal precautions. As per PMT, an EMS worker will be motivated to (a) protect their health, (b) comply with the universal precautions in order to reduce the likelihood of occupational exposure to a bloodborne or airborne pathogen, and (c) prevent the transmission of an infectious disease.

The PMT was used to explain the cognitive processes of health behavioral change in an effort to specify a health message that would promote and influence compliance with universal precautions in EMS workers (Bui, Mullan, & McCaffery, 2013). When an EMS worker encounters an occupational health threat in their work environment, two cognitive processes; threat appraisal and coping appraisal, are activated. These appraisals also include perceived severity, perceived susceptibility, perceived response-efficacy, and

perceived self-efficacy (Brouwers & Sorrentino, 1993). Consequently, EMS workers' perception of risks and resulting behaviors toward bloodborne and airborne pathogens can increase the possibility of occupational exposure. It can also affect their compliance with universal precautions.

Nature of Study

The nature of this study was investigate the compliance of universal precautions in EMS workers working in the prehospital environment in Miami-Dade County Florida. The research was conducted using a self-administered questionnaire to gather data about current occupational exposures to bloodborne and airborne pathogens, risk for transmission, knowledge and certification level, and attitudes regarding compliance with universal precautions to prevent such exposures. Quantitative research is consistent with a survey study to; analyze attitudes, knowledge, and risk factors of an occupational exposure in regards to compliance with universal precautions for the prevention and transmission of infectious diseases in EMS workers. Quantitative data was collected for statistical analysis.

This study is the first of its kind to use the PMT model to promote compliance with universal precautions. The results of this study can impact change in the EMS population and provide motivation for EMS workers to comply with universal precautions, infection control plans, and occupational exposure guidelines.

Definitions

Airborne pathogens: Microorganisms that can produce infection and cause disease in humans after being inhaled (NFPA, 2010).

Blood: Human blood, human blood components, and products made from human blood (NFPA, 2010).

Bloodborne pathogens: Pathologic (disease causing) microorganisms that are present in human blood, blood components, and blood products that can cause disease in humans (IAFF, 2001; NFPA, 2010).

Body fluids: Fluids that the body produces, including but not limited to: blood, semen, mucus, feces, urine, vaginal secretions, breast milk, amniotic fluids, cerebrospinal fluid, synovial fluid, pericardial fluid, sputum, and any other fluids that might contain pathogens (NFPA, 2010).

Emergency medical services: The treatment of patients, using first aid, cardiopulmonary resuscitation, basic life support, advanced life support, and other medical protocols prior to arrival at a hospital or other health care facility (NFPA 1581, 2010).

Emergency medical services personnel: Unique health care professionals who provide medical care and transportation in the prehospital environment as well as the emergency room setting with medical oversight (NHTSA, 2007).

Emergency medical technician (EMT): Responds to emergency calls to provide efficient and immediate care to the critically ill and injured, and to transport the patient to a medical facility (NHTSA, 2007).

Emergency medical responder: An individual whose primary focus is to initiate immediate lifesaving care to patients, performs basic interventions with minimal

equipment, and function as part of a comprehensive EMS response, under medical oversight (National Highway Traffic Safety Administration [NHTSA], 2007).

Exposure incident: A specific eye, mouth, other mucous membrane, nonintact skin, or parenteral contact with blood or other potentially infectious materials that results from the performance of an employee's duties (APIC, 2013).

Fire fighter: An individual who protects the public by responding to fires and other emergencies. They are frequently the first emergency personnel on the scene of an accident (Bureau of Labor Statistics [BLS], U.S. Department of Labor, 2013).

Hepatitis: Inflammation of the livers that may be caused by viruses, chemicals, drugs, autoimmune diseases, and a number of other conditions (IAFF, 2001).

Hepatitis B: A contagious liver disease that results from infection with the Hepatitis B virus (CDC, 2010).

Hepatitis C: Formerly known as "non-A, non-B hepatitis" and is considered to be a greater threat to fire fighters, paramedics, and EMTs than Hepatitis B virus (IAFF, 2001, p. #6).

High-risk population: A group of people in the community with a higher-than-expected risk for developing a particular disease, which may be defined on a measurable parameter-e.g., an inherited genetic defect, physical attribute, lifestyle, habit, socioeconomic and / or education feature, as well as environment. Also called high-risk group (McGraw-Hill Concise Dictionary of Modern Medicine, 2002).

HIV: HIV is a virus spread through body fluids that affects specific cells of the immune system, called CD4 cells, or T cells. Over time, HIV can destroy so many of

these cells that the body can't fight off infections and disease. When this happens, HIV infection leads to AIDS. Unlike some other viruses, the human body cannot get rid of HIV (CDC, 2013).

Infection: The state or condition in which the body or a part of it is invaded by a pathogenic agent (microorganism or virus) that, under favorable conditions, multiplies and produces effects that are injurious (NFPA 1581, 2010).

Infectious exposure: A specific eye, mouth, other mucous membrane, non-intact skin, or parenteral contact with blood, body fluids, or other potentially infectious material; inhalation of airborne pathogens; or ingestion of foodborne pathogens or toxins (NFPA, 2010).

International Association of Fire Fighters (IAFF): The nationwide employee representative for professional fire fighters and paramedics in the U.S., representing over 298,000 career fire fighters and paramedics (National Institute of Environmental Health Sciences (NIEHS) & National Institute of Health (NIH), 2012).

National Fire Protection Association (NFPA): Established in 1896, the NFPA is an international nonprofit organization whose mission is to reduce the worldwide burden of fire and other hazards on the quality of life by providing and advocating for of research, training, education and more than 300 consensus codes and standards (NFPA, 2013).

National Institute for Occupational Safety and Health (NIOSH): Is the federal agency responsible for conducting research and making recommendations for the prevention of work-related injury and illness (CDC, 2013).

Occupational exposure: Reasonably anticipated skin, eye, mucous membrane, or parenteral contact with blood or other potentially infectious materials that may result from the performance of an employee's duties (APIC, 2013).

Occupational contagious diseases: Infectious diseases that are contracted through the course of a person performing his or her work. (IAFF, 2001, p. #2).

Occupational Safety & Health Administration (OSHA): Was established by Congress in 1970 to ensure U.S. workers a safe and healthful working environment by setting and enforcing standards and by providing training, outreach, education, and assistance (OSHA, 2013).

Paramedic: An allied health professional whose primary focus is to provide advanced emergency medical care for critical and emergency patients who access the emergency medical system and is a link from the scene into the health care system (NHTSA, 2007).

Pathogens: Microorganisms such as a bacteria, virus, or fungus that is capable of causing disease (NFPA, 2010).

Percutaneous: Effected through the skin; the removal or injection of a fluid by needle (Venes, 2005).

Personal protective equipment (PPE): Specialized clothing or equipment worn by health professionals for protection against hazards (NFPA, 2010).

Potentially infectious materials: Any bodily fluid that is visibly contaminated with blood; all body fluids in situations where it is difficult or impossible to differentiate

between body fluids, sputum, saliva, and other respiratory secretions; and any unfixed tissue or organ from a living or dead human (NFPA, 2010).

Standard precautions: Precautions based on the principle that all blood, body fluid secretions except sweat, nonintact skin, and mucous membranes may contain infectious diseases (APIC, 2013). Implementation of standard precautions constitutes the primary strategy for the prevention of healthcare-associated transmission of infectious agents among patient and healthcare personnel (APIC, 2013).

Tuberculosis: A disease caused by a family of organisms known as *Mycobacteria (*CDC, 2005; Hill et al., 2012). TB usually affects the lungs. Symptoms of TB include but are not limited to weight loss, poor appetite, sweating at night, fever, chills, fatigue, coughing for 3 weeks or longer, and coughing up blood or brown colored sputum. The disease commonly known as TB is caused by one species of *Mycobacterium*, called *Mycobacterium tuberculosis* (IAFF, 2001).

Universal precautions: An approach to infection control in which human blood and certain human body fluids are treated as if known to be infectious for HIV, HBV, and other bloodborne pathogens (NFPA, 2010).

Assumptions

In this study, I assumed that having occupational exposure to bloodborne or airborne pathogens has negative consequences. I also assumed that OSHA, CDC, NOSH, NFPA, and IAFF all provide guidelines for the prevention and management of occupational exposure to HBV, HCV, HIV, and TB as well as provide sequenced steps for the assessment of such occupational exposures. I anticipated that an adequate

infection control plan, along with educational training regarding compliance with universal precautions, is important in preventing and assessing occupational exposure to infectious diseases. I presumed that an EMS worker's decision not to comply with universal precautions and follow federal guidelines is not ideal in the prehospital work environment.

Scope of Delimitations

I evaluated the relationship between the risks of occupational exposure to bloodborne / airborne pathogens and compliance with universal precautions in order to prevent the transmission of infectious diseases in EMS workers within several fire and non-fire service departments in Miami-Dade County, Florida. The sample population selected for this study was made up of state-certified first responders, EMTs, paramedics, and fire fighters currently working in Miami-Dade County. Currently, in Miami-Dade County there are six licensed fire departments and six licensed ambulance companies.

According to the Florida Department of Health (FDOH), Miami-Dade County had the highest reported EMS incidents by county of EMS transports and EMS patient encounters (FDOH, 2011). As of March 2013, Miami-Dade County had the highest number of cases of people with HIV/AIDS and chronic Hepatitis C in Florida (FDOH, 2013). Miami-Dade County is ranked fifth for the most TB cases, and ranked sixth for the most hepatitis B cases (FDOH, 2013). In this study, I attempted to determine the compliance with universal precautions in EMS workers.

Limitations

This study has several potential limitations that should be considered when interpreting the results. It is possible that there is an inability to compare fire service EMS workers and non-fire service EMS workers knowledge of compliance with universal precaution, which will potentially produce a bias. However, there is no obvious reason to suspect that non-fire service EMS workers are not susceptible to the same occupational infectious hazards as the responders. The EMS workers' unpredictable work environment, the number of calls, and limited time to complete questionnaire survey, may affect the results of the study.

EMS workers within the county include fire fighters an others non-fire service personnel. They also possess a diverse amount of health care experience. It was not known prior to the study the how much training in compliance with universal precautions EMS workers had. Similarly, their knowledge of the CDC, OSHA, and NIOSH infection control guidelines was acquired on the job. Furthermore, the results of this study may have been affected by the individuals' knowledge of his or her own department's plans and policy.

The data that was collected in certain counties within South Florida might not represent all EMS workers in Florida; the findings cannot be generalized and compared to the total EMS population. Nonetheless, the findings from this study should be representative of the EMS workers surveyed. A high level of comparability indicates consistency.

Significance

EMS workers are at risk to encounter bloodborne and airborne pathogens because they come in contact with high risk populations in an unpredictable environment. Understanding occupational exposure to bloodborne and airborne pathogens is of importance to EMS workers because of the long-term mental and physical effect these exposures can have on their health. An assessment of EMS workers' occupational exposure should occur.

Summary

EMS workers respond to medical emergencies, trauma incidents, and search and rescue situations in an unpredictable environment. Occupational exposure to bloodborne and airborne pathogens may lead to the transmission of an infectious disease such as HBV, HCV, HIV, or TB. Throughout the reviewed literature researchers have indicated that: (a) compliance with universal precautions, (b) wearing personal protective equipment, and (c) risks of occupational exposures to infectious diseases were crucial to health care workers' well-being and safety. However, there is minimal research on the occupational risks and levels of compliance with universal precautions for the prevention and transmission of infectious diseases such as HBV, HCV, HIV, and TB among EMS workers. No literature was documented on the use of the PMT model for occupational exposures and compliance with universal precautions in EMS workers. EMS fire and non-fire departments need to enforce compliance with infection control plans, occupational exposure policies, and CDC, OSHA, and NIOSH bloodborne / airborne pathogens prevention guidelines.

Chapter 2: Literature Review

Introduction

Emergency medical services (EMS) personnel (fire and non-fire) are exposed to a wide variety of infectious pathogens that can lead to the transmission of infectious diseases. Infectious pathogens such as HBV, HCV, HIV, and Mycobacterium tuberculosis (MBT) can cause diseases such as Hepatitis B, Hepatitis C, AIDS, and tuberculosis. There has been a significant amount of research on types, frequency, and risk of occupational exposures as well as on the benefits of health care workers' compliance with standard precautions. However, there is a lack of research on EMS personnel's occupational exposures and the knowledge of and specific influences on standard universal precautions compliance with regards to the risk of occupational exposures to infectious diseases. Universal precautions and standard precautions are used interchangeably to mean a set of guidelines to reduce the risk of transmission of any infectious disease in health care workers.

This chapter is organized into the following sections: Introduction, Overview, Theoretical Perspective, Risk from Occupational Exposures, Knowledge and Compliance of Standard Precautions, Factors Influencing Decision-Making, Variables Impacting Compliance, and Summary.

The literature review search was conducted to identify current research about EMS personnel and occupational exposures to bloodborne and airborne pathogens as well as health care precautions against HBV, HCV, HIV, and TB infectious diseases. Search terms included Hepatitis B, Hepatitis C, HIV that causes AIDS, tuberculosis, paramedic

(EMT-P), emergency medical technician (EMT), emergency medical services / workers, health care workers, compliance, standard precautions, universal precautions, Occupational Safety and Health Administration (OSHA) precautions / standard, Centers for Disease Control and Prevention (CDC) guidelines for management of occupational exposures and recommendations, occupational exposures, bloodborne pathogens, and protection motivation theory (PMT). These terms were used to search the Walden University Library Electronic Journal Services through the EBSCO database, Florida International University Library E-Resources and Databases, Centers for Disease Control (CDC), United States Department of Labor, United States Department of Helath and Human Services (HHS), MEDLINE, PubMed, ProQuest, CINAHL, Elsevier, and Science Direct data base to find literautre from the last 10 years.

Overview

EMS personnel and firefighter are increasingly being exposed to infectious disease such as hepatitis, HIV, and TB (IAFF, 2001). Occupational exposure to bloodborne and airborne infectious diseases is a hazard that firefighters, first-responders (ambulance workers), paramedics, and emergency medical technicians (EMTs) encounter daily. According to Carrillo, Fleming, and Lee (1996), paramedics, first-responders, and EMTs are a distinct group of health care personnel who are exposed to several different infectious pathogens while providing prehospital emergency medical care, which can potentially lead to disease transmission. Firefighters are also a part of this distinct group of emergency medical responders in communities. This diverse group of individuals is at

a particularly high risk of an occupational exposure to bloodborne and airborne pathogens.

OSHA publicized the Bloodborne Pathogens Standard (29 CFR 1910.1020), which changed how fire fighter, EMS personnel, and other health care workers potentially exposed to bloodborne disease should be trained and equipped to protect themselves from exposure to infectious diseases (OSHA, 1991; IAFF, 2004). The Needlestick Safety and Prevention Act were also signed into law in 2001 (US Department of Labor, 2001). EMS personnel should apply these standard precautions with patients regardless of their infectious status. The fundamentals of standard precautions relate to any and all blood and other body fluids that may be potentially infectious with the exception of feces and saliva, unless there is visible blood (CDC, 2012; IAFF, 2001; National Fire Protection Association 1581[NFPA],2010). Additionally, it is essential that emergency medical responders have an understanding of the basic principles of infectious diseases such as HBV, HCV, AIDS, and TB and their prevention, because an exposure can have a negative impact on the health of an emergency medical responder.

EMS workers are generally certified basic or intermediate EMTs, first responders, fire fighters or paramedics and provide prehospital emergency medical care (CDC, 2012; The National Institute for Occupational Safety and Health [NISOH], 2012). Among the most concerning health risks to EMS workers are exposure to infectious pathogens and disease transmission from patients with unrecognized illnesses while providing emergency care (IAFF, 2001). EMS workers have a greater chance of coming in contact

with a bloodborne or airborne pathogen than the general public. Each call for service presents the possibility of an occupational exposure to an infectious disease that can be physiologically as well as psychologically damaging.

If an exposure occurs, EMS personnel need to report it to their employer health occupation office and infection control coordinator. OSHA requires that a postexposure plan must exist for management of occupational exposures to bloodborne and airborne pathogens in all health care operating businesses. This plan provides a medical evaluation and postexposure prophylaxis for employees (CDC, 2001; IAFF, 2011; Moran, 1999). Education, training, and familiarity with information on the latest developments of infectious diseases have a significant impact on the prevention and management of an occupational exposure.

A fire-fighter, paramedic, EMT, or first-responder can be exposed to HIV, HBV, and HCV via the blood or body fluids of a patient. Immunization against HBV is available through most employers and can decrease the chance of contracting the disease (Beltrami et al., 2000; CDC, 2006, 2009; Cuming, Rocco, & McEachern, 2008; Dietchman, 2003; IAFF, 2011; NFPA 1581, 2010; OSHA, 2012; Rupp & Christensen, 2008). Currently, there are no immunizations for HIV or HCV, nor has a vaccine been licensed because experimental approaches to developing vaccines for these viruses have been unsuccessful (Institute of Medicine [IOM], 2013; National Institute of Allergy and Infectious Diseases [NIAID]/National Institute of Health [NIH], 2012; The United States Department of Health and Human Services [USDHHS]/CDC, 2011). Hepatitis C virus is a global public health problem (Jafari et al., 2012), and has been nicknamed the “silent

epidemic" (Tan, 2006). Moreover, the Hepatitis C virus is more common than HIV/AIDs due to the lack of signs and symptoms and can live in dried blood for approximately 10 days (Rodis, 2007; IOM, 2010). Approximately 5 million people in the United States are living with Hepatitis C, which is close to four times the number of people with HIV/AIDS (Rodis, 2007; IOM, 2010; USDHHA, 2011).

Occupational exposure to airborne pathogens can cause (a) influenza, (b) measles, (c) mumps, (d) rubella, (e) meningitis, (f) chicken pox, (g) severe acute respiratory syndrome (SARS), and (h) TB. Obtaining the proper immunizations can eliminate the likelihood of contracting most of these infectious diseases. The CDC, OSHA, and state and local health departments outline the necessary immunizations for health care workers as well as the general public (CDC, 2012). The NFPA 1581: Standard on Fire Department Infection Control Program and NFPA 1582: Standard on Comprehensive Occupational Medical Program for Fire Departments, outline the immunizations that should be provided to EMS personnel. Baseline protection is necessary pre- and postexposure. Person-to-person contact may also spread infectious disease to EMS personnel from patients who are already infected (IAFF, 2001). A break in the skin from needles and other sharp objects that are used on patients is another source of occupational exposure to infectious pathogens (CDC, 2005). Adequate protective measures against such occupational exposures should be taken by health care workers and their institutions. When used correctly, these standards and guidelines can decrease the percentage of occupational exposures to an infectious pathogen or disease.

Theoretical Prospective

The protection motivation theory (PMT) has been offered as a way to explain and predict individuals' cognitive attempt to change their health attitudes and behaviors in response to health threats and risks (Floyd, Prentice-Dunn, & Rogers, 2000; Milne, Sheeran, & Orbel, 2000; Plotnikoff & Higginbotham, 2002). PMT was originally proposed as a framework in an attempt to understand fear appeals (Boer & Seydel, 1995; Floyd et al., 2000; Norman, 2005), and was revised to include cognitive processes. Generally, individuals go through several cognitive processes that influence their behaviors and predict health-related decisions to protect themselves from threats. The cognitive processes are (a) perceived severity and susceptibility, and (b) perceived self-efficacy and response efficacy.

While PMT can be used to identify factors that may influence how individuals respond to a message about potential hazards or threats (American Public Health Association [APHA], 2005), it is best at depicting adaptive and maladaptive coping with a health threat. Health workers use PMT to determine the motivations a person may have to protect themselves against a health threat while complying with the recommended standards (Sutton, 2002).

Figure 1 depicts a modification of Roger's (1983) PMT model of the relationship between threat appraisals (perceived severity and susceptibility) and coping appraisals (perceived self-efficacy and response efficacy). PMT objective is to create intentions to adhere to universal precautions that will allow for behavioral changes of EMS workers in reducing the risk of an occupational exposure to a bloodborne and airborne pathogens. As an example of severity of threat is (a) bloodborne and airborne pathogens can make

the EMS workers sick; (b) perceived susceptibility is EMS workers are at risk of an occupational exposure because of their behaviors of noncompliance with universal precautions; (c) perceived response-efficacy is EMS workers avoid and reduce the risk of an occupational exposure; (d) perceived self-efficacy is EMS workers have the knowledge, educational training, and the ability to engage in the recommended compliance protocols with universal precautions.

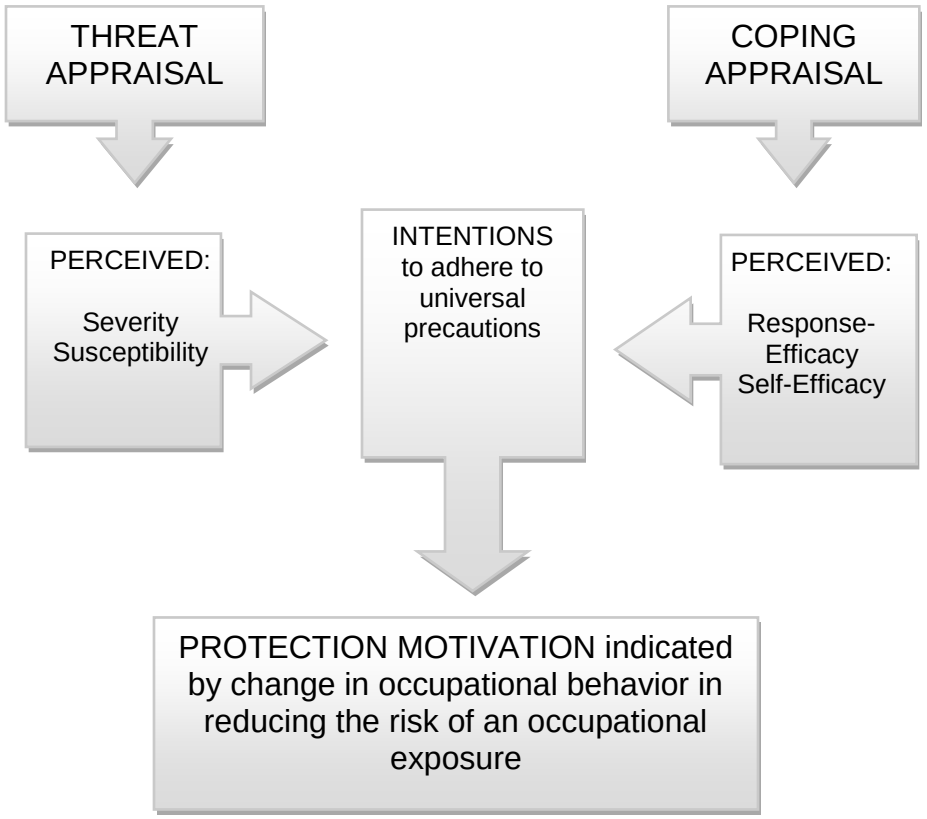


Figure 1. Protection motivation theory model applied to compliance and utilization of universal / standard precautions in reducing the risk of an occupational exposure to bloodborne and airborne pathogens.

According to Rodgers (1975), fear affects health attitudes and decision to implement protective health behaviors. EMS workers' motivations or intentions to protect themselves from any occupational exposure may be enhanced by four critical cognitive processes or perceptions: (a) the severity of the threat risk, (b) their personal vulnerability to the threat risk, (c) EMS workers' confidence in their ability to cope with the threat and implement preventive behaviors using universal precautions and, OSHA and CDC standards (i.e., self-efficacy), and (d) EMS personnel's ability to reduce the risk of transmission of an infectious disease due to an occupational exposures-such as response-efficacy (Maddux & Rogers, 1983; Rogers, 1983). In general, EMS workers' intentions to perform a behavior related to their attitudes about occupational exposures to bloodborne and airborne pathogens will be measured by using PMT.

Decreasing the risk of occupational exposures to infectious disease and pathogens is a health goal for EMS personnel. However, several characteristics and influencing factors may affect the attitude and health behavior of EMS workers. According to PMT, people make rational decisions based on the systematic use of available information and also consider the implications of actions before engaging in the behavior (Kretzer & Larson, 1998; Maskerine & Lobe, 2006). A behavior will lead to positive outcomes, such as adherence to universal precautions, OSHA and CDC compliance(s), and recommended precautions for preventing the transmission of infectious diseases in EMS workers.

PMT involves two processes, a threat appraisal and a coping appraisal. The threat appraisal process includes: (a) EMS personnel's perception of the severity of a potential occupational exposure to a bloodborne and airborne pathogens (perception of how severe

the risk of a threat is to their health), and (b) perceived vulnerability or susceptibility to harm from an infectious disease susceptibility of EMS personnel are to contracting an infectious disease (Floyd, Prentice-Dunn, & Rogers, 2000; Plotnikoff & Higginbotham, 2002, 1998; Prentice-Dunn & Rogers, 1986; Tanner, Day, & Crask, 1989). A coping appraisal process involves EMS personnel's perception of how complying with occupational standards of CDC and OSHA to practice universal precautions can reduce and prevent the risk of contracting an infectious disease (CDC, 2012, 2009, 2006; OSHA, 2012). It also includes the perception of how likely a person is to perform universal precautions, their perception, and their abilities to follow the recommended universal precautions and standards (Christakou & Lavallee, 2009).

Some form of occupational risk information about bloodborne and airborne pathogens can provide the impetus for EMS workers to determine the degree of risk severity, their vulnerability, and their ability to reduce as well as prevent the risk of exposure. When EMS workers perceive a threat of an occupational exposure, they are afraid enough of the negative consequences to avoid the threat.

PMT has been used for examining health threats while influencing health-related intentions and behaviors to further prevent health problems from occurring. Floyd et al., (2000) and Milne et al., (2000) used the PMT model as the basis for their theoretical framework. Floyd et al. investigated 65 relevant studies involving approximately 30,000 racial and ethical diverse participants and showed that the PMT model can be useful in understanding and predicting health behavior changes. In addition, Milne et al. (2000) studied 27 studies with, 8,000 participants and found a significant correlation in the

measuring of the PMT variables in the prediction of health-related intentions and behaviors. PMT has been shown to aid in the prevention of diseases or health issues as well as in examining the change in behaviors that may motivate individuals to act in a way that will lead to the implementation of preventive behaviors to reduce the risk of diseases.

PMT has been used to address multiple health-related behaviors and public health issues that range from (a) antismoking, (b) nutrition, (c) reducing alcohol consumption, (d) enhancing life styles, (e) diagnostic health behaviors, (f) exercise, (g) diet, (h) sexual behaviors, (i) coronary heart disease, (j) asthma, (k) fetal alcohol disorder, (l) living wills, (m) physical therapy, (n) rehabilitation, (o) breast cancer screening, (p) skin cancer, (q) advertising, and (r) emergency disasters. The PMT has been used as a structural theory for influencing health behaviors through health education interventions, in particular, sexually transmitted diseases and condom use. Abraham et al., (1994) used PMT to investigate perceived susceptibility and severity of a threat of HIV amongst teenagers. Additionally, Abraham et al., examined the teenagers' risk of acquiring HIV due to their sexual risk-taking behaviors, such as; several sexual partners and the lack of using condoms (Abraham et al., 1994). Abraham et al. used the framework of PMT to establish a correlation between adaptive cognitions, maladaptive cognitions, coping and threat appraisals, and previous sexual experience in regards to sexual risk-taking behaviors (preventive behaviors such as condom use). Abraham et al. did not specify all the variables of PMT, such as; self-efficacy measures in relation to reducing the number of sexual partners and condom use with the intention of preventing the spread of the HIV

infection. Others researchers have used the PMT framework and characteristics of sexual behavior for research, such as: unprotected sex (Block & Keller, 1998), condom use, and HIV/AIDS (Lwin et al., 2010; Umeh, 2004), and AIDS and multiple sex partners (Van der Velde &Van der Pligt, 1991). Abraham et al. substantiated that the PMT framework and its variables are an adequate predictor of preventive health intentions (HIV-preventive intentions) and expectations through health education. The PMT model is an effective model for health education training. According to PMT, certain coping mechanisms do not weaken an individual's readiness to take preventive actions, and motivates protection from sexual transmitted diseases. As it pertains to occupational exposures in EMS workers and compliance to universal precautions, PMT will be useful in studying EMS workers' perceptions that contribute to their intention to change their work behaviors.

PMT has also been used in examining motivation to exercise as it pertains to coronary artery disease (CAD) or coronary heart disease (CHD). The two medical terms are often used interchangeably. CAD, the narrowing of the arteries of the heart; is the leading cause of mortality for men and women in the United States (CDC, 2009). Regular exercise and physical activity is used in the prevention of a number of health problems, as well as reducing the risk of CAD. Tulloch et al. (2009) used the tracking exercise after cardiac hospitalization (TEACH) study from three tertiary care hospitals in Ontario, Canada to recruit the participants. Tulloch et al. was able to recruit the 878 participants at hospital discharge who completed a questionnaire regarding their intentions to exercise after discharge and the benefits thereof. Tulloch et al. included the

dimensions of threat appraisal (perceived susceptibility and severity), coping appraisal (self-efficacy and response-efficacy), exercise intentions (short-term and long-term), and exercise behavior and expanded to motivation, confidence, early planning, and structural equation modeling. The results of this study suggested short-term use of PMT had an impact on enhancing exercise objectives and behaviors outcomes in the early stages of recovery for cardiac patients (Tulloch et al., 2009). The flexibility of the PMT has allowed several researchers (Fruin et al., 1991; Milne et al., 2002; Norman et al., 2005; Plotnikoff & Higginbotham, 2002, Plotnikoff & Higginbotham, 1998; Stanley & Maddux, 1986; Tulloch et al., 2009; Wurtele & Maddux, 1987) to use PMT as a determiner for motivation to exercise as well as prediction of exercise.

The PMT has not only been used by researchers in the prevention and intervention of diseases or health issues, but has also been used to examine attitudes and life styles that may contribute to a disease or health condition. Baghianimoghadam et al., (2011) evaluated the significance of the variables within the PMT to sun tanning behaviors in female high school students living in Iran. Sunburn places individuals at risk for melanoma, the most dangerous and lethal type of skin cancer (CDC, 2007; NIH, 2012). McClendon and Prentice-Dunn (2001) stated that, although skin cancer is the most curable and preventable cancer of all cancers, it continues to increase annually in the United States. Individuals who are at risk, such as children are three times more susceptible to skin cancer than adults due to overexposure to the sun (Baghianimoghadam et al., 2011). Baghianimoghadam et al. developed a self-report based upon the PMT variables and divided the participants into two groups, a case and a control group

(*n*=360). Baghianimoghadam et al. found that the PMT framework was successful in helping the participants recognize the seriousness and the danger of being diagnosed with skin cancer and to take effective intervention measures to reduce their risks. Education regarding sun protection can lead to attitude and behavior changes concerning sun exposure (Baghianimoghadam et al., 2011). Baghianimoghadam et al., demonstrates that PMT can be used to prevent sunburn and reduce the risk of the skin cancer. Through education and influential communication, PMT allows individuals to recognize a health threat and proposes a way to change and increase healthy behaviors.

Homeowners use a form of PMT in protecting themselves from human created and natural occurring risks. Bender, Martin, and Raish (2006) conducted a study using the PMT as its framework to investigate homeowners' safety and perceptions of wildlife fires. Bender et al. used a sample of (*n* = 238) homeowners who resided in wildlife urban interface areas in three small communities in Colorado and Oregon. Bender et al. mailed out surveys about homeowners' preparedness and safety in the event of a wildland fire. Before mailing out the surveys, Bender et al. interviewed a focus group to learn about the history of these communities and their experiences in protecting themselves and communities from wildfire risk in wildlife urban interface. In the survey were two 7-point Likert scales questions centered on the risk perception of the PMT measurements. Bender et al. demonstrated that homeowners were motivated by perceived susceptibility and perceived severity of the wildfire risk. Additionally, Bender et al. revealed the importance of response-efficacy and self-efficacy factors influencing behavior intentions to reduce wildfire risks. Bender et al. used PMT to encourage individuals to avoid not

only health risks, but social risks as well. Using this concept to motivate risk reduction behaviors in EMS workers can be beneficial to the individuals socially and personally.

PMT has been applied in the area of health behavior change, particularly with exercising, sexually transmitted diseases, cancer screening and smoking cessation; however, researches haven't applied the PMT framework / variables to explain EMS workers' health risks of an occupational exposure to infectious diseases and their behavior to change and reduce such risks. As it pertains to perceived severity, perceived vulnerability and use of universal precautions (OSHA, NIOSH, CDC, and International Association of Fire Fighters [IAFF] occupational exposure standards), little research has been conducted on using the PMT as a theoretical framework. Because compliance with universal precautions is also a health- related behavior, PMT could be applied to EMS workers' behavior and attitude in regards to occupational exposures to bloodborne and airborne pathogens. PMT is applied to EMS workers' compliance with OSHA, CDC, ATFF, and NIOSH safety practices, as well as universal precautions. EMS workers might be motivated to change their attitudes and behaviors if they suspected that current practices and behaviors posed a threat of an exposure. Changes in behavior and work ethics would decrease their perceived severity (an occupational exposure to an infectious pathogen can make an individual sick), perceived susceptibility (EMS workers' perception of experiencing a transmission of an infectious disease as a result of their non-compliant risky work behaviors), response efficacy (EMS personnel can avoid getting infected and protect their health), and self-efficacy (EMS workers have the ability to engage in the recommended behaviors). EMS workers must perceive that their current

noncompliant practices, attitudes, and behaviors are an occupational health risk, and believe that universal precautions and standards would be beneficial to their health and motivation to protect them from an occupational exposure.

Risk of an Occupational Exposure / Transmission

Transmission of and exposure to bloodborne and airborne pathogens as well as other infectious diseases in the workplace, have been established as an occupational risk for EMS workers. Infectious disease transmission in healthcare sectors is through contact, droplet and airborne (CDC, 2013; Dietchman, 2000; IAFF 2011; NFPA 2010). Working in the pre-hospital environment and the conditions in which emergency care service to the public is rendered puts EMS workers at an increased risk for occupational exposure and occupationally-acquired disease transmission. Emergency medical care and treatment at the scene could involve extrication, inserting an intravenous line, intubation, and blood drawing in poor lighting with a bleeding patient (Association for Professionals in Infection Control and Epidemiology [APIC], 2013; NFPA, 2010; OSHA, 1998). While caring for the sick or injured in an emergency medical setting, EMS workers almost never know the infectious disease status of a patient, which may pose a risk to the EMS workers' health.

An occupational exposure may occur from the source patient's contaminated blood or bodily fluid through a needlestick; a cut from a sharp object; contact with a mucous membrane or non-intact skin; or splash or spray contact to the eyes, nose, mouth or broken skin. In addition, the risk of an occupational bloodborne infectious disease transmission from exposures has much to do with the source patients' titer level of a

virus, the time interval, and the amount of blood or body fluid exposed to during the incident, (Cardo& Bell, 1997). The airborne pathogen that is most commonly involved in occupational transmission is the Mycobacterium bacterium that causes TB. Bloodborne viruses that are most commonly involved in occupational transmission are HIV, HBV, and HCV (Beltrami et al., 2000).

CDC (1994) initially established guidelines in concerning air borne exposure to TB for health care facilities. OSHA (1997) proposed rules 62:54159-5403 regarding occupational exposure to TB but withdrew the rules in 2003 due to the rule ineffectiveness in reducing the transmission of TB. OSHA (2003) then proposed new rules 68:7577-75775 in health care settings for health care workers that experienced an occupational exposure to TB. The new rule(s) provided a more meaningful reduction of TB transmission in the event of an occupational exposure (Department of Labor, OSHA, 2008).

Exposure to TB in the health care setting is a documented occupational hazard. Although the rates of TB have been declining, there are certain geographic populations such as poor indigents, homeless, international travelers, immigrants, nursing home patients, institutionalized patients, prisoners, and individuals living in deprived economical urban areas due to several social and health conditions that are at an increased risk for TB (IAFF, 2001). EMS workers provide pre-hospital emergency services to all of these populations and are at risk for an occupational exposure to TB. EMS workers are in close proximity with patients for a prolonged period of time while providing care to these individuals in a small, closed-in space of their home or on the

back of an ambulance during transport to a health care facility, which can increase the risk of transmission in an EMS worker (CDC, 2005). The likelihood that the transmission of TB in an EMS worker will occur depends predominantly on the concentration of infectious droplet nuclei in the air and the duration of exposure (Hoffman, 2011).

The transmission of infectious diseases in healthcare workers due to occupational health exposures to bloodborne pathogens has been documented. Through 2001, 57 health care workers were known to have become infected with HIV through occupational exposure with 56 documented cases seroconversion (CDC, 2001). Another 138 HIV possible transmissions occurred in health care workers with a history of occupational exposure but without a documented seroconversion following occupational exposure to infectious blood and body fluids (CDC, 2001). Moran (2000) noted that seroconversion can occur within 6 to 12 weeks, while Rupp and Christensen (2008) reported 2 to 6 weeks following an initial occupational exposure to HIV. Moreover, the risk of infection from a single occupational exposure to a person known to be HIV positive is 0.3 % or 3 in 1,000 and after mucous membrane exposure, the risk is approximately 0.09% (CDC, 2008, 2005, 2001; IAFF, 2004; Rupp & Christensen, 2009). Additionally, after an occupational exposure, the risk of infection of HCV is 1.8% and for HBV the risk is 6%-30% and 23%-62% depending on the Hepatitis B antigens (Askew, 2007; Boel et al., 2008; CDC, 2005, 2008, 2011; Harris et al., 2010; Rupp & Christensen, 2008). After an occupational exposure there is a potential risk of transmission of HBV, HCV, and HIV diseases in EMS workers.

HIV transmission is not the only risk an EMS or health care worker faces through occupational exposures. The CDC (2010) calculated that in 2009, 19% of EMS workers treated for an occupational illness or injury were due to harmful exposures such as potentially infectious materials. The IAFF (2000) reported that 53 professional fire fighters died as a result of occupational diseases directly related to fire fighting and 3.8% of those 53 fire fighters deaths were caused by infectious disease. One in 50 was exposed to a communicable disease with 96.2% of these exposures occurring at the scene of an emergency incident (IAFF, 2000). In addition, the percentage of fire fighters exposed to Hepatitis A was 0.3%, Hepatitis B was 5.0%, Hepatitis C was 10.2%, HIV/AIDS was 8.6%, TB was 29.8%, meningitis was 10.6%, blood/bodily fluids was 16.1%, and other diseases was 19.4% (IAFF, 2000). The IAFF also reported that a result of an occupational exposure to bloodborne and airborne pathogens, 9.1% of fire fighters were forced to retire early. The duties of EMS workers' place them at an inherent risk for an occupational exposure. There is a need for continued education, universal precautions, standard protocols, and compliance in EMS workers in order to prevent occupational exposure to bloodborne and airborne pathogens.

Blood and body fluid exposures as well as needlesticks and sharp-object injuries are being examined for health care workers working in state hospitals. According to the University of Virginia (2011), 20 categories of healthcare workers reported exposures to blood and body fluid. Nurses (44.3%) had the most exposures and then paramedics (2.3%). The source patient was identifiable 93.8% of the time and blood or blood products (73.8%) were involved in the exposures with direct patient care (58.7%). A

large percentage of the needlestick exposures involved injection, intramuscular-subcutaneous (30.5%) as the intended use of the needle (University of Virginia, 2011). Needlesticks or a bloodborne exposure is likely to occur in the health care work environment. Health care workers including EMS workers must be trained by their employer on appropriate and safe work practices, applicable engineering controls, and the proper use of personal protective equipment in order to reduce and prevent such exposures.

Needlesticks and injuries from contaminated sharps pose a risk of exposure to potentially infectious pathogens for EMS workers and other health care workers. The Needlestick Safety and Prevention Act (2002) became effective in response to such injuries and newly developed equipment. Soon after, NIOSH revised their blood borne pathogen plan based on the Needlestick Safety and Prevention Act. Over 800,000 occupational needlestick injuries occur each year in health care workers (Askew, 2007; OSHA, 2001; Peate, 2001). Some exposures to needlesticks occur due to incorrect use of needles. However, others are accidents. Nevertheless, needlestick injuries can be prevented and reduced if standard precautions as well as OSHA, CDC and NIOSH guidelines are followed.

There are several other factors that influence the risk of an occupational exposure to an infectious disease in EMS workers. To determine the risk and estimate the risk of exposure to blood, Leiss (2009) conducted a survey study assessing the level of blood contact with non-intact skin in U.S. paramedics. Leiss found that if the proper personal protective equipment (PPE) was provided to the paramedics and if management would

have spoken to their employees regarding CDC's Universal Precautions and OSHA's Bloodborne Pathogens Standards, there would have been a decrease in the risk of occupational exposures. In addition, Leiss documented that over a year, the risk of non-intact skin blood occupational exposures was 8.7% due to supervisors' behaviors for not promoting safe working habits and limiting the provision of PPE to the paramedics during work. Providing the proper PPEs and supervisory behaviors to reinforce safe work practices can decrease the risk of an occupational exposure to an infectious disease.

Knowledge of Compliance

Despite OSHA's Bloodborne pathogens Standards, CDC Universal Precautions, other governmental agencies, and existing infection control protocols; noncompliance remains to be a problem. Stein, Makarawo, and Ahmad (2003) investigated doctors' and nurses' attitudes about infection control guidelines and compliance with the Department of Health Universal precautions in three teaching hospitals in the United Kingdom. Using a 13 item cross-sectional survey in the form of a Likert scale and multiple choice questions questionnaire, Stein et al., measured work practice, behaviors and attitudes concerning compliance with Universal Precautions, knowledge of transmission of blood borne pathogens, and history of occupational exposures. Stein et al. indicated that there was a lack of knowledge regarding compliance with universal precautions to reduce the risk of an occupational exposure to blood borne pathogens. Although the nurses displayed a much better attitude than the doctors, Stein et al. found that all participants' attitudes were poor when it came to compliance, hand hygiene, needlesticks, and reporting occupational exposures. Education and improvement in infection control

practices is necessary to change the attitudes of the nurses and doctors regarding compliance to universal precautions (Stein et al., 2003).

Knowledge level and adherence of using standard universal precautions varies among health care workers. Askarian et al., (2011) found that nurses, physicians, medical students, and nursing students had low knowledge and awareness regarding seroconversion rate of bloodborne pathogens after an occupational exposure. Although the health care workers in this study had some knowledge of the transmission of bloodborne pathogens and infectious disease with an attitude to practice universal precautions during patient care, their behaviors did not reveal their knowledge of an occupational risk to infectious diseases. Education and training should be reinforced as an important means of compliance to OSHA's and CDC's standard /universal precautions in the daily duties of health care workers to reduce the risk of an occupational exposure to an infectious disease.

Not enough is known about compliance and noncompliance of universal precautions among EMS workers. Harris and Nicolai (2010) used a convenience sample of EMS providers *(N*=311*)* to determine their knowledge of and compliance with universal precautions when at risk for an occupational exposure. Harris and Nicolai distributed questionnaires to five different certification levels of EMS providers in the state of Virginia: first responders, EMT-basic, EMT-cardiac tech, EMT-shock trauma and EMT-paramedic. Knowledge level of compliance and universal precautions were inconsistent among the EMS providers (Harris & Nicolai, 2010). Harris and Nicolai found that all of the EMS providers admitted to appropriate glove use 100% of the time.

However, placement of needles in puncture resistant containers and use of protective eyewear ranged from 71% to 100% depending on the certification levels, types, and duties of the EMS providers. There is a lack of overall compliance with universal precautions and inconsistency in using precautions in an effort to reduce the risk of an occupational exposure and the transmission of infectious diseases. There is a need for further research concerning compliance with universal precautions in EMS workers.

Various researchers have stressed that health care workers' compliance with universal precautions is inadequate. Gammon et al., (2008) reviewed a total of 51 research articles concerning evidence for substandard compliance with universal precautions among health care practitioners. Most of the researchers indicated that overall compliance was unacceptably low and personal protective property was not used appropriately while caring for patients. Compliance to specific aspects of universal precautions included handling needles, disposal of needles and gloves, wearing gloves, use of gowns/aprons, hand washing / hand hygiene, and eye protection/ mask (Gammon et al., 2008). Education increases the knowledge of universal precautions with the intention to improve compliance; Gammon et al. suggested that the application of behavioral change models may warrant a more permanent solution. Several behavioral change models have been applied to incorporating change in individuals regarding their health and have been proven to be successful in improving the individual's health. Applying the same behavioral change models to improve compliance with universal precautions in health care practitioners can contribute to improvement in practice.

An occupational exposure to an infectious disease may result from health care workers' failure to comply with universal precautions. Physicians are a subgroup of heath care workers that are at risk for an occupational exposure to blood and body fluids while caring for patients. Jawaid et al., (2009) investigated physicians working in tertiary care teaching hospital knowledge, attitudes, and compliance with universal precautions. More than half of the physicians (52.5%) in this study knew nothing about CDC's universal precautions, whereas 40% had some knowledge of the standards. Surveys were collected from 120 physicians, 72 interns (60%), 41 residents (34%), and seven consultants (5.8%). Nelsing et al. (1997) surveyed Danish physicians regarding noncompliance with universal precautions and the risk associated with an occupation exposure to blood. The group of Danish physicians' compliance with universal precautions was unacceptably low. Jawaid et al. established that the knowledge of compliance with universal precautions among physicians working in a tertiary care teaching hospital was inadequate. Compliance is associated with the evading of an occupational exposure to blood and other body fluids and should be used by all health care workers at all times. Physicians are not an exception to the infection control standards and universal precautions.

In other countries, health care workers are also confronting knowledge, attitudes, and compliance with universal precautions. In study conducted in Chandigarh India, health care workers in the obstetrics and gynecology wards were noncompliant because they never used their personal protective equipment: double gloves (6%), apron / gowns (13.3%), shoe protectors (61.2%), and face shield / protective eye wear 64% (Dhaliwal et

al., 2011). Reasons for not wearing the proper personal protective equipment with universal precautions included inconvenience, time constraints, no availability of personal protective equipment, and assumption that the patient(s) were not infected. These reasons for noncompliance have been documented by Gammon et al., (2006). Although researchers have suggested that compliance with universal precautions is below the standard, Dhaliwal et al. (2011) indicated that there was a fair level of knowledge about universal precautions among the 217 health care workers in this study. In other words, the health care workers on the wards were lacking information and education on the importance of using their personal protective equipment in order to prevent exposure to infectious pathogens.

Many researchers have highlighted that different sub-groups of health care workers' compliance with universal precautions and other infectious control standards are generally inadequate and unacceptable. In addition, educational interventions to improve compliance are insufficient. Health care workers (doctors, nurses, laboratory technicians, EMTs, paramedics, medical students, nursing students, respiratory therapist, and others) are all at risk for an occupational exposure to bloodborne pathogens while performing their clinical duties. The transmissions of bloodborne and airborne pathogens in the health care occupations are associated with failure to comply with recommended infection control precautions (Hoy & Richmond, 2011). Although the majority of health care workers know that proper personal protective equipment (mask, goggles, gowns, apron, gloves, and protective shoe wear) must be used appropriately and compliance is

mandated when there is a potential risk of exposure, compliance with the use of personal protective equipment is relatively low.

Statistics regarding health care workers' perceptions of an occupational exposure, risk of acquiring a bloodborne or airborne infection, compliance with universal precautions, and reporting an exposure are remarkable. Universal precautions are designed to protect all health care workers and those in collaboration with health care services. According to OSHA (2001) and CDC (2009), universal precautions are a system of infectious disease control in which a patient's blood and some body fluids are treated as if they are infectious for bloodborne pathogens. Health care workers should treat all patients as if they have an infectious disease and, accordingly, should adhere to CDC, NIOSH, OSHA, and NIH recommended precautions, needlestick preventions, infection control procedures, and standards. Compliance with universal precautions and other infection control standards reduces the risk of transmission of an infectious disease and contributes to the reduction of an occupational exposure to an infectious pathogen.

Factors Influencing Decision-making

The working environment of an EMS worker is a distinctive, multifaceted, emergent, and dynamic environment. In such environments, EMS workers are required to make critical decisions under pressure and with of uncertainty where all the facts are not known (Laxmisan et al., 2007). While initiating on-scene emergency care to patients, EMS workers are not always focused on the risks of an occupational exposure and not consistently using universal precautions to reduce their risk of an infectious disease.

Consequently, decisions are quickly changing as they are being made due to an environment of uncertainty (Smith et al., 2006).

The scope of practice for EMS workers has steadily progressed to include increasingly complex interventions in the prehospital setting, which can have implications on the outcome of EMS workers' and the patient's health. Approximately 20 million people each year in the United States are treated by EMS workers (National Highway Traffic Safety Administration [NHTSA], 2007, p. #4). For a variety of reasons, it is important that workers assume all patients to be infectious and all contact with blood or potentially infectious body fluids should be avoided; workers must also wear proper personal protective equipment (Mathews et al., 2008). EMS workers that are aware of the risks for an occupational exposure to bloodborne and airborne pathogens and have had adequate training /education regarding the proper use of personal protective equipment still make decisions not to comply with universal precautions. Because decisions are made under limited time constraints, in moving ambulances / rescue vehicles with restricted spaces, EMS workers are possibly underestimating their risk for an occupational exposure to an infectious disease.

The compliance of universal precautions remains the primary means of preventing an occupational exposure to bloodborne and airborne pathogens. The knowledge and level of practice of universal precautions by EMS workers may differ from one type of EMS worker to another. According to Smith et al., (2006), the level of expertise influences the decisions made and how fast and accurate the decisions are made. Harris et al., (2010) reported that more highly trained EMS workers were inclined to correctly

use precautions in diverse work settings. The number and types of decisions are related to work environment, perception of clinical role, and operational autonomy (Thompson et al., 2004).

Making quality decisions regarding compliance with universal precautions is an essential component of good clinical practice and demonstrates knowledge. A lack of knowledge concerning an occupational exposure can lead to inappropriate decisions, substandard use of universal precautions, and insufficient use of infection control strategies to prevent occupational exposures. Knowledge of factors associated with compliance helps to explain why health care workers occasionally display inadequate compliance (McGovern et al., 2000). Use of a behavior change model may be used to help promote the health care workers' behavior that would positively influence compliance and result in adherence to universal precautions by affecting change in the attitudes and beliefs of the health care workers (Gammon et al., 2007, p. 165). In order to be effective, efforts to encourage appropriate decision-making strategies and improve compliance to universal precautions must be reinforced through educational interventions and infection control training in any health care setting.

Variables Impacting Compliance

A variety of factors have been found to influence compliance with universal precautions in the prevention of occupational exposures to infectious diseases. Social, economic, culture, physical, environmental, lack of knowledge, lack of time, forgetfulness, lack of means, negative influence of the equipment, skin irritation, lack of training, distance to necessary equipment or facility, self-efficacy, and conflict between

the need to provide care and self-protection are factors that can influence or control compliance with universal precautions (Efstathiou et al., 2011). Efstathiou et al. used a focus group of nurses and most nurses' perceptions were in an emergency situation, they would be more concerned about saving the patient's life than using proper personal protective equipment. For some nurses, there is a lack of availability of the personal protective equipment, and PPE interfered with providing care and is a discomfort to the patients (Efstathiou et al., 2011; Lynn et al., 1999; Picheansathian, 1995; Williams et al., 1994). Efstathiou et al. (2011) claimed that the nurses stated that they were too busy and, did not have enough personnel to implement PPE. Participants also claimed that the physician's influence, working experience, and the time consuming implementation of universal precautions were factors that prevented the use of their PPE. These all have been documented as factors that negatively influence nurses' compliance with universal precautions.

General self-efficacy and knowledge of compliance with universal precautions exerts a positive impact on compliance. Luo et al. (2010) found that these factors reduced the risk of an occupational exposure in the health care staff. Luo et al., found that standard precautions training and knowledge, presence of a sharps disposal box in the department, hospital grade, stock irregularity, gloves not available at the emergency sites, reduction of tactile sensation, general self-efficacy, exposure to patients, and department in which the nurses work were factors that impacted compliance with universal precautions. Although schools and hospital neglect professional protection education, administration should focus on comprehensive compliance monitoring with

proper universal precautions training. Through learning, knowledge and skills can be attained to strengthen the health care workers' health concepts, beliefs, and attitudes to provide greater compliance with universal precautions.

Over time, the risks of an occupational exposure to bloodborne pathogens through percutaneous injuries have increased for health care workers. Osborne (2003) conducted a study regarding the outcome of nursing compliance with universal precautions in the operating rooms in Australia. Osborne supported previous research that there is less than 100% compliance rate with universal precautions in health care workers. Precautions were based on the operating room nurses' perceptions of risk, severity, benefits, and barriers which were influential in impacting improvement of compliance with universal precautions in the operating room. Godin et al. (2000) reported that perceived barriers and personal normative belief were two of the most important factors impacting compliance and intentions to use universal precautions in the clinical setting. Nevertheless, education is essential in acknowledging these perceptions to increases nurses' adherence to universal precautions and reduces risks of an occupational exposure.

Factors affecting compliance with universal precautions in preventing an occupational exposure varies with each study. McGovern et al. (2000) determined that workers with a longer tenure in their job, increased knowledge of HIV transmission, a conservative attitude toward risky behaviors, a perception of a strong organizational safety climate and having had some training in the use of personal protective equipment are more likely to comply with the required precautions. Health care workers' behaviors

were assessed for compliance with universal precautions as independent and dependent variables. Independent variables were specific to the use of personal protective equipment, wearing gloves, disposal of sharp objects properly, hand washing, and no recapping of needles. Dependent variables included personal traits, demographics, knowledge, perceptions and attitudes, job characteristics, workload, cognitive demands, safety climate, training, and availability of personal protective equipment. Compliance varied in each health care workers' behavior as such that work tenure were 1.7 times more likely to comply with universal precautions, knowledge of transmission were 1.6 times more likely, attitudes toward risky behaviors were 1.9 times more likely, perception safety climate were 2.9 times more likely, and training regarding personal protective equipment were 5.7 times more likely to comply with universal precautions (McGovern et al., 2000). McGovern et al. found that risk management administration need to continue to work closely with hospital administration to facilitate a compliant and institutional safe climate. This research is an indication that workers with more experience, education, and training have are more apt to comply with universal precautions and reduce occupational exposures to bloodborne and airborne pathogens.

Summary

Researchers have indicated the importance of compliance with measures that prevent the risks of an occupational exposure to bloodborne and airborne pathogens, including preventing the transmission of such infectious diseases. PMT was used as the theoretical framework for this study. According to PMT, EMS workers can acknowledge

their risk of an occupational exposure, their readiness to change, and be motivated to protect themselves from an occupational exposure to an infectious disease.

EMS workers are at increased risk to endure an occupational exposure to bloodborne and airborne pathogens. These occupational exposures often place EMS workers at an occupational risk for acquiring an infectious disease such as HBV, HCV, HIV, and TB. Throughout the reviewed literature, researchers found that enforcing compliance of OSHA, CDC, NIOSH, and other governmental agencies rules and regulations was important for the prevention of bloodborne and airborne occupational exposures. EMS employers need to educate, implement, and maintain infection control programs. These programs should include annual education about occupational exposures that can lead to the transmission of bloodborne and airborne infectious diseases. Occupational exposure reporting, pre and post exposure prophylaxis, treatment, and follow-up were found to be significant in an infection control plan for EMS workers if an exposure were to take place. Regardless of the CDC, OSHA, ATFF, NIOSH, and NFPA recommendations and guidelines for the prevention of an occupational exposure to blood- borne and airborne pathogens, no researchers have shown the number of exposures, knowledge of compliance with universal precautions, or current transmission of infectious diseases due to occupational exposures in EMS workers, nor statics regarding the lack of compliance in this subgroup of health care workers. Compliance with all of the above mentioned agencies are necessary to preventing transmission of infectious diseases.

Chapter 3: Research Method

Introduction

While providing prehospital care, EMS workers in Miami-Dade County may be exposed to a higher number of bloodborne and airborne pathogens than any other county in the state of Florida (FDOH, 2013). Miami-Dade County, Florida, has an estimated population of 2,591,035 with a land area of approximately 1,807.72 square miles (United States Census Bureau, 2012). According to the FDOH (2011), in 2010, Miami-Dade County had a total of 470,647 EMS incidents, the highest in the state of Florida. The total number of incidents in the state of Florida is defined as the total number of EMS events that were submitted by each licensed EMS provider (FDOH, 2011). These findings indicate that there is more of an opportunity for an occupational exposure to an infectious disease in EMS workers in Miami-Dade County than any other county in the state of Florida. EMS workers in Miami-Dade County encounter more patients and incidents with a population that has the highest number of cases of HIV/AIDS and Chronic Hepatitis C, ranked fifth for the most TB cases, and sixth for the most Hepatitis B cases in the state of Florida (FDOH, 2013).

In this chapter, I described the methodology used in the research to evaluate the knowledge of universal precautions, levels of compliance, attitude, and risks of occupational exposures to bloodborne / airborne precautions of Miami-Dade County EMS workers towards universal precautions. This chapter is an outline of (a) the research design, (b) the population, and sampling along with sampling procedures, (c) procedures for recruitment participants, (d) data collection, (e) procedures for recruitment

and participants, (f) instrumentations and materials, (g) survey instrument, (h) study variables, (i) threats to validity, (j) ethical procedures, (k) inclusion and exclusion criteria, (l) data collection, and (m) data analysis. I obtained estimates of compliance with universal precautions, knowledge of universal precautions, and occurrence of occupational exposures to bloodborne and airborne pathogens in EMS workers. The study will provide useful information for the EMS groups implementing educational and training programs to improve compliance with universal precautions and reduce risk of occupational exposures and transmission of infectious diseases.

Research Design

The research design chosen for this study was a cross sectional study design using quantitative approaches. The quantitative research design is the most appropriate method used in this study to assess EMS workers knowledge of compliance with universal precautions. Also, this research design was helpful in the evaluation of occupational exposures to infectious diseases. The design allows for an assessment of the relationship between occupational exposures to infectious diseases and knowledge of compliance with universal precautions among EMS workers (fire and non-fire service) in Miami-Dade County.

The purpose of this quantitative cross sectional study was aimed at utilizing a survey based on the PMT theoretical framework for data collection. Through the literature review, I established that PMT has been used to promote positive health behaviors and can be used as a framework for influencing and predicting various health behaviors. The cross sectional design will assist in examining the relationship between:

(a) the variables, (b) compliance behaviors, (c) knowledge of universal precautions, (d) attitudes regarding occupational exposures, (e) risk factors, and (f) outcome of interest of a sub group of EMS workers (Levin, 2006).

Cross sectional study design takes less time, is conducted over a short period at one point in time, is inexpensive, and appropriate for the purpose of the study (Frankfort-Nachmias & Nachmias, 2008, pp. 116-118). Surveys are a quick and inexpensive way of collecting statistical data and information for research, prevention, and health education. A cross-sectional survey instrument was chosen to collect data evaluating the frequency of occupational exposures to infectious diseases, potential risk factors, and the assessment of attitudes and knowledge of compliance to universal precautions among EMS workers at the time of the study with no loss to follow-up. A disadvantage or weakness of a cross-sectional survey design may involve a potential bias due to nonresponses and the inability to measure occurrences within the study population (Barratt & Kirwan, 2009).

A self-administered survey questionnaire was used to gather reliable and unbiased data from a representative sample of the participants in this study (Burn et al., 2008). A self-administered survey questionnaire is (a) inexpensive, (b) can be dispersed in large numbers at once, (c) participants are assured obscurity and confidentiality, (d) does not allow room for interviewer mistakes, and (e) permits the researcher to collect data that can generate applicable percentages. A high response rate can lessen biases in the study. However, weaknesses of self-administered survey questionnaires can include bias in a

low response rate, error due to misinterpretation of the questions, skipped questions, and an incomplete survey.

Population and Sample

The population for this study is EMS workers currently working for a fire department or non-fire service ambulance company in Miami-Dade County Florida who are involved in patient care. EMS workers in Miami-Dade County Florida are the target population for this study, therefore, a sample was selected from the accessible population of current certified EMTs, paramedics, fire fighters, and first responders currently working for the six fire departments and six non-fire ambulance service departments. The sample at the time of this study included EMS workers currently licensed as a certified fire fighters, EMTs, paramedics, and first responders in Miami-Dade County Florida. EMTs, paramedics, and fire fighters must all attend an institution that is in compliance with the Department of Educations. In addition, all state certified EMS workers must pass practical training and a state written exam for certification per CHAPTER 401 Florida Statue 401.27 Personnel; standards and certification. The Florida Administrative Code (FAC) requires EMT-basic and EMT-Paramedic as per United States Department of Transportation (U.S. DOT) to obtain (a) certification licensure in advance cardiac life support (ACLS), (b) basic life support (BLS), and (c) continued education (CEUs) along with HIV, blood borne pathogens, infectious disease training upon recertification.

At the time of the study, there was approximately 3095 fire fighters, EMTs, and paramedics employed for the six fire departments and approximately 1020 EMS workers

employed for the six ambulance services incorporated in Miami-Dade County during this study.

The data for the population was obtained through the State of Florida Department of Health Bureau of Emergency Medical Services, Florida Emergency Medical licensed services and other providers' code list, Internet search, and telephone calls made to the different EMS departments providing emergency and non-emergency services to the communities in Miami-Dade County Florida. Participants were petitioned from the six fire departments and six ambulance services in Miami-Dade County and were sampled based on the availability, accessibility, and ease of their volunteering to take part in the research study. Table 1 displays the number of employees at the six fire departments and ambulance services.

Table 1

Groups of EMS workers (fire and non-fire service) in Miami-Dade County Florida

Fire departments	Number of fire fighters (Including EMTs and paramedics)
City of Hialeah Fire Department	263
City of Miami Fire Rescue	545
City of Miami Beach Fire Department	285
City of Key Biscayne Fire Rescue Department	35
Coral Gables Fire Department	129
Miami-Dade Fire Rescue Department	1838
Ambulance Service, Inc.	**Number of EMS Workers (Including EMTs and Paramedics)**
American Ambulance Response DBA AMR	Over 180
Florida Medi-Van Ambulance Service	50-99 as per supervisor
MCT Express, Inc. DBA Miami-Dade	240
Medi-Car Ambulance Service, Inc.	Unknown
Medics Ambulance Service (Dade) Inc.	Over 500 employees in the tri-county
Randle-Eastern Ambulance Service, Inc.	50-99

Sampling Procedures and Recruitment

A convenience sampling method was used for participation of EMS workers. A convenience sampling was used instead of a stratified random sampling because there is not a master database list of all EMS workers in Miami-Dade County Florida. However, I was able to over recruit to get an adequate sample that will be representative of the EMS population involved in the study. Participation includes two groups of EMS workers, fire service and non-fire service ambulance transport in Miami-Dade County. A list with the addresses for fire stations and ambulance companies were obtained along with the hours of operation. I was able to visit the fire stations as well as ambulance

transport facilities on an arranged date and time, introduce myself, explain the purpose of the visit, benefits of the study, and seek consent from participants for the study. Once an EMS worker had agreed to participate, a signed consent was obtained; an anonymous self-administered questionnaire survey was distributed to all volunteering participants. I was able to collect minimally de-identifiable information on refusers. I calculated the participation rate and examined whether participants or refusers are systematically different from one another in order to gauge the level of selection basis. No names were documented and no names were necessary for the participation of the study.

Sample Size

The minimum sample size for this study was established by using the z-test to specify a meaningful difference between two independent proportion groups (fire service group and non-fire service ambulance group) representing the proportion of EMS workers complying with universal precautions recommendations across two generic groups (Mish, 2008). Statistical power calculations were performed using G Power software application version 3.1. 7. Using an alpha level of 0.05 and with a sample size of 268 persons (or 134 persons / group) yielded 80% statistical power (1-ß) to detect a delta (difference) in the percentage of persons achieving a given outcome (e.g., compliance with universal precautions) of approximately 15% between any two comparison groups (e.g., 50% compliance in example fire service group vs. 35% in example non-fire service ambulance group).

Participation (Participants)

The data was collected over a two month period from July 2014 to September 2014. Approximately 3,095 EMS workers are currently employed with either one of the six fire departments and six non-fire service ambulance transport companies in Miami-Dade County. Among these state certified EMS workers who agreed to participate and were enrolled into the study, were EMTs, paramedics, and fire fighters. All qualified EMS workers in the fire service departments and non-fire service ambulance transport companies were given the opportunity to participate in the study. Qualified EMS workers in the fire service departments composed of fire fighters, EMTs, and paramedics who agree to participate were enlisted into the study. EMS workers in the non-fire service ambulance transport companies included EMTs and paramedics. Furthermore, EMS workers who do not meet the inclusion criteria were excluded from the study.

Setting

The research study was conducted at fire stations throughout Miami-Dade County Florida. City of Hialeah Fire Department has eight fire stations located within 23 square miles with 20 emergency response engines, aerials, and rescue ambulances. City of Miami Fire Rescue has 14 neighborhood fire stations with 48 emergency response vehicles (http://www.miami.gov). City of Miami Beach Fire Department has four fire stations located through the north and south beach area (www.miamibeach411.com). City of Key Biscayne Fire Rescue Department has one fire station (http://usfiredept.com/key-biscayne-fire-rescue=12-35.html). Coral Gables Fire Department has three fire stations that cover an area of 14 square miles with approximately 43,000 residents (www.coralgables.com). Miami-Dade Fire Rescue

Department has 137 emergency response vehicles (rescue vehicles, hazmat units, engines, air truck, aerials, foam trucks, and platform trucks), two fire boats, a venom response team, plus four trauma helicopters all located within 72 stations through Miami-Dade County (www.miamidade.gov/fire/sttions-units.asp). Moreover, each fire department personnel works three shifts at a fire station for 24 hours a day seven days a week, shift A, B, and C.

Exclusion Criteria

Several individuals were excluded from the study in order to warrant similarity between the EMS workers in the fire service and non-fire service ambulance companies. This study was limited by the following employees:

1. Individuals not providing any patient care.
2. Individuals not exposed to patients' blood or other bodily fluids.
3. Individuals working in an office at a desk.
4. EMS personnel not working in the pre-hospital environment.
5. Non-essential workers (i.e., civilians).

Inclusion Criteria

Typically, EMS workers for the fire service departments work a 24 hour shift. The study was delimited to the following:

1. EMS workers that were currently working in the pre-hospital environment providing emergency health care.
2. EMS workers exposed to blood and other bodily fluids during their shift work.
3. EMS workers employed for a year or more as an EMS provider.

Data Collection

The data was collected using a self-administered questionnaire survey. The questionnaire was administered at several different fire stations throughout Miami-Dade County. Dates and times were scheduled with the different departments for the distribution of the survey questionnaire. The data was collected and analyzed using the SPSS software, version 22 (IBM SPSS Statistics 22 Core System). The collected data was treated with confidentiality and put in safekeeping on a password protected computer. Linear regression, frequencies, detectable differences, test associations, and two by two tables were used to compare different meaningful proportions of the two groups: of EMS workers in the fire departments and non-fire service EMS ambulance workers.

Instrumentation and Materials

One 2010 survey instrument was available that could be utilized with some modifications, to meet the purposes of collecting data for this study. A study conducted by Harris and Nicolai (2010) investigated compliance with universal precautions and occupational exposures to blood and body fluids among EMS providers. The survey used in the study conducted by Harris and Nicolai's was obtained via email. In addition, permission was granted by Shelley A. Harris, MSc, PhD; allowing the survey to be reviewed as well as revised for the purpose of this dissertation research study. A similar study conducted by Stein, Makarawo, and Ahmad (2003). They investigated knowledge about infection control and attitudes about compliance with universal precautions among doctors, nurses, and phlebotomists in a teaching hospital. The actual survey from the

Stein et al. (2003) study was provided via email by Adam Stein, M.D., with permission to use the survey for this dissertation research study. Attached in the appendix are the emails of permission from the correspondences allowing use of their survey questionnaire instruments for dissertation research.

The survey questionnaire used in the study steered by Stein, Makarawo, and Ahmad (2003) as per Adam Stein, M.D., was not validated independently and was created specifically for the above mentioned study. A pilot study was implemented based on the Birmingham Department of Health guidelines. The final survey questionnaire in Stein et al. (2003) study comprised of 13 main questions in the form a Likert scale, with some checklist multiple choice questions. Attached in the appendix is Stein et al. (2003) survey questionnaire. Nevertheless, the study indicated there is a need to improve compliance with universal precautions practice related to infection control.

In addition, Harris and Nicolai (2010), 43 question survey questionnaires was pilot tested with at least 22 EMS providers in New Kent County Virginia. There were five levels of EMS certification providers were assessed in Harris and Nicolai (2010) study; first responders (FR), emergency medical technician – basic (EMT-B), paramedic (EMT-P), emergency medical technician-cardiac tech (EMT-C), and emergency medical technician-shock trauma (EMT-ST). Harris and Nicolai survey questionnaire questions were geared towards evaluating risk perception, knowledge of universal precautions, glove use, face mask, handling of needles, and any occurrence of occupational exposures or bloodborne and airborne contaminations. Multiple logistic regression analyses were used to determine adjusted odd ratios for: association between certifications types and

exposures along with compliance of universal precautions, knowledge of universal precautions, and self-reported needle stick injuries, behaviors, and perceptions (Harris & Nicolai, 2010). Although a strong relationship was founded between the level of training and knowledge of universal precautions, there is a lack of consistency in compliance with universal precautions in the pre-hospital work environment in order to reduce the risk of an occupational exposure to bloodborne and airborne infectious diseases.

Survey Instrument

The content of the survey questionnaire instrument for this dissertation research study was developed based on the literature review, Harris and Nicolai (2010) survey, and Stein, Makarawo, and Ahmad (2003) survey, with modifications. The survey was submitted to the dissertation Chair and Committee member. Revisions were made based on feedback from both groups prior to conducting pilot testing.

A 40 question survey questionnaire was developed and pilot tested on a random sample of EMS workers to ensure feasibility, validity, and interpretation of responses. These EMS participants represented two of the four certification levels including fire fighter EMT-B and fire fighter EMT-P. The questionnaire was established to investigate knowledge of and attitude toward compliance with universal precautions as well as, occupational exposures involving compliance with universal precautions in EMS workers.

The survey questionnaire included 40 questions regarding EMS participants knowledge of compliance (10 questions), attitudes toward compliance of universal precautions (2 questions), and occupational events and practices (9 questions) regarding

risk perceptions toward universal precautions. Demographics (7 questions) included information provided by the participants on age, gender, years of EMS experience, current department of employment, and exposure to universal precaution training sessions. Knowledge type questions (12 questions) were designed to assess the EMS workers' knowledge of compliance with universal precautions associated with occupational exposures to infectious diseases. Attitude questions were implemented to assess behaviors towards compliance with universal precautions. Occupational practices questions involved risk perception of occupational exposures to infectious diseases related to compliance with universal precautions. The research provided information for future educational training programs to promote the prevention of occupational exposures to bloodborne and airborne infectious diseases in EMS providers in the pre-hospital work environment.

Validity and Reliability of the Survey Instrument

Validity

In order to evaluate the validity of the research survey instrument, the researcher ensured that the instrument measures the variables it claims to measure (Frankfort-Nachmias and Nachmias, 2008). In assessing the content validity of the instrument a panel of experts including but not limited to fire departmental chiefs, EMS infection control nurses, a fire department EMS Medical Director, an EMS fire department quality assurance administrator, and an EMS assistant quality assurance specialist, were used to assess the relevance of the survey questions.

In assessing the face validity of the survey questionnaire instrument, the researcher made sure that the questions were relevant to the construct and concept by comparing to questionnaires (Frankfort-Nachmias and Nachmias, 2008, p. 150). The current survey questionnaire is a modification of the questionnaire used in Harris and Nicolai (2010) study. The 40 question instrument was distributed to a convenience sample of at least 15 fire fighters EMT-B and fire fighter EMT-P for pilot testing. The individuals that participated in the pilot testing of the survey instrument were asked to give their assessment of the questionnaire, to state whether or not the purpose of the questionnaire was clear, and comment on any particular questions that might have been unclear. During the pilot testing, the researcher kept a record of the length of time it took each participant to complete the survey questionnaire. The length of time should range from six minutes to ten minutes. Feedback from the participants should be that the survey instrument and the questions were reasonable and relevant for the purpose of assessing levels of compliance with universal precautions, knowledge of universal precautions, observation of risk factors, and occurrence of occupational exposures to bloodborne and airborne pathogens to prevent transmission of an infectious disease among EMS workers in a prehospital environment. Pilot testing the questionnaire did aid in the assessment of the face validity of the questions, to determine variables in relation to compliance with universal precautions in the event of an occupational exposure to bloodborne and airborne infectious diseases are measured (Frankfort-Nachmias and Nachmias, 2008, p. 150).

Reliability

Reliability refers to the extent to which the survey instrument reflects characteristically a true score or true score variance, relative to the error of inconsistency (Frankfort-Nachmias and Nachmias, 2008, p. 154). The Split-Half method were used to test the reliability of the survey questionnaire instrument by the participants in the pilot testing. In testing the reliability of the instrument using the Split-Half method, the instrument questions were separated into two groups; the odd numbered question were one group and the even numbered question were the other group. The two groups were tested as separate questionnaires while performing correlation coefficients to determine if they will produce similar results as separate groups.

Variables

Definition of Variables

Several independent and dependent variables were measured to determine any association between each variable and an occupational exposure as well as compliance with universal precautions. The generable study variables in this research included universal precaution training, knowledge of universal precautions, compliance with universal precautions, attitude and behaviors regarding universal precautions, perceived risks, and perception of risk of an occupational exposure to bloodborne and airborne pathogens. Independent variables were surveyed for their association with compliance to universal precautions. Other independent variables included were demographic variables such as gender, age, education, certification level, workplace location, work hours, attitude and years of experience.

Table 2

Description of Variables Considered in Analysis

Question(s)	Variable name / category	Type of variable	How measured	Level(s) of measurement
Q1	Training in Universal Precautions	Independent	None, <1 year, 1-5 years, 5-10 years, >10 years	Ordinal
Q2	Knowledge	Independent	Use face masks & gloves, placement of needles after use	Ordinal
Q7, Q18, Q25-Q32	Occupational Exposure	Dependent	Scale of 1-5 with 1 being never and 5 always**.** Scale of 1-5 with 1 being extreme risk and 5 being no risk.	Ordinal
Q3	Compliance with Universal Precautions	Dependent	Scale of 1-5 with 1 being never and 5 always**.** Scale of 1-5 with 1 being never and 5 always**.**	Ordinal
Question(s)	Variable Name / Category	Type of Variable	How Measured	Level(s) of Measurement
Q11-Q14	Handwashing	Independent	Scale of 1-5 with 1 being never and 5 always**.** Scale of 1-4 with 1 being Not Important and 4 being Extremely Important**.**	Ordinal
Q15, Q16	Gloves	Independent	Scale of 1-5 with 1 being never and 5 always**.**	Ordinal
Q4, Q17, Q22, Q20	Work Practices	Independent	Scale of 1-5 with 1 being never and 5 always**.**	Ordinal & Interval
Q5, Q19-Q21, Q23, Q24	Needles / IV Catheters	Independent	Scale of 1-5 with 1 being never and 5 always**.**	Ordinal Dichotomous & Interval
Q6, Q8, Q9, Q10	Respiratory Mask & Barriers	Independent	Scale of 1-5 with 1 being never and 5 always**.**	Ordinal

Table 2 (continues)

Socio-Demographic Variables

Question(s)	Variable name / category	Type of variable	How measured	Level(s) of measurement
Q33	EMS Agency	Independent	FF Dept. or Ambulance	Nominal
Q34	Shift Work	Independent	24 hrs. on 48 hrs. off, 24 hrs. on 72 hrs. off, 24 hrs. on 24 hrs. 12 hrs. days, 12 hrs. nights, 8 hrs. / day	Nominal
Q35	Certification Level	Independent	FF EMT-B, FF EMT-P, EMT-B, EMT-P	Ordinal
Q36	Years as an EMS Provider (Job seniority)	Independent	Years Continuous	Continuous Interval
Q37	Educational Level	Independent	Diploma/GED, Some College, Trade School, College Degree, Graduate School	Ordinal
Q38	Gender	Independent	Female, Male	Dichotomous
Q39	Age	Independent	Years Continuous	Continuous Interval
Q40	Attitude	Independent	Dissatisfied / Satisfied	Ordinal

Data Analysis

This section describes the method that was used for data analysis for this quantitative cross-sectional study. Calculations and data analysis were done using the Epi Info 7 statistical software for epidemiology and the SPSS software, version 22 (IBM SPSS Statistics 22 Core System) to evaluate the data between the two groups in this study to determine if there is a relationship between perceived severity, susceptibility, response-efficacy, self-efficacy, and the utilization of universal precautions to prevent occupational exposures in the EMS workers. The analysis of the collected data was tested for logical consistency set up in the coding specifications (Frankfort-Nachmias &

Nachmias, 2008, p.314). Furthermore, frequencies were generated and the chi square test was used to analyze the EMS provider population in Miami-Dade County to determine the relationship between knowledge and attitude, knowledge and practice, demographics, occupational exposures to blood borne and air borne pathogens. Does knowledge, attitude, level of training and years of experience in an EMS worker predict compliance with universal precautions, and does knowledge about an occupational exposure to bloodborne and airborne pathogens result in compliance with universal precautions? Adhering to the compliance of universal precautions by proper hand hygiene, utilizing proper respiratory barriers, properly wearing personal protective equipment, awareness of risk of an occupational exposure and preventing an occupational exposure to infectious pathogens are related. Multivariable analyses, multiple logistic regression, percentages, and frequencies test were used to calculate a meaningful association with the independent and dependent variables along with factors impacting compliance. Also, to analyze the magnitude of the multiple logistic regression relationships between the independent and dependent variables, estimate the effects of the variables, as well as calculate the difference in the variables proportions essentially constructing a two by two contingency table (Frankfort-Nachmias & Nachmias, 2008, pp. 402-403).

Threats to Validity

Internal Validity

Threats to internal validity and external validity possibly can or cannot be controlled in different types of research study designs. The research design chosen for this study was a cross sectional study design using quantitative approaches. As stated

earlier in this chapter, cross sectional study design takes less time, conducted over a short period at one point in time (snapshot), and is inexpensive. Since the research for this study was conducted at one point in time, the study may be particularly vulnerable to history effects (Bergh, Hanke, Balkundi, Brown, and Chen, 2004). In the research there is no treatment nor is the participants' part of a control or an experimental group. However, comparison of fire service and non-fire service EMS workers is plausible; the threat to the history of internal validity is likely not relevant and will not occur.

Maturation is not a threat to the internal validity in this study because the research wasn't conducted over a long period of time; having no chance for change in the physical or mental state of the participants. In addition, there were no pretest and posttest research designs involved in this research study. Testing and statistical regression are threats to internal validity that includes repeated measures or pretest and posttest. Testing and statistical regression are unlikely relevant in this research study.

An instrumentation effect is not feasible for this study because there were no changes nor a lack of consistency in the measuring instrument (survey questionnaire). The same survey questionnaire were distributed to all the participants involved in the study. In calculating the minimum sample size of the participants, the G Power software version 3.1.7 was used to attain the effect size allowing no chance of a statistical regression threat to internal validity.

Selection has been known to be an apparent threat to internal validity in cross sectional studies involving group comparison (Bergh et al., 2004). The research being conducted for this study didn't involve randomization and didn't involve self-selection.

The participants participated in this study on a volunteer bases by completing a simples survey questionnaire. The participants were informed about the study and consented to participate but are not required to partake in the study. There is no experiment nor treatment included in the research. However, statistical comparisons between the fire service and non-fire service EMS workers may help address the selection threat to internal validity. The likelihood of a selection threat to internal validity is likely not relevant in this research study.

Mortality / Attrition are not a threat to internal validity due to the nature of the research study and sample population of participants. Again, there is no control group nor experimental group and no loss of participants dropping out in this study. As mentioned above, the measuring instrument used is a survey questionnaire which participants volunteer to participate in the study by completing the survey. If the individuals choose not to complete the survey, they are not calculated in the data analysis. Therefore, mortality / attrition threat to internal validity is likely not relevant.

Interaction with selection threats to internal validity, especially history, maturation, and instrumentation are unlikely for this research study. There are no treatment groups, no experimental groups, no pretest or posttest of the participants, and no selection of participants based on experience or age. No simultaneous threats to internal validity involved in this research.

Ambiguity about direction of causal inference threat to internal validity is a frequent occurring threat in cross sectional studies (Bergh et al., 2004). Bergh et al. (2004) published and conducted research analyzing 76 empirical Strategic Management

Journal articles investigating control of threats to internal validity in several research designs. Since, cross sectional designs are a one period in time (snapshot), the likelihood of an ambiguity threat to internal validity is highly plausible because of causation of the independent and dependent variables will not be controlled. Though, the data that was collected for this research will occur over a short period of time, the data was collected at the exact same time allowing for a time lag thus providing a guard against the threat of ambiguities of causal inference (Bergh et al., 2004). The researcher had confidence that the study was not compromised and a relationship between the independent variables and dependent variables did exist. In summary, the chance of a threat to internal validity in this research is possible but low thus, having a high internal validity.

External Validity

External validity is just as important as internal validity. It is important to know not only that compliance with universal precautions was effective in preventing an occupational exposure to bloodborne and airborne pathogen in EMS workers in Miami Dade County, but that compliance is likely to be effective in other EMS workers in the pre-hospital environment in other counties and with other EMS workers in different health care settings (Steckler & McLeroy, 2008).

A reactive effect of testing usually involves pre-testing and post-testing of participants in an experimental study. The participants' awareness of the partaking in a study and knowing that they can be observed will modify their responses, test scores, and behavior thus confounding the results. This is a similar concern in reactive effects of experimental arrangements; as a result the Hawthorne effect. The participants were

consented to participate in this research by completing a simple survey questionnaire. Participation is on a volunteer bases and not mandatory. There is no penalization for not completing the survey questionnaire hence, reducing and selection bias. The basis for the research study was explained allowing the individuals to participate reducing the effect on how the participants respond. In this research, no pre-testing, post-testing, experiments, or treatments were involved allowing the results of this research to be generalized to an untested EMS provider population. In addition, no multiple treatments were given to the participating participants in this research study, with no carry-over effect. The reactive effect of testing threat to external validity, reactive effects of experimental arrangements threat to external validity, and multiple-treatment interference threat to external validity were unlikely in this research.

Interaction effects of selection and experimental variables may be plausible for this research but not relevant. The population participating in the research were an exclusive group of individuals where no two individuals are the same; however, their line of work as an EMS provider in a pre-hospital environment, is the same in any county, city, or state. Some of the independent variables in the demographics questions identify other characteristics such as educational level, years of experiences, and type of EMS worker increasing generalization of the results. This wasn't an experimental design and the participants participated willingly by consenting to complete a survey questionnaire, reducing any selection bias and experimental variables threat to external validity.

External validity is important because the researcher was able to generalize the conclusion of the research study to a larger EMS population. In other words, the same

study can be conducted in other EMS population groups generating similar results. Furthermore, external validity cannot exist without internal validity or else there would be nothing to make inference on and ensure the conclusion of the study. In summary, the chance of a threat to the external validity is this research is not likely relevant indicating a high external validity.

Construct Validity

This research is projected to be significant in displaying construct validity. The survey was be pilot tested to insure that the instrument was used as intended supporting documenting and explaining the outcome of the study. Although only one version (paper and pencil) of the instrument was used, the operation of the research didn't occur in a single place at one single point in time to allow for the concept of compliance with universal precautions in EMS workers in Miami Dade County. The instrument is a simple survey questionnaire in which the participants consent to complete a confidential survey with no guessing of the results of the study. Individuals that consented to participate in the research were not required to complete the survey consequently, eliminating evaluation apprehension. Completing the survey was optional.

The objective of the survey instrument was to measure constructs in demonstrating the perception of compliance with universal precautions which can prevent as well as reduce an occupational exposure to infectious diseases. The relationship between knowledge, the risks of an occupational exposure, and compliance with universal precautions to prevent the transmission of an infectious disease in EMS workers can be recognized and measured by the research instrument. There were no treatments

implemented to participants, no targeted symptoms, or testing of participants involved in the instrument used in the research to result in labeling issues. The survey instrument in this research was expected to show adequate measurements of the research outcome and important concepts. Nevertheless, threats to construct validity are questionable.

Statistical Conclusion Validity

The research established an accurate assessment about the relationship between the variables involved as well as the strength of that relationship. As mentioned in the sampling procedures earlier in this chapter, the sample size was established using the z-test to specify a meaningful difference representing a percentage of EMS works for the study population. Calculations using the G Power software application version 3.1.7 estimated the sample size for needed for this study to be approximately 268 participants yielded 80% statistical power (1-ß) to detect a delta (difference) in the percentage of participants achieving a given out of compliance with universal precautions at an alpha level of 0.05.

The A-priori power analyses was used in the estimation of the sample size, as it provides a method to lower and control both types of error probability (type-1 alpha and type-2 beta) as well as attain any measurement of the effect size (Mayr, S., Erdfelder, E., Buchner, A., and Faul, F., 2007; Erdfelder, E., Faul, F., and Buchner, A., 1996). The estimation of the effect size was appropriate and accurate for the research. The A-priori power analyses increased the chance that the research will find a relationship between the variables with a low possibility of unreliability of measures and assumptions of statistical test; therefore reducing the chance of a threat to statistical conclusion validity.

A pre-printed survey cover letter with instruction regarding the survey was disturbed along with the survey questionnaire and all participants received the same instructions. Each individual will complete the survey at their place of employment with minimum noise level. While there are no treatments included in the research, the pre-printed survey cover letter eliminated the chance of heterogeneity of participants and the unreliability of treatment implementation threat to statistical conclusion validity.

Ethical Procedures

My objectives were to ensure the participants that professional standard in conducting and disseminating the study was demonstrated. Prior to conducting the study, ethical approval was obtained from Walden University Institutional Review Board (IRB). All of the participants' rights were protected; confidentiality protected, and the participants weren't at risk of any physical and psychological danger or harm. The confidentiality of all organizations involved in this study was protected as well. The participants weren't forced to partake in the study and were recruited on a voluntary basis. Permission to carry out the study was obtained from the six fire service departments in Miami-Dade County Florida. The participants were educated on the description, nature, and purpose of the study. An informed consent were obtained from the participants.

Summary

This chapter included clarification of methodology used to address the research questions, purpose of the quantitative research, and determine the relationship between the independent and dependent variables. A cross-section design was allowed for an

assessment of the relationship between variables, compliance behaviors, knowledge of universal precautions, attitudes regarding occupational exposures, risk factors, and use of a survey based instrument were used to collect the data. This chapter outlined and discussed the research design and rationale, population and sample, sapling procedures and recruitment, sample size, exclusion and inclusion criteria, data collection and analysis, survey instrument, definition of variables in the study, ethical procedures, validity and reliability of the study, and threats to validity in the study. Chapter 4 provides a synopsis of the statistical analysis of the pilot test and results from the study.

Chapter 4: Results

Introduction

This chapter presents the results of the quantitative cross-sectional research study. The purpose of the study was to analyze the knowledge of universal precautions, levels of compliance, attitude, and risks of occupational exposures to bloodborne/ airborne infectious diseases of Miami-Dade County EMS workers towards universal precautions. The chapter was organized into sections: (a) Introduction, (b) pilot (c) study results and impact on study, (d) descriptive information regarding data collection, (e) treatment and /or intervention fidelity as appropriate, (f) results of statistical analysis, and (g) a summary of the chapter.

Research Questions

The study specifically focused on the following research questions (RQ) and hypotheses:

1. Does knowledge, attitude, certification level and years of experience in an EMS worker predict levels of compliance with universal precautions?
2. Does awareness concerning an occurrence of occupational exposures to bloodborne and airborne pathogens result in compliance with universal precautions?
3. Is there a relationship between perceived severity, susceptibility, response-efficacy, self-efficacy, and compliance with the utilization of universal precautions to prevent occupational exposures in the EMS workers population in Miami-Dade County?

Hypothesis

The following hypotheses presented were addressed in relation to the research questions proposed above:

H_o1: There is no significant difference in compliance with universal precautions among EMS workers based upon the following factors:

H_o1A: Knowledge,

H_o1B: Attitude,

H_o1C: Certification level, and

H_o1D: Years of experience as an EMS worker.

Ha1: There is a significant difference in compliance with universal precautions among EMS workers based upon the following factors:

Ha1A: Knowledge,

Ha1B: Attitude,

Ha1C: Certification level, and

Ha1D: Years of experience as an EMS worker.

H_o2: Awareness concerning an occupational exposure to bloodborne and airborne pathogens does not result in compliance with universal precautions among EMS workers.

Ha2: Awareness concerning an occupational exposure to bloodborne and airborne pathogens does result in compliance with universal precautions among EMS workers.

H_o3: There is no significant relationship in compliance with the utilization of universal precautions to prevent occupational exposures among EMS workers in Miami-Dade County based upon the following:

H_o3A: Perceived severity,

H_o3B: Susceptibility,

H_o3C: Response-efficacy, and

H_o3D: Self-efficacy.

Ha3: There is a significant relationship in compliance with the utilization of universal precautions to prevent occupational exposures among EMS workers in Miami-Dade County based upon the following:

Ha3A: Perceived severity,

Ha3B: Susceptibility,

Ha3C: Response-efficacy, and

Ha3D: Self-efficacy.

Above mentioned RQ#1 and related hypothesis was evaluated with Pearson's product moment correlation, t-test, Analysis of Variance and linear regression models. RQ#2 was evaluated with t-test, Analysis of Variance and linear regression model, and RQ#3 was evaluated with Pearson's product moment correlation and linear regression models.

Pilot Study

After receiving approval from Walden University Institutional Review Board (Approval # 05-06-14-0155306) to conduct this study, the pilot study instrument was

prepared for distribution. In assessing the content validity of the instrument a panel of experts including, but not limited to (a) fire departmental chiefs, (b) EMS infection control nurses, (c) fire department EMS Medical Director, (d) EMS fire department quality assurance administrator, and (e) EMS assistant quality assurance specialist was used to assess the relevance of the survey questions. The panel of experts stated that the questions were applicable for the research in adequately addressing the purpose and hypotheses. One question (question #15) regarding the use of gloves was changed because of the word "latex." The panel of experts pointed out that not everyone can wear latex gloves because of allergies to the material. The question originally read: do you wear latex gloves on each call you go on? The word "latex" was eliminated from the question and the new question read: do you wear gloves on each call? After receiving this feedback and the correction was made, the content validity of the instrument was deemed adequate.

EMS workers employed by Miami-Dade Fire Rescue were invited to participate in the pilot testing of the survey questionnaire. I informed each participant that the survey was anonymous and personal information will not be obtained nor asked. The time taken by the researcher to give an overview of the dissertation research study and distribute the survey questionnaires was approximately three to five minutes. Participants demonstrated their informal consent by agreeing to participate in the pilot study and by completing the five page 40 question self-administered survey.

The pilot study was conducted in Miami-Dade Count Florida in May 2014. A convenience sample (N=15) of EMS workers at Miami-Dade Fire Rescue volunteered to

participate in the pilot testing. During the pilot testing, I observed the participants' abilities to follow the instructions and kept a record of the length of time it took each participant to complete the survey. The individual participants were asked to give their assessment of the questionnaire, to state whether or not the purpose of the questionnaire was clear, and comment on any particular questions that might have been unclear. The time it took an individual to complete the self-administered survey questionnaire ranged from six minutes to ten minutes. The feedback from the participants indicated that the self-administered survey questionnaire was appropriate, clearly understood, and relevant for the purpose of assessing levels of compliance regarding universal precautions. This information was used in the collection of the data for the research study.

Data from the 15 EMS worker participants were entered directly into the IBM Statistical Package for Social Sciences (SPSS) Statistics 22 computer database, with specific codes used for each questionnaire item. Percentages, linear regressions, frequencies, detectable differences, test associations, tables, mean and median were used for analyzing differential meaningful percentages in assessing (a) level of knowledge, (b) attitude, (c) certification level, (d) degree of compliance to universal precautions and (e) socio-demographic data.

Results of the Pilot Study

A descriptive statistical analysis of the pilot study indicated that there were 15 EMS providers volunteering to participate. A total of 12 (80%) participants of the pilot study answered the complete questionnaire shown in Table 3.

Table 3

Distribution of valid responses during pilot study

	Question	Valid responses		Missing	
		N	%	N	%
Q1	Have you received any training of standard precautions / universal precautions	15	100%	0	0%
Q1a	If yes, when was your last training session	15	100%	0	0%
Q1b	If no, do you want training on standard precautions - universal precautions knowledge	15	100%	0	0%
Q2a	In your opinion, use of face mask - protective eyewear is universal precautions	15	100%	0	0%
Q2b	In your opinion, monitoring patient's vitals is Universal Precautions	15	100%	0	0%
Q2c	In your opinion, placement of needles in puncture-resistant containers is Universal Precautions	15	100%	0	0%
Q2d	In your opinion, use of gloves is Universal Precautions	15	100%	0	0%
Q3	In your opinion, proper UP are expected to be used by all EMS providers at your agency	15	100%	0	0%
Q4	In your opinion, do your agency's units have adequate equipment and supplies	15	100%	0	0%
Q5	How regularly have you started an IV in the past month	15	100%	0	0%
Q6	How regularly have you intubated a patient in the past month	15	100%	0	0%
Q7	Do you treat every patient as if they are carrying a bloodborne virus	15	100%	0	0%
Q8	Would you wear a facemask when transporting a patient with tuberculosis	15	100%	0	0%
Q9	Would you wear a mask when transporting a patient with other airborne illnesses, such as influenza	15	100%	0	0%
Q10	Would you use a protective device (such as a bag valve mask) when performing resuscitation	15	100%	0	0%
Q11	Do you clean your hands before contact with each patient	15	100%	0	0%

Q12	Do you clean your hands after contact with each patient	15	100%	0	0%
Q13	How important do you think it is to clean your hands before any contact with each patient	15	100%	0	0%
Q14	How important do you think it is to clean your hands after any contact with each patient	15	100%	0	0%
Q15	Do you wear gloves on each call you go on	15	100%	0	0%
Q16a	What are your reasons for not wearing gloves at all times - Forget	15	100%	0	0%
Q16b	What are your reasons for not wearing gloves at all times - Don't have time	15	100%	0	0%
Q16c	What are your reasons for not wearing gloves at all times -Patient appears to be low risk for transmission of ds	15	100%	0	0%
Q16d	What are your reasons for not wearing gloves at all times - Other	15	100%	0	0%
Q16e	What are your reasons for not wearing gloves at all times - Gloves aren't always available or close by	15	100%	0	0%
Q16f	What are your reasons for not wearing gloves at all times - Don't wear gloves when Patients aren't bleeding	15	100%	0	0%
Q17	In the last month, how many calls did you go on	15	100%	0	0%
Q18	In the last month, how many of your patients were bleeding	15	100%	0	0%
Q19	Do you handle needles as part of your duties as an EMS provider	15	100%	0	0%
Q20	Do you recap the needles after use	15	100%	0	0%
Q21	Do you dispose of all needles in a marked red biohazard container	15	100%	0	0%
Q22	Do you dispose of other contaminated materials in a marked red biohazard container	15	100%	0	0%
Q23	Have you ever been stuck with a contaminated lancet in your experiences as an EMS provider	15	100%	0	0%
Q23a	How many times have you been stuck in the last year	15	100%	0	0%
Q23b	How many times have you been stuck in the last month	15	100%	0	0%
Q23c	Did you report it	15	100%	0	0%

Q24	Have you ever been stuck with a contaminated hypodermic needle in your experiences as an EMS provider	15	100%	0	0%
Q24a	How many times have you been stuck in the last year	14	93%	1	7%
Q24b	How many times have you been stuck in the last month	14	93%	1	7%
Q24c	Did you report it	15	100%	0	0%
Q25	Do you know the DOH and CDC guidelines R/T PEP after an occupational exposure to HIV and HBV/HCV	15	100%	0	0%
Q26	According to DOH, CDC, OSHA, if you are exposed to HIV following a needle stick injury, ideally how soon afterwards should PEP commence for optimum efficacy	14	93%	1	7%
Q27	Have you ever been exposed to blood as an EMS provider	15	100%	0	0%
Q27a	How many times in the last month have you been exposed to blood	15	100%	0	0%
Q28	Have you ever been exposed to other body fluids as an EMS provider	14	93%	1	7%
Q28a	How many times in the last month have you been exposed to other body fluids	15	100%	0	0%
Q29a	Which of the following body fluids (presuming that they are not blood-stained, should be handled with the same precautions as blood - Breast Milk	15	100%	0	0%
Q29b	Which of the following body fluids (presuming that they are not blood-stained, should be handled with the same precautions as blood - Peritoneal Fluid	15	100%	0	0%
Q29c	Which of the following body fluids (presuming that they are not blood-stained, should be handled with the same precautions as blood - Saliva	15	100%	0	0%
Q29d	Which of the following body fluids (presuming that they are not blood-stained, should be handled with the same precautions as blood - Feces	15	100%	0	0%
Q29e	Which of the following body fluids (presuming that they are not blood-stained, should be handled with the same precautions as blood - Urine	15	100%	0	0%

Q29f	Which of the following body fluids (presuming that they are not blood-stained, should be handled with the same precautions as blood - Cerebrospinal Fluid	15	100%	0	0%
Q29g	Which of the following body fluids (presuming that they are not blood-stained, should be handled with the same precautions as blood - Pleural Fluid	15	100%	0	0%
Q29h	Which of the following body fluids (presuming that they are not blood-stained, should be handled with the same precautions as blood - Synovial Fluid	15	100%	0	0%
Q29i	Which of the following body fluids (presuming that they are not blood-stained, should be handled with the same precautions as blood - Vomit	15	100%	0	0%
Q30	In your opinion, what are the risks of acquiring HIV as a result of EMS work	15	100%	0	0%
Q31	In your opinion, what are the risks of acquiring hepatitis as a result of EMS work	15	100%	0	0%
Q32	Have you been vaccinated for HBV	15	100%	0	0%
Q33	Please indicate the type of EMS agency with which you are currently affiliated	15	100%	0	0%
Q34	Please indicate the type of shift work worked in the pre-hospital environment	15	100%	0	0%
Q35	What is your current EMS certification level	15	100%	0	0%
Q36	How many years have you been an EMS provider	15	100%	0	0%
Q37	What is your highest level of education	15	100%	0	0%
Q38	What is your gender	15	100%	0	0%
Q39	What is your age	15	100%	0	0%
Q40	How satisfied are you with your present EMS paid position	15	100%	0	0%

The pilot study sample consisted of nine (60%) female and six (40%) male participants shown in Table 4. The majority of the participants (87%) were between 41-50 years of age, and the remaining participants (13%) were between 31-40 years of age.

All of the participants in the pilot study had some sort of college education with 60 percent of the participants (*n*=9) had a college degree, 27 percent of the participants (*n*=4) had some college, and the remaining 13 percent of the participants (n=2) had a graduate degree. Thirteen of the participants (87%) were Fire Fighter EMT-P certification and two of the participants (13%) were Fire Fighter EMT-B certification. The participants' years of experience as an EMS provider was:

- 40% of the participants (*n*=6) had 11-15 years of experience;
- 26% of the participants (*n*=4) had 16-20 years of experience;
- 20% of the participants (*n*=3) had 25+ years of experience;
- 7% of the participants (*n*=1) had 6-10 years of experience; and
- 7% of the participants (*n*=1) had 21-25 years of experience as an EMS provider.

Finally, the participants' satisfice with their current EMS paid position is:

- 60% of the participants (*n*=9) were extremely satisfied;
- 20% percent of the participants (*n*=3) were somewhat satisfied;
- 13% of the participants (*n*=2) were neutral; and
- 7% of the participants (*n*=1) were somewhat dissatisfied with their present EMS paid position.

Table 4

Social-Demographic characteristics of the pilot tested sample population

Variables	Responses	n	Percentages (%)
Age			
	31-40	2	13%
	41-50	13	87%
Gender			
	Female	9	60%
	Male	6	40%
Level of Education			
	Some College	4	27%
	College Degree	9	60%
	Graduate School, etc.	2	13%
Certification Level			
	Firefighter EMT-B	2	13%
	Firefighter EMT-P	13	87%
Years of Service			
	6-10	1	7%
	11-15	6	40%
	16-20	4	26%
	21-25	1	7%
	>25	3	20%
Satisfied with present EMS paid position			
	Somewhat Dissatisfied	1	7%
	Neutral	2	13%
	Somewhat Satisfied	3	20%
	Extremely Satisfied	9	60%

More than half of the participants (68%) in the pilot study accurately identified all three examples of Universal Precautions from the multiple choice question (Q2) shown in Table 5. Use of gloves, placement of needles in puncture-resistant containers, and use of face and protective eyewear are the correct choices for Q2. The EMT-B participants more accurately identified knowledge of Universal Precautions (75% correct) than the EMT-P participants (58% correct) shown in Table 5. Overall, 68% of the 15 EMS providers participating in the Pilot Study correctly identified the knowledge of Universal Precautions in Q2.

Table 5

Knowledge of Universal Precautions overall and among each certification level

Universal Precautions Knowledge	Yes	No	% Correct
1. Use of gloves	15	0	100%
2. Monitoring the patient's vitals (no is correct)	9	6	40%
3. Placement of needles in puncture-resistant containers	5	10	33%
4. Use of face masks and protective eyewear	15	0	100%
Universal Precautions Knowledge by Certification Type/Level, N=15			
EMT-B (n= 2)			
1. Use of gloves	2	0	100%
2. Monitoring the patient's vitals (no is correct)	1	1	50%
3. Placement of needles in puncture-resistant containers	1	1	50%
4. Use of face masks and protective eyewear	2	0	100%
EMT-P (n=13)			
1. Use of gloves	13	0	100%
2. Monitoring the patient's vitals (no is correct)	13	0	0%
3. Placement of needles in puncture-resistant containers	4	9	31%
4. Use of face masks and protective eyewear	13	0	100%

In conducting the reliability statistics, I obtained Cronbach's alpha of 0.75 for the study instrument (see Table 6), which indicated a good level of internal consistency for this scale. Results of split-Half method of reliability testing also showed in Table 5. A total of 47 items on the questionnaires were split into two parts of 20 and 27 items respectively. The results were displayed in Table 7. Part I with 20 items shows Cronbach's alpha of 0.43 and part 2 with 27 items showed Cronbach's alpha of 0.78. Correlation between forms' is 0.21 that shows the reliability of the scale if it has 20 items or 27 items. The reliability of the entire scale would be 0.35 if it had made up of these two parts that have item reliability of 0.21.

Table 8 shows Item-Total correlation and Cronbach's Alpha if the item was deleted. Removal of any question in this scale did not result in greater gain in Cronbach's Alpha hence no question was removed from the instrument for the main study.

Table 6

Alpha Method Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha based on standardized items	*N* of items
0.75	0.827	47

Table 7

Split-Half Method Reliability Statistics

Cronbach's Alpha	Part 1	Value	0.43
		N of items	20
	Part 2	Value	0.78
		N of items	27
	Total *N* of items		47
Correlation Between Forms			0.21
Spearman-Brown Coefficient	Equal Length		0.35
	Unequal Length		0.35
Guttman Split-Half Coefficient			0.27

Table 8

Item-total statistics

	Item on study instrument	Scale mean if item deleted	Scale variance if item deleted	Corrected item-total correlation	Cronbach's Alpha if item deleted
Q1a	If yes, when was your last training session	119.92	181.54	-0.53	0.77
Q1b	If no, do you want training on standard precautions - universal precautions knowledge	118.83	168.52	0.29	0.75
Q2b	In your opinion, monitoring patient's vitals is Universal Precautions	120.17	169.79	0.19	0.75
Q2c	In your opinion, placement of needles in puncture-resistant containers is Universal Precautions	119.83	169.79	0.19	0.75
Q4	In your opinion, do your agency's units have adequate equipment and supplies	117.00	164.36	0.44	0.74

Q5	How regularly have you started an IV in the past month	119.50	157.73	0.48	0.73
Q6	How regularly have you intubated a patient in the past month	119.92	170.63	0.01	0.76
Q7	Do you treat every patient as if they are carrying a bloodborne virus	117.33	165.88	0.17	0.75
Q8	Would you wear a facemask when transporting a patient with tuberculosis	116.58	168.81	0.48	0.75
Q9	Would you wear a mask when transporting a patient with other airborne illnesses, such as influenza	116.83	169.79	0.13	0.75
Q11	Do you clean your hands before contact with each patient	118.00	164.00	0.19	0.75
Q12	Do you clean your hands after contact with each patient	116.58	170.63	0.23	0.75
Q13	How important do you think it is to clean your hands before any contact with each patient	117.58	173.54	-0.15	0.75
Q15	Do you wear gloves on each call you go on	116.67	170.06	0.14	0.75
Q16d	What are your reasons for not wearing gloves at all times - Other	120.00	162.55	0.72	0.74
Q17	In the last month, how many calls did you go on	120.08	180.81	-0.31	0.77
Q18	In the last month, how many of your patients were bleeding	119.83	166.33	0.12	0.75
Q19	Do you handle needles as part of your duties as an EMS provider	120.33	173.33	-0.10	0.75
Q20	Do you recap the needles after use	120.25	177.30	-0.24	0.76
Q22	Do you dispose of other contaminated materials in a marked red biohazard container	116.83	166.15	0.17	0.75
Q23a	How many times have you been stuck in the last year	116.33	148.06	0.44	0.73
Q24a	How many times have you been stuck in the last year	116.33	148.06	0.44	0.73

Q23b	How many times have you been stuck in the last month	116.33	148.06	0.44	0.73
Q24b	How many times have you been stuck in the last month	116.33	148.06	0.44	0.73
Q23c	Did you report it	118.75	165.30	0.42	0.74
Q24c	Did you report it	118.75	165.30	0.42	0.74
Q25	Do you know the DOH and CDC guidelines R/T PEP after an occupational exposure to HIV and HBV/HCV	120.17	172.70	-0.04	0.75
Q26	According to DOH, CDC, OSHA, if you are exposed to HIV following a needle stick injury, ideally how soon afterwards should PEP commence for optimum efficacy	119.92	170.81	0.10	0.75
Q27	Have you ever been exposed to blood as an EMS provider	120.08	166.81	0.40	0.74
Q27a	How many times in the last month have you been exposed to blood	118.42	149.54	0.26	0.75
Q28	Have you ever been exposed to other body fluids as an EMS provider	119.92	166.27	0.45	0.74
Q28a	How many times in the last month have you been exposed to other body fluids	118.00	146.55	0.30	0.75
Q29a	Which of the following body fluids (presuming that they are not blood-stained, should be handled with the same precautions as blood - Breast Milk	119.92	168.81	0.25	0.75
Q29b	Which of the following body fluids (presuming that they are not blood-stained, should be handled with the same precautions as blood - Peritoneal Fluid	120.17	166.52	0.45	0.74
Q29c	Which of the following body fluids (presuming that they are not blood-stained, should be handled with the same	120.25	166.75	0.47	0.74

	precautions as blood – Saliva				
Q29d	Which of the following body fluids (presuming that they are not blood-stained, should be handled with the same precautions as blood - Feces	120.17	164.33	0.62	0.74
Q29e	Which of the following body fluids (presuming that they are not blood-stained, should be handled with the same precautions as blood - Urine	120.08	163.72	0.64	0.74
Q29f	Which of the following body fluids (presuming that they are not blood-stained, should be handled with the same precautions as blood - Cerebrospinal Fluid	120.17	165.42	0.54	0.74
Q29g	Which of the following body fluids (presuming that they are not blood-stained, should be handled with the same precautions as blood - Pleural Fluid	120.00	167.46	0.35	0.74
Q29h	Which of the following body fluids (presuming that they are not blood-stained, should be handled with the same precautions as blood - Synovial Fluid	120.08	163.72	0.64	0.74
Q29i	Which of the following body fluids (presuming that they are not blood-stained, should be handled with the same precautions as blood - Vomit	120.25	164.93	0.63	0.74
Q30	In your opinion, what are the risks of acquiring HIV as a result of EMS work	119.25	162.75	0.29	0.74
Q31	In your opinion, what are the risks of acquiring hepatitis as a result of EMS work	119.17	155.79	0.53	0.73
Q32	Have you been vaccinated for HBV	120.42	172.63	-0.03	0.75

Q35	What is your current EMS certification level	119.67	170.79	0.15	0.75
Q36	How many years have you been an EMS provider	117.42	153.90	0.55	0.73
Q37	What is your highest level of education	117.00	166.91	0.20	0.75
Q38	What is your gender	120.08	164.63	0.57	0.74
Q39	What is your age	117.67	169.88	0.24	0.75
Q40	How satisfied are you with your present EMS paid position	117.25	171.84	-0.02	0.76

Data Collection

After receiving approval from Walden University Institutional Review Board (Approval # 05-06-14-0155306) a draft of the "Letter of Cooperation from a Community Service Partners" were emailed to the Chair member for approval. Once approved by Chair member, the researcher emailed out numerous "Letters of Cooperation from a Community Service Partners" to each of the six fire departments and six non-fire service ambulance companies in Miami-Dade County inviting the departments to participate in the research study. Letters were emailed out from May – July 2014.

Several attempts were made to obtain a letter of cooperation of community service partners from the non-fire service ambulance companies. On June 23, 2014, I visited Medics Ambulance Service / American Medical Response (formally Randall Eastern), National Health Transport ambulance service (formally Florida Medi-Van), and Miami Dade Ambulance services (formally MCT Express / Medi-Car). I attended scheduled meetings with the Clinical Educational Specialist, mangers, and supervisor to personally invite each company to participate in the dissertation research study. I conducted a seven minute presentation regarding the purpose of the research study. The

non-fire service ambulance companies were made aware that the participation of their employees will be completely anonymous and voluntary. At the time each individuals stated that they would get back to the researcher with a decision. Several telephone calls were made to each of the non-fire service ambulance companies on May 8th, May 25th, June 23rd, June 24th, July 3rd, July 10th and July 22nd, 2014. Throughout the entire month of July 2014, emailed Letter s of Cooperation from a Community Partner continued to be directed out to AMR/Medics, National Health Transport, and Miami Dade Ambulance service companies with no response or agreement to participate in the dissertation research study. Thus, the researcher wasn't able to include the non-fire service ambulance companies in the dissertation research study.

Letters of Cooperation from a Community Research Partner were obtained between June and July 2014from all six fire departments in Miami-Dade County Florida. The letters was signed by the Fire Chief and or Assistant Chief of each of the participating departments. Once signed, the letter was emailed to Walden University's IRB for approval to distribute the self-administered survey questionnaire for the collection of data. Once approved by Walden University's IRB, date and times were set up indicating when the researcher could visit the different stations for distribution of the self-administered survey questionnaire.

To conduct this study, a convenience sampling method was used to obtain an adequate sample of participants; representative of the EMS fire service population in Miami-Dade County. This research study used a survey based quantitative approaches for data collection. Participation was completely anonymous and voluntary. The data

collection involved the distribution of the 40 question self-administered survey questionnaire over a period of approximately two months from July 21 to September 24, 2014 with EMS providers from all six fire departments in Miami-Dade County Florida. The self-administered survey questionnaire for this study included the following items: a) knowledge, training, and attitude related issues regarding infection control and compliance to universal precautions; b) occupational practices involving exposures to bloodborne and airborne infectious diseases; and c) socio-demographics (EMS agency, shift work, certification level, and years of professional experience, educational level, gender, and age).

Descriptive Social-Demographic Characteristics of the Sample

A total of two hundred and forty six self-administered survey questionnaires were collected from volunteer EMS providers from all six fire departments in Miami-Dade County. Two surveys were not included in the statistical analysis because more than 90% of the surveys were not completed leaving 244 questionnaires for analysis. Based on the G-Power sample analysis, the research estimates that this sample represented approximately eight percent of the total population of EMS providers in the fire departments of Miami-Dade County.

There were 244 participants in the research study (see Table 9). Final sample consisted of 28 females (11.5%), 214 males (87.7%), and 2(0.8%) did not respond to the question. Essentially 39 percent of the participants (*n*=94) were between 41-50 yrs. of age, approximately 30 percent of the participants (*n*=73) were between 31-40 yrs. of age, almost 15 percent of the participants (*n*=36) were between 51-60 yrs. of age, 2 percent of

the participants (*n*=5) were more than 60 yrs. of age, 0.8 percent (*n*=2) did not respond, and the remaining 14 percent of the participants (*n*=34) were under 30 yrs. of age. Approximately 57 percent of the participants (*n*=139) had a college degree, 32.8 percent of the participants (*n*=80) had completed some college, 4 percent of the participants (*n*=10) had a graduate degree, 0.8 percent of the participants attended trade school, 0.8 percent of the participant did not respond, and remaining more than 4.5 percent of the participants (*n*=11) had completed high school degree (or had GED). Almost 91 percent (*n*=221) study participants had Fire Fighter EMT-P certification, about 7 percent (*n*=17) study participants had Fire Fighter EMT-B certification and remaining 2 percent (*n*=5) participants had either EMT-B or EMT-P certification. Almost 25 percent (1 out of 5) of the participants (*n*=60) had 6-10 yrs. of experience as an EMS provider, more than 14 percent of the participants (*n*=34) had 21-25 years of experience as an EMS provider, nearly 18 percent of the participants had 25+ years of experience as an EMS provider, 17 percent of the participants (*n*=42) had 11-15 yrs. of experience as an EMS provider, 15 percent of the participants (*n*=37) had 16-20 years of experience as an EMS provider and remaining about 11 percent (*n*=26) of the participants had 5years or less of experience as an EMS provider. Furthermore, approximately 50 percent of the participants (*n*=123) were extremely satisfied with their present EMS paid position, 27 percent of the participants (*n*=66) were somewhat satisfied with their present EMS paid position, 11 percent of the participants (*n*=27) were neutral with their present EMS paid position, 9 percent of the participants were somewhat dissatisfied with their present EMS paid position, approximately 2 percent of the participants (*n*=4) were extremely dissatisfied

with their present EMS paid position, and the remaining one percent of the participants (*n*=3) did not respond to the question.

Table 9

Social-Demographic characteristics of the studied sample

Variables	Responses	*n*	Percentages (%)
Age			
	21-30	34	13.9%
	31-40	73	29.9%
	41-50	94	38.5%
	51-60	36	14.8%
	>60	5	2.0%
	No Response	2	0.8%
Gender			
	Female	28	11.5%
	Male	214	87.7%
	No Response	2	0.8%
Level of Education			
	High School / GED	11	4.5%
	Trade School	2	0.8%
	Some College	80	32.8%
	College Degree	139	57.0%
	Graduate School, etc.	10	4.1%
	No Response	2	0.8%
Certification Level			
	Firefighter EMT-B	17	7.0%
	Firefighter EMT-P	221	90.6%
	EMT-B	1	0.4%
	EMT-P	4	1.6%
	No Response	1	0.4%
Years of Service			
	1-5	26	10.7%
	6-10	60	24.6%
	11-15	42	17.2%
	16-20	37	15.2%
	21-25	34	13.9%

	>25	43	17.6%
	No Response	2	0.8%
Satisfied with Present EMS paid position			
	Extremely Dissatisfied	4	1.65
	Somewhat Dissatisfied	22	9.0%
	Neutral	27	11.1%
	Somewhat Satisfied	66	26.6%
	Extremely Satisfied	123	50.4%
	No Response	3	1.2%

There were 244 participants in this cross sectional study were a non-probability convenience sample of the population. No two individuals were the same, however, their line of work as an EMS provider in a pre-hospital environment is the same. At the time of this research study, the participants participating symbolized approximately 8% of the total EMS population in Miami-Dade County Florida (shown in Table 8). There were 40 (16%) from the City of Hialeah Fire Rescue Department, 47 (20%) from the City of Miami Fire Rescue Department, 43 (18%) from the City of Miami Beach Fire Rescue Department, 43 (17%) from the City of Coral Gables Fire Rescue Department, 52 (21%) from Miami-Dade Fire Rescue Department, and 19 (8%) from the Village of Key Biscayne Fire Rescue. The survey sample was roughly 8% of the estimated total population of fire service EMS providers. Even though there were differences in participation rate by different fire departments, an adequate sample was collected for this research study. Consequently, the results were more influenced by certain fire departments than others.

Table 10

Representative Sample of the Population

Fire Departments in Miami-Dade County Florida	Participants	Approximate *N* firefighters employees	Percentage of firefighters employees	Percentage of total participants
City of Hialeah Fire Rescue Department	40	263	15%	16.4%
City of Miami Fire Rescue Department	47	545	9%	19.3%
City of Miami Beach Fire Rescue Department	43	285	15%	17.6%
Coral Gables Fire Rescue Department	43	129	33%	17.6%
Miami-Dade Fire Rescue Department	52	1838	3%	21.3%
Village of Key Biscayne Fire Rescue	19	35	54%	7.8%
Total	244	3095	8%	100%

Treatment and / or Intervention Fidelity

This research study did not involve any administered treatment, adverse events, serious consequences, or intervention fidelity. This research study was cross-sectional study design using survey based quantitative approaches for data collection. A self-administered survey questionnaire was used to gather reliable and unbiased data from a representative sample of EMS worker participants employed in Miami-Dade County for this research study (Burn et al., 2008).

Results

The total compliance score among study participants ranged from 6.6 to 10.0 with average compliance score of 8.6 (SD=0.76) and median score of 8.8. The total knowledge score among study participants ranged from 5.5 to 10.8 with mean score of 8.4 (SD=0.97) and median score of 8.4. Participant's attitude towards using Universal Precautions was determined by used questions related to reason about not using gloves during patient care and participant's satisfaction with current EMS position. When asked about reasons behind not wearing gloves, out of total study participants, 7 percent (*n*=17) responded that they forgot to wear gloves, 2 percent (*n*=4) responded they don't have time to wear gloves, 15 percent (*n*=37) didn't wear gloves if patient appears to be low risk, 4 percent (*n*=9) did not wear gloves because they were not readily available, 3 percent (*n*=7) responded that they did not wear gloves when patients were not bleeding and 24 percent (*n*=58) participants did not wear gloves because of specific reason. Less than 2 percent (*n*=4) of the total study participants were extremely dissatisfied with their current EMS position and 9 percent (*n*=22) participants were somewhat dissatisfied. However, almost 80 percent of study participants (*n*=188) were either somewhat satisfied or extremely satisfied with their current EMS position.

The relationship between total knowledge score and total compliance score was assessed with Pearson's product-moment correlation. The correlation coefficient showed weak positive correlation (*r*=0.18) correlation between total knowledge score and total compliance score (See Figure 2). This correlation was statistically significant (*p*-value=0.005). This suggest that the compliance with UP among study participant increased with increase in total knowledge score.

Table 11 shows mean compliance score among study participant was stratified by response to questions related to attitude towards using universal UP. The mean compliance score was statistically significantly lower among those participants who did not wear gloves because patient appeared low risk (mean compliance score=8.38) compared to those use the gloves (mean compliance score=8.68). For other reasons of not wearing gloves there was no significant difference in mean compliance score. Similarly, mean compliance score did not differ by participant's satisfaction to their current EMS position (*p*-value=0.69). Also, results did not show statistically significant difference in mean compliance score by certification level of EMT training received by the participant. However, participants with 1-5 years of experience and those with 25+ years of experience had the highest mean compliance scores. Results of analysis of variance show that this difference in mean compliance score among different years of experience was statistically significant with the *p*-value=0.01 (See Table 11 and Figure 3 and 4).

Table 11

Distribution of Total Compliance Score by Attitude Related Questions, Level of Experience and Years of Experience (N=varies by question)

Question related to RQ#1			N	%	Mean compliance score (SD)	P-value
Reasons for not wearing gloves at all times	Forget	No	227	93.0%	8.65 (0.8)	0.24
		Yes	17	7.0%	8.4 (0.8)	
	Don't have time	No	240	98.0%	8.63 (0.8)	0.84
		Yes	4	2.0%	8.7 (0.6)	
	Patient appears low risk	No	207	85.0%	8.68 (0.8)	0.02*
		Yes	37	15.0%	8.38 (0.7)	
	Other	No	186	76.0%	8.65 (0.7)	0.63
		Yes	58	24.0%	8.59 (0.9)	
	Not readily available	No	235	96.0%	8.63 (0.8)	0.72
		Yes	9	4.0%	8.73 (0.8)	
	Patient were not bleeding	No	237	97.0%	8.64 (0.8)	0.38
		Yes	7	3.0%	8.37 (0.8)	
How satisfied are you with your present EMS paid position		Extremely Dissatisfied	4	1.7%	8.85 (0.9)	0.69#
		Somewhat Dissatisfied	22	9.1%	8.64 (0.6)	
		Neutral	27	11.2%	8.55 (0.6)	
		Somewhat Satisfied	65	27.0%	8.55 (0.7)	
		Extremely Satisfied	123	51.0%	8.69 (0.8)	
Certification level		FF EMT-B	17	7.0%	8.65 (0.8)	0.9#
		FF EMT-P	221	90.9%	8.63 (0.8)	
		EMT-B	1	0.4%	8.8 (-)	
		EMT-P	4	1.6%	8.6 (0.7)	
Years of experience		1-5 yrs.	26	10.7%	8.93 (0.8)	0.01#*
		6-10 yrs.	60	24.8%	8.64 (0.8)	
		11-15 yrs.	42	17.4%	8.62 (0.7)	
		16-20 yrs.	37	15.3%	8.37 (0.6)	
		21-25 yrs.	34	14.0%	8.46 (0.7)	
		>25 yrs.	43	17.8%	8.84 (0.8)	

Note: #p-value for F-test, rest of the p-values for t-test, *p-value statistically significant.

Figure 2

Relationship between total knowledge score and total compliance score

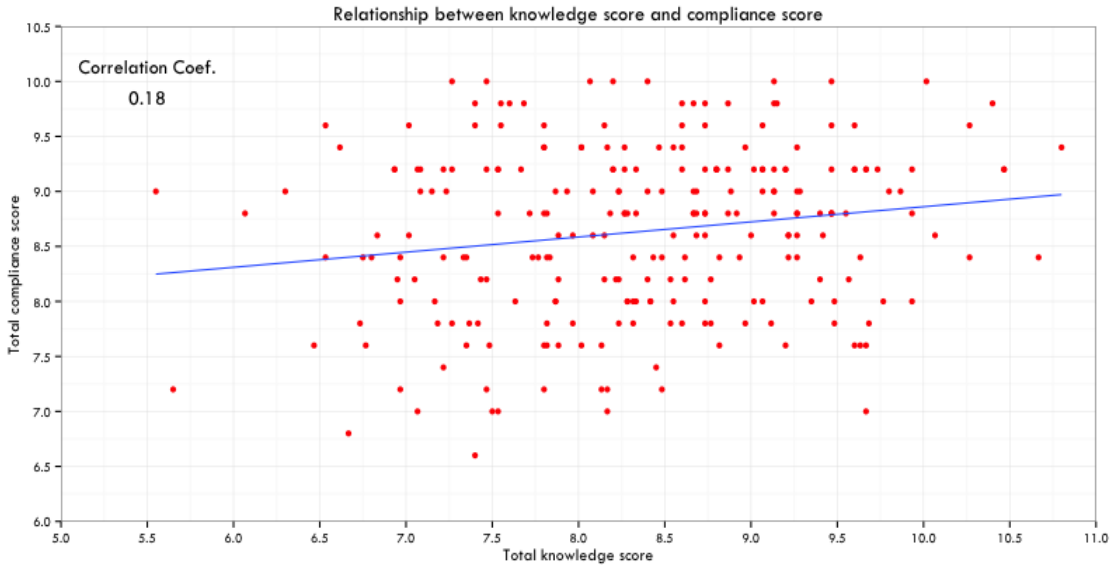


Figure 3

Distribution of total compliance score by reason of not using gloves

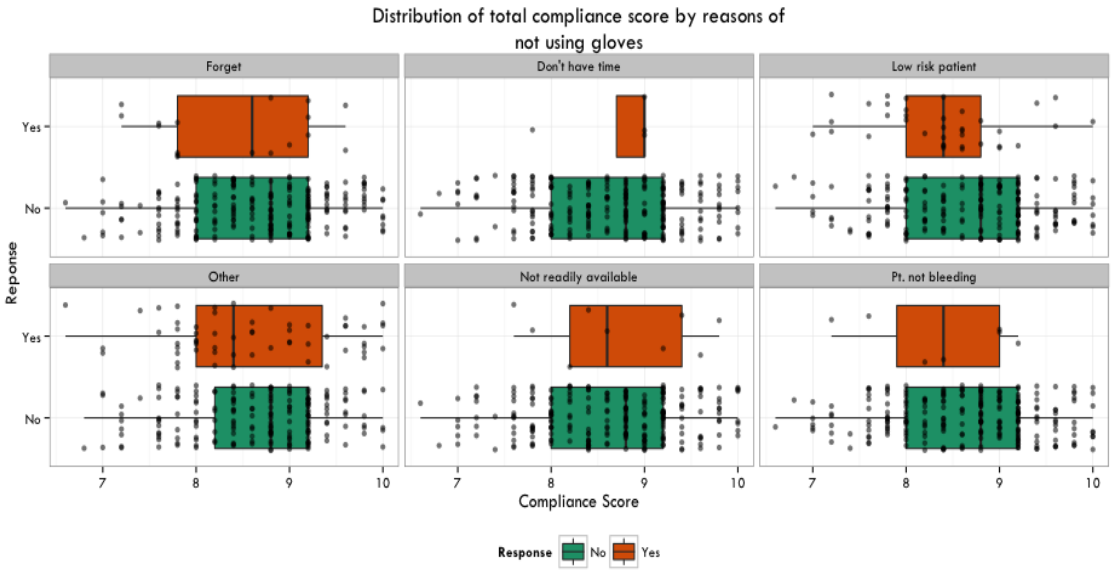


Figure 4

Distribution of total compliance score by satisfaction at current EMS position

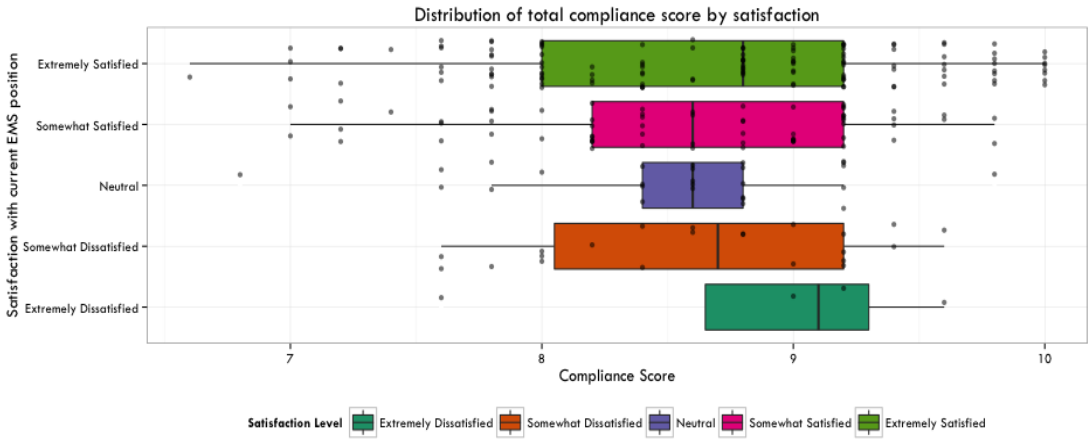


Table 12 shows results of simple and multivariate linear regression evaluating hypothesis for research question 1; "Does knowledge, attitude, certification level and years of experience in an EMS worker predict level of compliance with universal precautions"? For the assessment of RQ#1, 10 different regression models were used to separately evaluate each variable associated with knowledge, attitude, certification level and years of experience. The generic equation for this multiple linear regression models would be written as follows:

Average compliance score = intercept + < *variable associated with research question 1*> + Age_Group + Gender + Education + Years of experience.

Where each model substitute *"variable associated with research question 1"* with variable associated with knowledge, attitude, certification level or years of experience.

After adjusting for age and gender, education and years of experience, each 1-unit increase in mean total score was associated 0.13-point increase in mean total compliance

score. In other words, increase in knowledge was associated with increase in compliance score. This association between total knowledge score and total compliance score was statistically significant (*p*-value=0.01). After adjusting for effect of age, gender, education and years of experience, participants who did not wear gloves because patient appeared low risk had lower mean compliance score compared to their counterparts (*p*-value=0.03). However, participants who gave other reasons about not using gloves did not have statistically significant difference in mean compliance score.

Compared with participants who were extremely dissatisfied with their current EMS position, participants who were somewhat or extremely satisfied did not have statistically significantly different mean compliance score. Similarly, after adjusting for effects of age, gender, education and years of experience, participants with Fire Fighter EMT-P, EMT-B certification or EMT-P certification did not have significantly different compliance scores compared to Fire Fighter EMT-P certificate. Participants who had 16-20 years of experience as an EMS provider had on average 0.56 point lower mean compliance score compared to participants with 1-5 years of experience as an EMS provider, after adjusting for potential confounders. This difference in mean compliance levels was statistically significant (*p*-value=0.02). However, there was no significant difference in mean compliance score between participants with 1-5 years EMS experience compared to participants with other periods of EMS experience.

According to results of multivariate linear regression model, I can conclude that there was significant difference in compliance with universal precautions among EMS

workers based upon knowledge and years of experience as EMS provider but the difference was not significant based upon attitude and certification level.

Distribution of total compliance score by different responses to questions related to occupational exposure to blood and airborne pathogens were shown in Table 14. Results show that participants who had been stuck with contaminated lancet 20 times or more within last year had higher mean total compliance score (mean=9.7) compared to those who had been stuck with contaminated lancet for 0-5 times within last year (mean=8.61). This difference in mean was statistically significant (*p*-value=0.001). Participants who had never been exposed to other body fluids had higher mean compliance score (mean=8.89) compared with those participants who were ever exposed to other body fluids (mean=8.54).

Analysis of variance results showed that there was statistically significant difference in mean compliance score by different level of exposures to other body fluids (See table 13).

Table 12

Result of simple and multivariate linear regression for research question 1

Question related to RQ#1			Unadjusted Beta estimate (95% CI)	P-value	Adjusted* Beta estimate (95% CI)	P-value
Total knowledge score		Intercept	7.48 (6.66, 8.3)	<0.01	8.31 (7.35, 9.27)	<0.01
		Total knowledge score	0.14 (0.04, 0.23)	0.01	0.13 (0.03, 0.23)	0.01
Reasons for not wearing gloves at all times	Forget	Intercept (No)	8.65 (8.55, 8.75)	<0.01	9.44 (8.84, 10.05)	<0.01
		Yes	-0.25 (-0.63, 0.12)	0.18	-0.21 (-0.58, 0.16)	0.27
	Don't have time	Intercept (No)	8.63 (8.54, 8.73)	<0.01	9.46 (8.85, 10.06)	<0.01
		Yes	0.06 (-0.69, 0.82)	0.87	0.02 (-0.73, 0.78)	0.96
	Patient appears low risk	Intercept (No)	8.68 (8.58, 8.78)	<0.01	9.47 (8.87, 10.07)	<0.01
		Yes	-0.3 (-0.56, -0.03)	0.03	-0.27 (-0.53, 0)	0.05
	Other	Intercept (No)	8.65 (8.54, 8.76)	<0.01	9.46 (8.85, 10.06)	<0.01
		Yes	-0.06 (-0.29, 0.16)	0.6	-0.03 (-0.25, 0.2)	0.82
	Not readily available	Intercept (No)	8.63 (8.53, 8.73)	<0.01	9.46 (8.85, 10.06)	<0.01
		Yes	0.1 (-0.41, 0.61)	0.7	0.01 (-0.57, 0.59)	0.98
	Patient were not bleeding	Intercept (No)	8.64 (8.55, 8.74)	<0.01	9.48 (8.88, 10.08)	<0.98
		Yes	-0.27 (-0.85, 0.3)	0.35	-0.44 (-1.01, 0.12)	0.13
How satisfied are you with your		Intercept (Extremely	8.85 (8.1, 9.6)	<0.01	9.67 (8.7, 10.63)	<0.01

present EMS paid position	Dissatisfied)				
	Somewhat Dissatisfied	-0.21 (-1.03, 0.6)	0.6	-0.15 (-0.96, 0.66)	0.71
	Neutral	-0.3 (-1.1, 0.5)	0.46	-0.28 (-1.08, 0.51)	0.48
	Somewhat Satisfied	-0.3 (-1.07, 0.47)	0.44	-0.28 (-1.06, 0.49)	0.47
	Extremely Satisfied	-0.16 (-0.91, 0.6)	0.69	-0.21 (-0.97, 0.55)	0.59
Certification level	Intercept (FF EMT-B)	8.65 (8.28, 9.01)	<0.01	9.4 (8.7, 10.09)	<0.01
	FF EMT-P	-0.02 (-0.39, 0.36)	0.93	-0.13 (-0.26, 0.52)	0.52
	EMT-B	0.15 (-1.39, 1.7)	0.85	0.42 (-2, 1.16)	0.60
	EMT-P	-0.05 (-0.88, 0.79)	0.91	-0.18 (-0.65, 1.01)	0.67
Years of experience	Intercept (1-5 yrs.)	8.93 (8.64, 9.22)	<0.01	9.45 (8.85, 10.06)	<0.01
	6-10 yrs.	-0.29 (-0.63, 0.05)	0.1	-0.29 (-0.67, 0.08)	0.12
	11-15 yrs.	-0.31 (-0.67, 0.06)	0.1	-0.33 (-0.75, 0.09)	0.12
	16-20 yrs.	-0.56 (-0.94, -0.19)	<0.01	-0.56 (-1.02, -0.1)	0.02
	21-25 yrs.	-0.47 (-0.85, -0.09)	0.02	-0.92 (-0.98, 0.06)	0.09
	>25 yrs.	-0.09 (-0.45, 0.27)	0.63	-0.02 (-0.54, 0.49)	0.92

Note: *beta-coefficient of regression model were adjusted for effects of age, gender, education and years of experience.

Table 13

Occupational Exposures to Bloodborne and Airborne Pathogens vs. Compliance with Universal Precautions

Occupational Practices			N	%	Mean Compliance score (SD)	p-value
Have you received any training or standard precaution / universal precaution knowledge	No		8	3.0%	8.85 (0.7)	0.43
	Yes		236	97.0%	8.63 (0.8)	
How regularly have you started an IV in the past month?	Never		45	18.0%	8.52 (0.7)	0.25#
	Seldom		32	13.0%	8.61 (0.9)	
	Sometimes		60	25.0%	8.51 (0.7)	
	Most of the times		55	23.0%	8.76 (0.8)	
	Always		52	21.0%	8.76 (0.7)	
How regularly have you intubated a patient in the past month?	Never		112	46.0%	8.61 (0.7)	0.18#
	Seldom		76	31.0%	8.59 (0.9)	
	Sometimes		40	16.0%	8.62 (0.7)	
	Most of the times		8	3.0%	8.85 (0.6)	
	Always		8	3.0%	9.25 (0.8)	
Have you ever been stuck with a contaminated lancet (for	Yes		22	9.0%	8.59 (0.7)	0.75
	No		222	91.0%	8.64 (0.8)	
	How many	0-5	54	96.4%	8.61 (0.7)	0.001*

blood glucose testing) in your experiences as an EMS provider	times have you been stuck in the last year?	>20	2	3.6%	9.7 (0.1)	
	How many times have you been stuck in the last month?	0-5	49	98.0%	8.63 (0.7)	--
		>20	1	2.0%	9.6 (-)	
	Did you report it?	Yes	19	57.6%	8.73 (0.7)	0.83
		No	14	42.4%	8.67 (0.8)	
Have you ever been stuck with a contaminated hypodermic needle (for IVs) in your experiences as an EMS provider?	Yes		26	11.0%	8.6 (0.7)	0.77
	No		218	89.0%	8.64 (0.8)	
	How many times have you been stuck in the last year	0-5	38	97.4%	8.59 (0.7)	--
		6-10	1	2.6%	9.6 (-)	
	How many times have you been stuck in the last month	0-5	37	97.4%	8.58 (0.7)	--
		6-10	1	2.6%	9.6 (-)	
	Did you report it	Yes	22	75.9%	8.66 (0.6)	0.41
		No	7	24.1%	8.4 (0.7)	
Have you ever been exposed to blood as an	Yes		186	76.0%	8.59 (0.8)	0.09
	No		58	24.0%	8.79 (0.8)	

EMS provider	How many times in the last month have you been exposed to? Blood	0-5	144	75.8%	8.59 (0.7)	0.31#
		6-10	19	10.0%	8.46 (1)	
		11-15	15	7.9%	8.83 (0.6)	
		16-20	6	3.2%	8.1 (0.7)	
		>20	6	3.2%	8.43 (1.1)	
Have you ever been exposed to other body fluids as an EMS provider	Yes		177	73.0%	8.54 (0.7)	0.001*
	No		67	27.0%	8.89 (0.7)	
	How many times in the last month have you been exposed to other body fluids	0-5	140	76.5%	8.57 (0.7)	0.02#*
		6-10	25	13.7%	8.48 (0.9)	
		11-15	9	4.9%	8.98 (0.6)	
		16-20	4	2.2%	7.5 (0.5)	
		>20	5	2.7%	8.8 (0.8)	

Note: #p-value for F-test, rest of the p-values for t-test, *p-value statistically significant.

Next, simple linear regression and multivariate linear regression model was used to evaluate the research question 2; “Does awareness concerning an occurrence of occupational exposures to bloodborne and airborne pathogens result in compliance with universal precautions”? Regression analysis assessing RQ#2 used 15 different regression models. The generic equation for this multiple linear regression models would be written as follows:

Average compliance score = intercept + <*variable associated with research question 2*> + Age_Group + Gender + Education + Years of experience.

Where each model substituted *"variable associated with research question 2"* for the variable derived from questions associated with occupation exposure.

Results of these models are shown in Table 14. After adjusting for effects of gender, age, education and years of experience, the participants who always intubated patients in last month had statistically significantly higher mean total compliance score compared to participants who never intubated the patients in last month (*p*-value<0.01). Similarly, participants who were stuck with contaminated lancet for 20 or more times within last year had mean compliance score greater by 0.85 units compared to participants who were stuck for 0-5 times within last year (*p*-value=0.13). After adjusting for effects of age, gender, education and years of experience, participants who had never been exposed to other body fluids had mean compliance score higher by 0.28 units compared to those participants who have ever been exposed to other body fluids. This association between participant's exposure to other body fluids and mean compliance score was statistically significant (*p*-value<0.01). Likewise, participants who were exposed to other body fluids for 16-20 times within last month had their mean compliance score lower by 1.14 units compared to participants who were exposed to other body fluids 0-5 times within last month. This difference was statistically significant (*p*-value=0.01)

The perceived response efficacy-perceived self-efficacy (PRE-PSE) score ranged from 5.5 to 9.3 among study population with mean and median score of 7.9. The perceived severity and perceived susceptibility (PS-PS) score ranged from 2.93 to 6 with

mean and median score of 4.5. The PRE-PSE score had medium positive relationship with total compliance score (Pearson's correlation coefficient =0.5). This indicates that with increase in perceived response efficacy-perceived self-efficacy among participant compliance with UP increased. This relationship was statistically significant (*p*-value<0.001). The PS-PS score had a slight positive relationship with total compliance score. It showed that with increase in perceived severity and perceived susceptibility among the participants compliance with UP increased. This association was statistically significant (*p*-value =0.002) (see Figure 5 and 6). Simple and multivariate linear regression model was used to evaluate relationship between PS-PS score and compliance score as well as PRE-PSE score and compliance score. A separate multivariate regression model was used to assess relationship between compliance and PS-PS score as well as relationship between compliance and PRE-PSE score. The following are equations for multivariate regression models used for RQ#3; "Is there a relationship between perceived severity, susceptibility, response-efficacy, self-efficacy, and compliance verses non-compliance in the utilization of universal precautions to prevent occupational exposures in the EMS workers population in Miami-Dade County"?

Average compliance score = intercept + PS-PS score + Age_Group + Gender + Education + Years of experience.

Average compliance score = PRE-PSE score + Age_Group + Gender + Education + Years of experience.

After adjusting for effects of gender, age, education and years of experience, each unit increase in mean PRE-PSE score was associated with mean increase in total

compliance score by 0.4 units. This association was statistically significant (p-value<0.01).

Table 14

Results of Simple and Multivariate Linear Regression Model for Research Question 2

Occupational Practices		Unadjusted		Adjusted*	
		Beta estimate (95% CI)	P-value	Beta estimate (95% CI)	P-value
Have you received any training or standard precaution / universal precaution knowledge	Intercept (No)	8.85 (8.32, 9.38)	<0.01	8.9 (8.3, 9.49)	<0.01
	Yes	-0.22 (-0.76, 0.32)	0.42	9.69 (8.91, 10.47)	<0.01
How regularly have you started an IV in the past month?	Intercept(Never)	8.52 (8.3, 8.75)	<0.01	-0.28 (-0.86, 0.3)	0.34
	Seldom	0.09 (-0.26, 0.43)	0.62	9.31 (8.65, 9.97)	0.00
	Sometimes	-0.01 (-0.31, 0.28)	0.94	0.08 (-0.27, 0.42)	0.66
	Most of the times	0.23 (-0.07, 0.53)	0.13	-0.04 (-0.35, 0.26)	0.79
	Always	0.24 (-0.07, 0.54)	0.13	0.2 (-0.12, 0.52)	0.21
How regularly have you intubated a patient in the past month?	Intercept (Never)	8.61 (8.47, 8.75)	<0.01	0.25 (-0.08, 0.57)	0.13
	Seldom	-0.02 (-0.25, 0.2)	0.83	9.39 (8.78, 10.01)	<0.01
	Sometimes	0.01 (-0.27, 0.28)	0.97	-0.04 (-0.26, 0.19)	0.75
	Most of the times	0.24 (-0.31, 0.78)	0.4	0.13 (-0.41, 0.67)	0.63
	Always	0.64 (0.09, 1.18)	0.02	0.56 (0.02, 1.1)	0.04

Table 14 *(continued)*

Occupational Practices			Unadjusted		Adjusted*	
			Beta estimate (95% CI)	P-value	Beta estimate (95% CI)	P-value
Have you ever been stuck with a contaminated lancet (for blood glucose testing) in your experiences as an EMS provider	Intercept (Yes)		8.59 (8.27, 8.91)	<0.01	9.41 (8.71, 10.12)	<0.01
	No		0.05 (-0.29, 0.38)	0.77	0.04 (-0.31, 0.39)	0.82
	How many times have you been stuck in the last year?	Intercept (0-5)	8.61 (8.42, 8.8)	<0.01	10.12 (8.59, 11.64)	<0.01
		>20	1.09 (0.07, 2.11)	0.04	0.85 (-0.26, 1.96)	0.13
	How many times have you been stuck in the last month?	Intercept (0-5)	8.63 (8.42, 8.84)	<0.01	9.78 (7.81, 11.75)	<0.01
		>20	0.97 (-0.54, 2.48)	0.2	0.67 (-0.85, 2.19)	0.38
	Did you report it?	Intercept (Yes)	8.73 (8.38, 9.07)	<0.01	8.48 (6.21, 10.76)	<0.01
		No	-0.05 (-0.58, 0.47)	0.83	0.13 (-0.55, 0.82)	0.69
Have you ever been stuck with a contaminated hypodermic needle (for IVs) in your experiences as an EMS provider?	Intercept (Yes)		8.6 (8.31, 8.89)	<0.01	9.41 (8.74, 10.08)	<0.01
	No		0.04 (-0.27, 0.35)	0.8	0.05 (-0.27, 0.37)	0.77
	How many times have you been stuck in the last year	Intercept (0-5)	8.59 (8.36, 8.82)	<0.01	9.76 (8.04, 11.49)	<0.01
		6-10	1.01 (-0.45, 2.47)	0.17	0.77 (-0.85, 2.39)	0.33
	How many times have you been stuck in the last month	Intercept (0-5)	8.58 (8.34, 8.82)	<0.01	9.81 (8.08, 11.54)	<0.01
		6-10	1.02 (-0.46, 2.49)	0.17	0.79 (-0.84, 2.41)	0.33
	Did you report it	Intercept (Yes)	8.66 (8.38, 8.95)	<0.01	9.87 (7.41, 12.33)	<0.01
		No	-0.26 (-0.85, 0.32)	0.36	-0.2 (-1.01, 0.62)	0.61

Table 14 *(continued)*

Occupational Practices			Unadjusted		Adjusted*	
			Beta estimate (95% CI)	P-value	Beta estimate (95% CI)	P-value
Have you ever been exposed to blood as an EMS provider	Intercept (Yes)		8.59 (8.48, 8.7)	<0.01	9.4 (8.78, 10.01)	<0.01
	No		0.2 (-0.03, 0.42)	0.08	0.11 (-0.12, 0.34)	0.35
	How many times in the last month have you been exposed to?	Intercept (0-5)	8.59 (8.47, 8.71)	<0.01	9.53 (8.81, 10.25)	<0.01
	Blood	10-Jun	-0.13 (-0.49, 0.23)	0.48	-0.16 (-0.51, 0.2)	0.39
		15-Nov	0.23 (-0.17, 0.64)	0.25	0.19 (-0.2, 0.59)	0.33
		16-20	-0.49 (-1.11, 0.12)	0.12	-0.24 (-0.92, 0.43)	0.48
		>20	-0.16 (-0.77, 0.46)	0.61	-0.15 (-0.77, 0.46)	0.62
Have you ever been exposed to other body fluids as an EMS provider	Intercept (Yes)		8.54 (8.43, 8.65)	<0.01	9.29 (8.68, 9.9)	<0.01
	No		0.35 (0.14, 0.56)	<0.01	0.28 (0.06, 0.49)	0.01
	How many times in the last month have you been exposed to other	Intercept (0-5)	8.57 (8.45, 8.69)	<0.01	9.22 (8.52, 9.92)	<0.01
	body fluids	10-Jun	-0.09 (-0.4, 0.22)	0.57	-0.08 (-0.4, 0.23)	0.60
		15-Nov	0.41 (-0.09, 0.9)	0.11	0.36 (-0.16, 0.88)	0.17
		16-20	-1.07 (-1.8, -0.34)	<0.01	-1.14 (-2, -0.28)	0.01
		>20	0.23 (-0.43, 0.89)	0.49	0.18 (-0.47, 0.83)	0.59

Note: *beta-coefficient of regression model were adjusted for effects of gender, age, education and years of experience

Figure 5

Relationship between PS-PS score and total compliance score

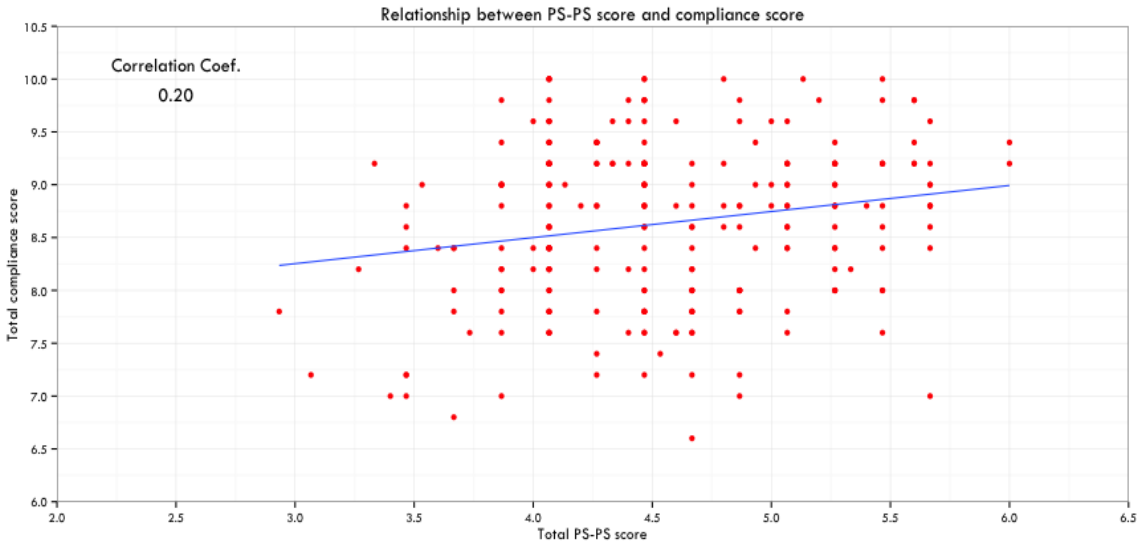


Figure 6

R*elationship between PRE-PSE score and total compliance score*

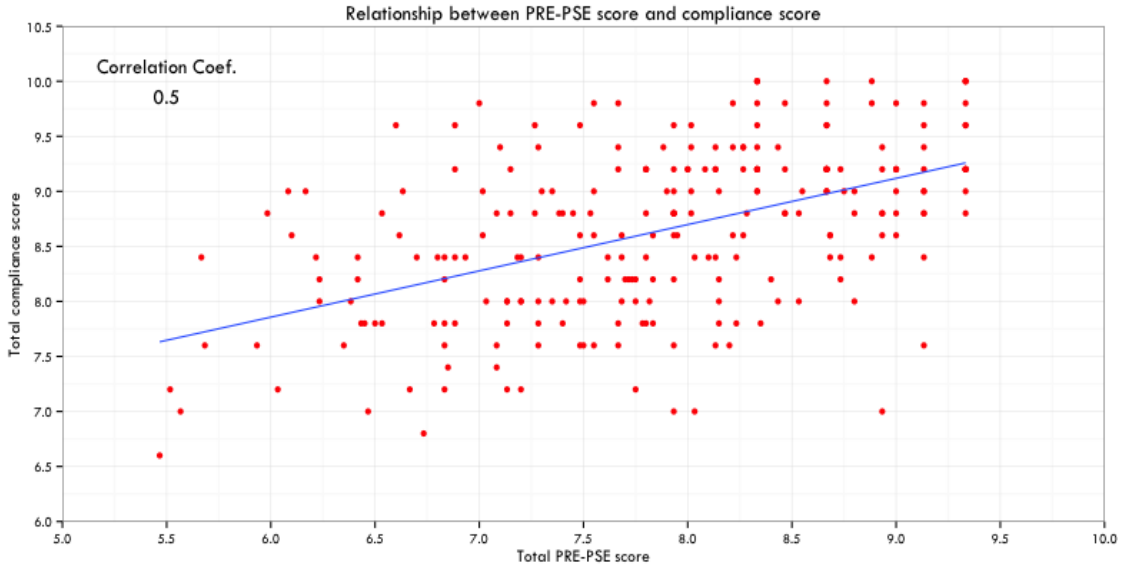


Table 15

Results of Simple and Multivariate Linear Regression for RQ3

Variables associated with RQ#3		Unadjusted Beta estimate (95% CI)	P-value	Adjusted* Beta estimate (95% CI)	P-value
Perceived Response Efficacy and Perceived Self-efficacy (PRE-PSE) Score	Intercept	5.33 (4.61, 6.06)	<0.01	6.26 (5.39, 7.14)	<0.01
	PRE-PSE score	0.42 (0.33, 0.51)	<0.01	0.4 (0.31, 0.49)	<0.01
Perceived Severity and Perceived Susceptibility (PS-PS) score	Intercept	7.51 (6.81, 8.22)	<0.01	8.5 (7.58, 9.41)	<0.01
	PS-PS score	0.25 (0.09, 0.4)	<0.01	0.21 (0.06, 0.37)	0.01

Note: *beta-coefficient of regression model were adjusted for effects of age group, gender, education and years of experience

Similarly, after adjusting for effects of gender, age, education and years of experience each unit increase in mean PS-PS score was associated with mean increase in total compliance score by 0.21 units. This association was statistically significant (p-value<0.01) as shown in Table 15.

Furthermore, a model regression diagnostics were performed on linear regression model used in the analysis. Results of these diagnostics showed that most of the assumptions of linear regression were satisfied. The detail of these results are presented below in figures (7 and 8).

Fig 7. *Diagnostic plots for linear regression model (unadjusted) for RQ#1*

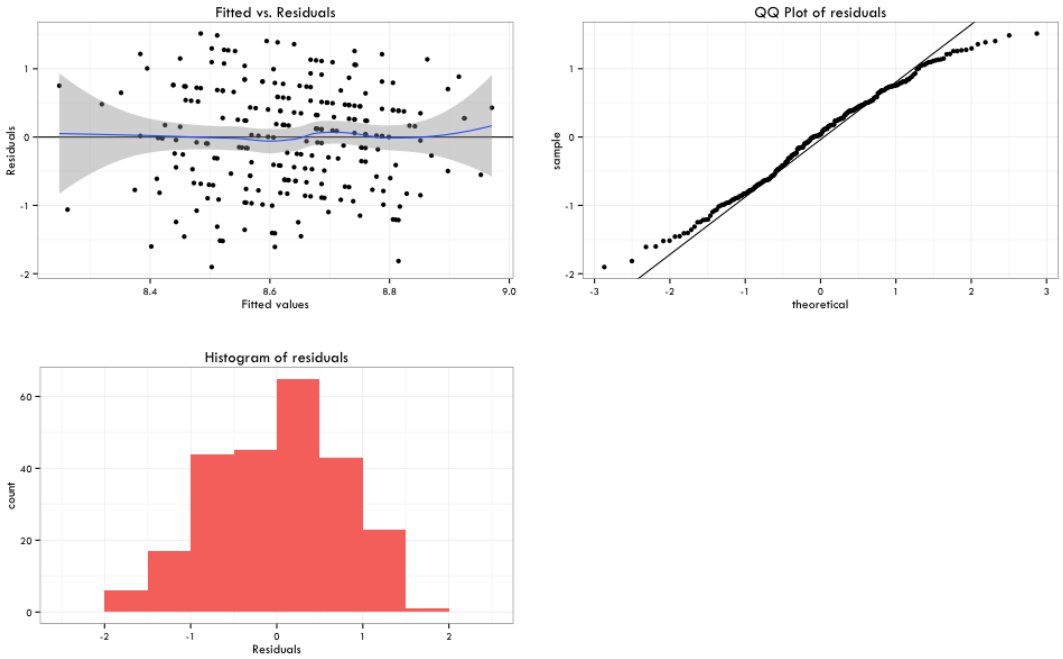
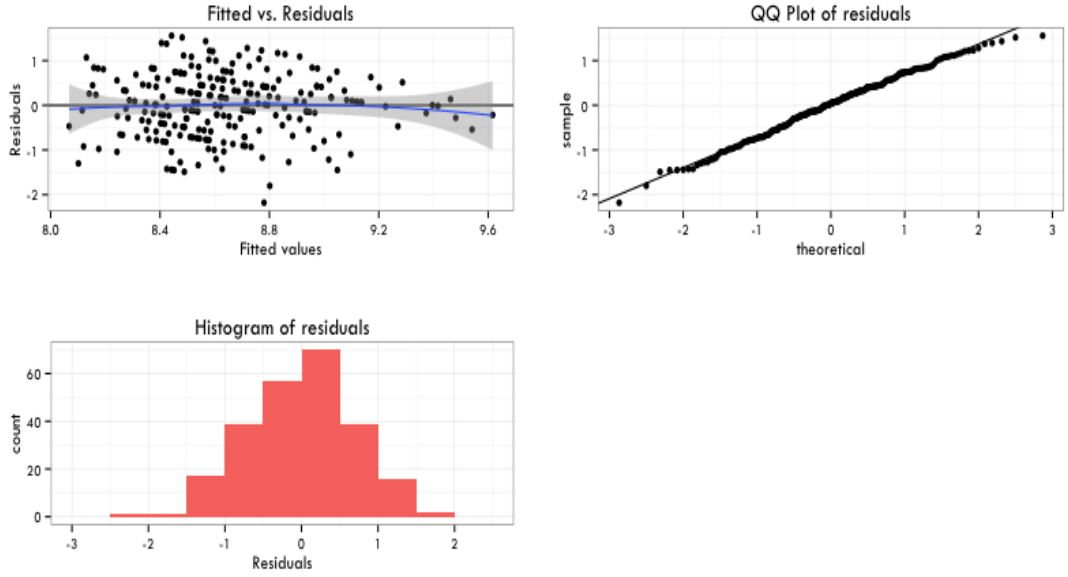


Fig 8. *Diagnostic plots for linear regression model (adjusted) for RQ#1*



A Fitted vs. Residuals plot show that residuals are randomly distributed around zero line suggesting assumption of linearity of residuals is reasonable. Residuals roughly form a horizontal bad around zero line that suggests constant variance of residuals. QQ plot and histogram of residuals also suggests satisfaction of linearity assumption for residuals (see fig.7).

Similar conclusion is derived diagnosis plots for age and gender adjusted linear regression model used for research question 1 (see fig. 8). Figure 8 contains the model with Perceived Response Efficacy and Perceived Self-Efficacy (PRE-PSE) score as an independent variable.

Fig 9. Diagnostic plots for linear regression model (unadjusted) for RQ#3

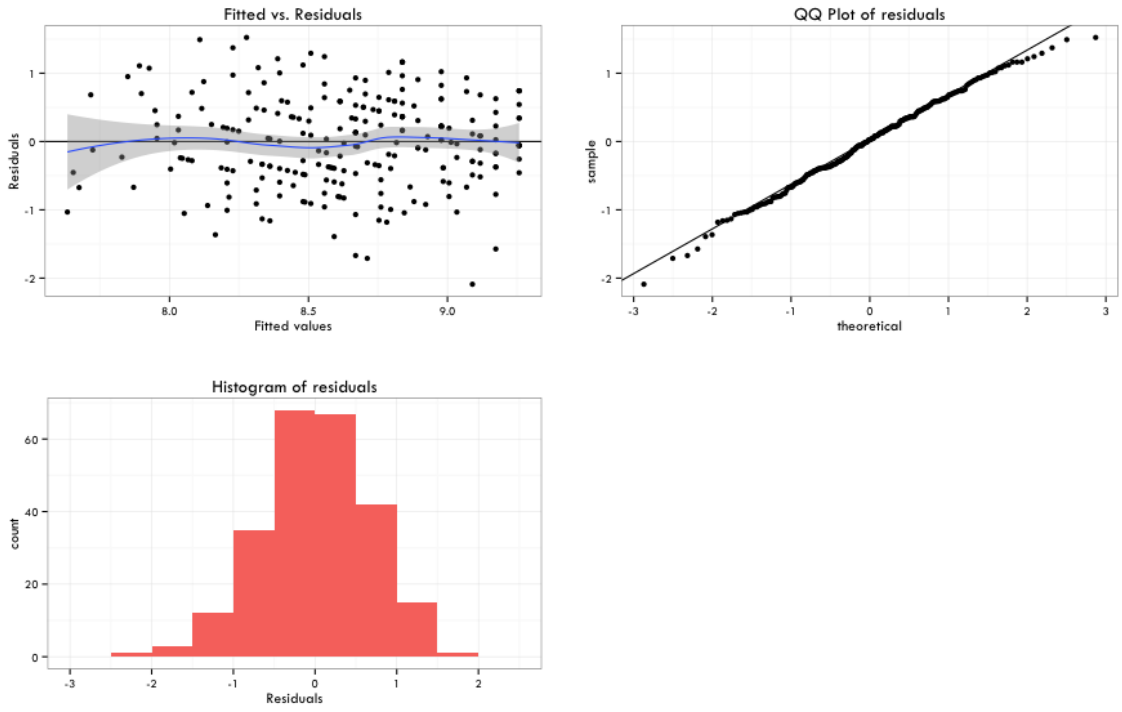


Fig. 9 and Fig. 10 shows model diagnosis plots for unadjusted and (gender and age) linear adjusted regression models used for assessing research question 3. Fitted vs. Residuals plot show that residuals are randomly distributed around zero line suggesting assumption of linearity of residuals is reasonable. Residuals roughly form a horizontal bad around zero line that suggests constant variance of residuals. QQ plot and histogram of residuals also suggests satisfaction of linearity assumption for residuals.

Fig 10. *Diagnostic plots for linear regression model (adjusted) for RQ#3*

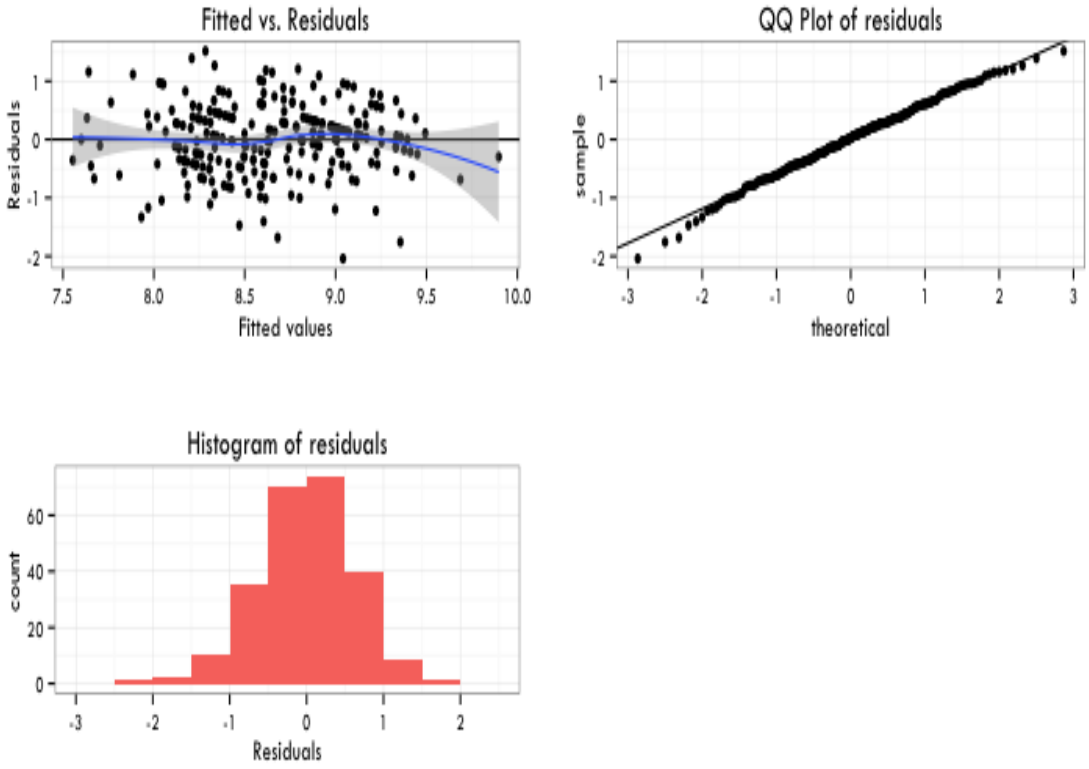


Fig 11. *Diagnostic plots for linear regression model (unadjusted) for RQ#3*

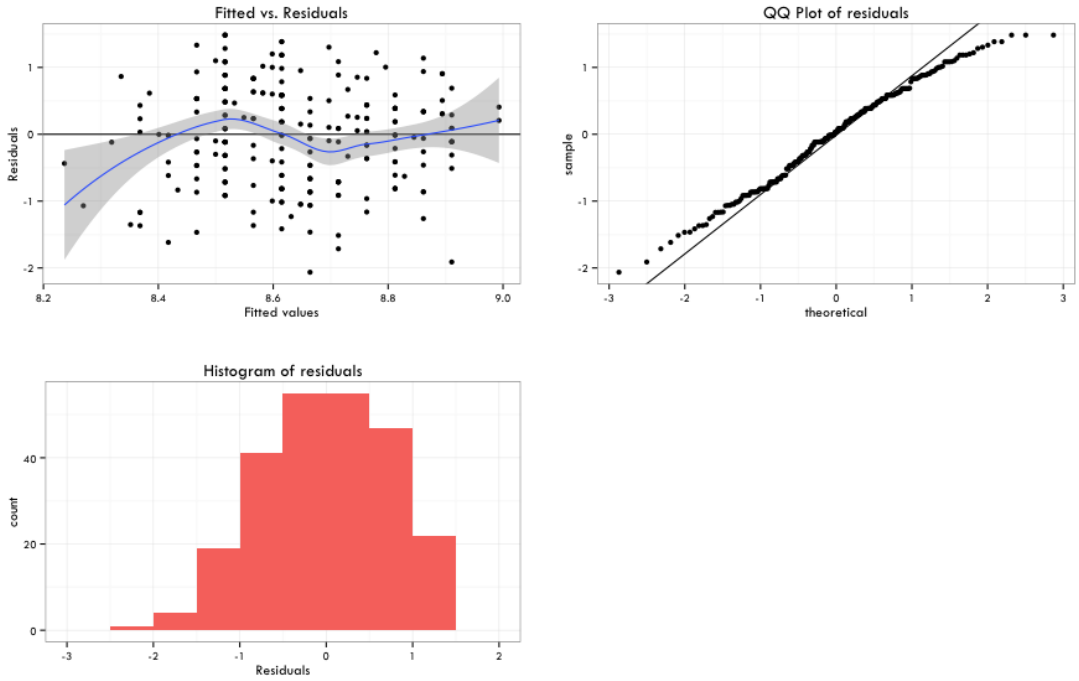
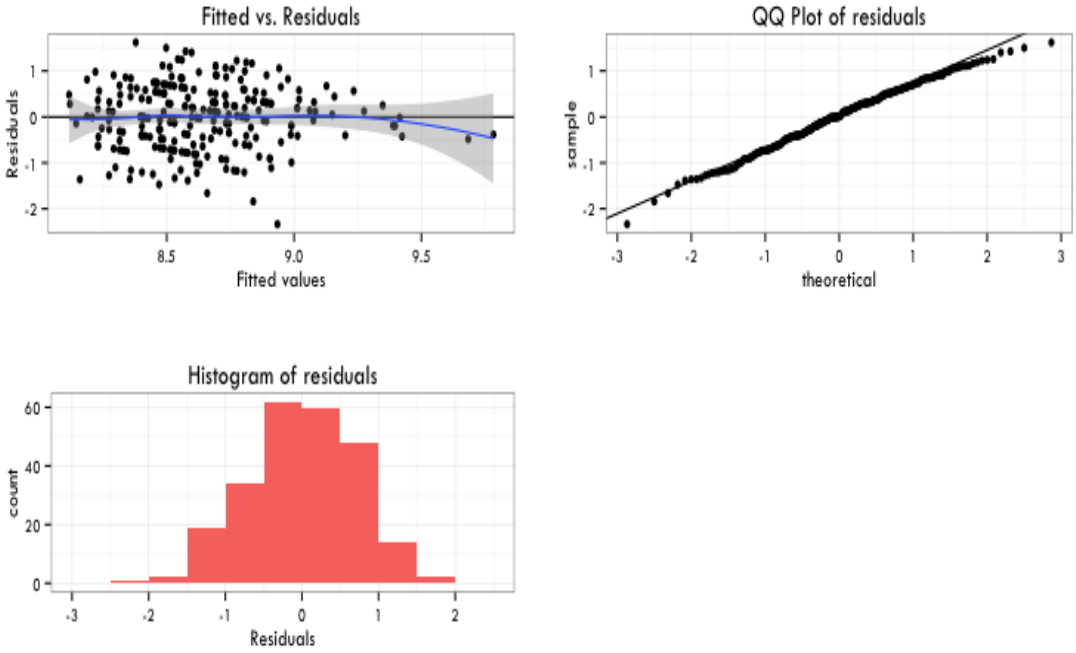


Fig. 11 and Fig. 12 shows model diagnosis plots for unadjusted and (gender and age) linear adjusted regression models used for assessing research question 3 with Perceived Severity and Perceived Susceptibility (PS-PS) score as independent variable. Fitted vs. Residuals plot show that residuals are randomly distributed around zero line suggesting assumption of linearity of residuals is reasonable. Residuals roughly form a horizontal bad around zero line that suggests constant variance of residuals. QQ plot and histogram of residuals also suggests satisfaction of linearity assumption for residuals.

Fig 12. Diagnostic plots for linear regression model (adjusted) for RQ#3



Summary of Findings

Chapter 4 began with details about data collection and descriptive analysis of the study sample. Then I tested three research questions with student's t test and Analysis Of Variance, simple and multivariate linear regression models. I found statistically significant association between knowledge and compliance with universal precautions among EMS workers and significant difference in compliance with UP by years of experience. However difference was not significant based participants' attitude and level of EMS training. Also, participants who had been stuck with contaminated lancet 20 or more times had higher compliance with UP compared to participants who had been stuck

with contaminated lancet 0-5 times within last month. The participant who had never exposed to other body fluids had higher compliance to Universal Precautions compared to those who ever exposed to other body fluids. However, I found statistically significant association between perceived severity, susceptibility, response-efficacy and self-efficacy, and compliance verses non-compliance with the utilization of universal precautions to prevent occupational exposures among EMS workers in Miami-Dade County.

In chapter 5, I discussed the results observed in this study and compare them to the previous published literature. Also, I discussed limitations of this study, explain implications and provide recommendations for future research.

Chapter 5

Introduction

The purpose of this crosssectional study was to assess (a) the levels of compliance with universal precautions, (b) knowledge of universal precautions and, (c) occurrence of occupational exposures to bloodborne and airborne pathogens among EMS workers in a prehospital environment. This study included 244 firefighters EMS personnel in six fire departments working in the pre-hospital environment within Miami-Dade County Florida. These research participants represented a sample of approximately 8% of the total population of firefighter EMS personnel working at all six of the career fire departments in Miami-Dade County. The information collected from this study attempted to bring about social change by influenceing awareness regarding occupational exposures in the pre-hosptial workers' environment.

The nature of this study was a survey research with a quantitative method. The research was conducted using a self-administered questionnaire to gather data about current occupational exposures to bloodborne and airborne pathogens, level of training, and knowledge of compliance with universal precautions. Quantitative research is consistent with a survey study to: analyze attitudes, knowledge, and risk factors of occupational exposure in regards to compliance with universal precautions for the prevention and transmission of infectious diseases in EMS workers.

This chapter discusses the interpretation of the findings of the research questions, limitations of the study, recommendations, implications for social change and a conclusion. The findings in this study suggest that there was a relationship between: (a)

the total knowledge and total compliance with Universal Precautions (UP), (b) years of experience and compliance with UP, and (c) compliance with UP by different levels of exposures. Also, there was a significant relationship between compliance with UP and increased levels of perceived severity and perceived susceptibility; while perceived response efficacy and perceived self-efficacy was moderately statistically significant. However, there was no statistical significant difference in: (a) compliance with UP by the level of EMT training, (b) attitude towards compliance with UP and the certification level, nor (c) job satisfaction and compliance with UP. The information provided in this research study involved EMS personnel in the fire service and occupational exposure to infectious diseases will bring about a social change in the pre-hospital work environment.

Interpretation of the Findings

This cross sectional study assessed 244 fire fighter EMS responder personnel working for the fire service departments within Miami-Dade County Florida. This study focused on three objectives in the form of research questions: (a) to evaluate if knowledge, attitude, certification level and year so experience in firefighter EMS responders predict levels of compliance with Universal Precautions, (b) to assess awareness concerning an occurrence of occupational exposures to bloodborne and airborne pathogens results in compliance with Universal Precautions, and (c) to determine if there is a relationship between perceived severity, perceived susceptibility, response-efficacy, response self-efficacy, and compliance verses non-compliance in the utilization of universal precautions to prevent occupational exposures in firefighter EMS responders in Miami-Dade County Florida.

Research Question 1

Does knowledge, attitude, certification level and years of experience in an EMS worker predict levels of compliance with universal precautions?

The mean compliance score among the firefighter EMS responder personnel participants was 8.6 and the mean knowledge score was 8.4. The relationship between the knowledge and compliance score was assessed with Pearson's product-moment correlation. Although the correlation coefficient indicated a weak positive correlation (r=0.18), the correlation was statistically significant (p=0.005). Therefore, compliance with Universal Precautions among the firefighter EMS responder personnel participants increased with increase in total knowledge score.

A large percentage (80%) of the participants (n-188) had a positive attitude regarding their current EMS position. Likewise, the mean compliance score did not differ by the firefighter EMS responder personnel participants satisfaction to their current EMS position (p-value=0.69). The mean compliance score was stratified by response related to attitudes towards using Universal Precautions. The compliance mean score was lower (8.38) for the study participants that did not wear gloves compared to the compliance mean score (8.68) for the study participants that did wear gloves. However, the analysis of variances was statistically significant (p-value=0.01) in showing a difference in mean compliance score among the different years of experience in the study participants.

A large percentage of the 244 EMS firefighter participants in this study did not consistently wear their gloves in the prehospital work environment. According to the

results, 78.3% always wear gloves on each call. On the other hand, the remainder percentage is as follows: seldom (1.6%), sometimes (4.5%), and most of the time (15.6 %). The reason given was because the patients appeared to be low risk. OSHA, CDC, NIOSH, and IAFF guidelines and standards state that gloves should be worn at all times when coming into contact with patients. All patients should be treated as if they have a bloodborne infectious disease. Furthermore, according to DOH and DOL, employers must provide Latex free gloves to employees with Latex allergies. Being non-compliant with Universal Precautions by not routinely using gloves, the firefighter EMS responder personnel are putting themselves at risk of an occupational exposure to an infectious bloodborne pathogen. Furthermore, results indicated that participants who had 16-20 years of experience as an EMS provider had on average 0.56 points lower mean compliance scores compared to participants with 1-5 years of experiences as an EMS provider. This is statistically significant (*p*-value=0.02), but arguably not in terms of the actual magnitude of the effect seen in the research.

Hypotheses 1

H_o1: There is no significant difference in compliance with universal precautions among EMS workers based upon (H_o1B) attitude and (H_o1C) certification level.

Statistical significance did not exist between Firefighter EMS responder personnel participants who were extremely dissatisfied with their current EMS position compared to those participants who were somewhat or extremely satisfied with their current position. Furthermore, participants with Fire Fighter EMT-P or Fire Fighter EMT-B certification did not have a significant difference in mean compliance score

Ha1: There is a significant difference in compliance with universal precautions among EMS workers based upon (Ha1A) knowledge and (Ha1D) years of experience.

Multivariate linear regression was used to evaluate hypothesis 1 for research question 1. Results indicated each 1-unit increase in mean total knowledge score was associated 0.13 point increase in mean total compliance score. Thus, an increase in knowledge was associated with increase in compliance score and was statistically significant (*p*=value=0.01).

In conclusion for Hypotheses 1, the results concluded that there was a significant difference in compliance with Universal Precautions among Fire Fighter EMS responder personnel based upon knowledge and years of experience as an EMS provider but, the difference was not statistically significant based upon attitude and certification level in the pre-hospital occupational environment.

Research Question 2

Does awareness concerning an occurrence of occupational exposures to bloodborne and airborne pathogens result in compliance with universal precautions?

Analysis of variance, simple linear regression, and multivariate linear regression model was used to evaluate research question two. There was a statistically significant difference in the mean compliance score by different levels of exposure to other bodily fluids. The results of this study revealed that those participants who had never been exposed to any bodily fluids had a higher mean compliance score (8.85) than those who had.

Hypotheses 2

Ha2: Awareness concerning occupational exposure to bloodborne and airborne pathogens does result in compliance with universal precautions among EMS workers.

As mentioned in Chapter 4, participants who had never been exposed to other bodily fluids had a compliance score higher than those participant who had been exposed to other bodily fluids. The score was at least 0.28 units higher and statistically significant (p-value<0.01). Likewise, participants who were exposed to other bodily fluids more than 16 times within the last month had lower compliance scores. Oddly, the results displayed in participants that were stuck with contaminated lances for 20 times or more in the last month had a compliance score greater than those who were stuck five times or less within the last year. Participants who intubated patients on a regular bases showed a statistically significant higher total compliance score compared to those who had not intubated a patient in the last month (p-value<0.01). Those participants utilized Universal Precautions when performing intubation skills and techniques because of their knowledge regarding intubation patient care in the pre-hospital environment.

Research Question 3

Is there a relationship between perceived severity, susceptibility, response-efficacy, self-efficacy, and compliance with the utilization of universal precautions to prevent occupational exposures in the EMS workers population in Miami-Dade County?

As mention in Chapter 1 of this study, the protection motivation theory (PMT) has been offered as a way to explain and predict individuals' cognitive attempt to change their health attitudes and behaviors in response to health threat and risks (Floyd, Prentice-Dunn, & Rogers, 200; Miline, Sheeran, & Oribel, 2000; Plotnikoff & Higginbotham,

2002). Among the study population, the perceived response-efficacy and perceived self-efficacy (PRE-PSE) mean score was 7.9 and the perceived severity and perceived susceptibility (PS-PS) median score was 4.5. Additionally, the scores of PRE-PSE and the PS-PS had medium positive relationship with total compliance score (Pearson's correlation coefficient=0.5).

Hypothesis 3

Ha3: There is a significant relationship in compliance with the utilization of universal precautions to prevent occupational exposures among EMS workers in Miami-Dade County based upon the following: (Ha3A) Perceived Severity, (Ha3B) Perceived Susceptibility, (Ha3C) Perceived Response-Efficacy, and (Ha3D) Perceived Self-Efficacy.

The results of the Pearson's product moment correlation and linear regression model results indicated that there is a statistical significance; PRE-PSE with a (p-value<0.01) and PS-PS with a (p-value=0.002). Thus, indicating an association between PRE-PSE and PS-PS with compliance of universal precautions. An increase in the PS-PS and PRE-PSE mean score was associated with mean score increase in the total compliance score.

Therefore, according to the responses of Fire Fighter EMS responder personnel participants on the self-administered survey questionnaire used in this study, participants (a) perceived severity to a threat: bloodborne and airborne pathogens can make them sick, (b) perceived susceptibility: participants are at risk of an occupational exposure because of behaviors that could be considered negative and non-compliant with universal

precautions (c) perceived response efficacy: participants can avoid and reduce the risk of an occupational exposure, and (d) perceived self-efficacy: participants do possess the knowledge, educational training, and the ability to engage in recommended standards of compliance with universal precautions.

Limitations of the Study

As mentioned in chapter 1, the study has several potential limitations that should be considered when interpreting the results. The results were construed with consideration of the environment of the study. There was an inability to compare the knowledge of compliance with universal precautions of firefighter EMS responders with non-firefighter EMS responders, which could have potentially produced a bias. Yet, no bias was formed because only firefighter EMS personnel participated in the study. However, there is no obvious reason to suspect that non-firefighter EMS responders are not susceptible to the same occupational infectious hazards as the firefighter EMS responders in the unpredictable pre-hospital work environment.

The current study is that it was conducted using participants currently certified as firefighter EMS personnel working in a career fire service department in Miami-Dade County Florida. The participants in this study volunteered to complete the survey questionnaire. The researcher intended to conduct their research study by issuing the self-administered survey questionnaire with EMS personnel from the six major non-fire service ambulance transport companies in Miami-Dade County Florida. However, EMS personnel from non-fire service ambulance transport companies were not available for the study. Thus, the non-fire service EMS personnel within the county function at

different levels: some fire and others non-fire service, as well as possess a diverse amount of experience and did not participate in the study.

It was not known prior to the study the quantity of training regarding compliance with universal precautions; knowledge of CDCs, OSHA, and NIOSH infection control guidelines; and occupational exposures to bloodborne and airborne pathogens acquired on the job. The study population was restricted to Miami-Dade County Florida. The participants involved in this research study represented 8% of the total firefighter EMS personnel of all six fire departments in Miami-Dade County Florida. In addition, the sample size may have been adequate for the purpose of the research however, an adequate distribution of the EMS personnel universe in Miami-Dade County wasn't necessarily acquired. Since, the sample population was collected from accessible participants currently employed by the six fire departments; the results were aggregated by the overall participants and not by each fire department.

The researcher may have failed to include other important variables that influence firefighter EMS personnel's knowledge of universal precautions, occupational exposure to infectious diseases policies and procedures for each of the six career fire service departments. In addition, some of the participants may have collaborated on the self-administered survey questionnaires regardless of the instructions given that the survey is based on each individual's personal experience(s) and career as a firefighter EMS responder (Stein, Makarawo, & Ahmad, 2003). Therefore, influencing the responses. Moreover, data collected in Miami-Dade County Florida might not represent all EMS workers in Florida Emergency Medical Services Region 7. According to the Florida

Department of Health – Florida Emergency Medical Providers Licensure and Call Volume Report (2013, October), Region 7 consist of four counties; Palm Beach County, Broward County, Monroe County and Miami-Dade County. Although Region 7 has the most EMS incidents, the findings of this study conducted in Miami-Dade County cannot be generalized and compared to the total EMS population in the State of Florida.

Recommendations

There is a need for further research concerning compliance with universal precautions in firefighter EMS responders' personnel. Various researchers have stressed that health care workers' compliance with universal precautions is inadequate. Firefighter EMS responders are under the umbrella of health care workers. Future research should emphasize on education, awareness, and training regarding occupational exposures to infectious diseases as well as complying with guidelines to prevent and reduce the risk of such exposures in the firefighter EMS responders working in the pre-hospital environment.

Previous studies have shown that there is a lack of knowledge regarding compliance with universal precautions to reduce the risk of an occupational exposure to infectious diseases (Stein et al., 2003). Other studies have indicated that health care workers stated that compliance with universal precautions is time consuming, not always necessary with patients that appear to be low risk and is a hindrance or obstruction in completing medical skills and tasks (Harris and Nicolai, 2010). To ensure adequacy comprehension of the occupational practices that must take place in order to comply with

all the guidelines and standards, instructors must provide evidence that the training was effective in accomplishing the projected objectives.

In this study the results indicated whenever there was an increase in knowledge, there was an increase in compliance with universal precautions. In addition, the study suggested that those participants that had never been exposed to any other body fluids exhibited higher compliance to universal precautions. While on the other hand those participants that were exposed to other body fluids greater than 15 times within the last month had a low compliance score to universal precautions. It appears that firefighter EMS personnel with education and training regarding the CDC, WHO, NIOSH, and OSHA guidelines; training on how to properly dispose of needles, utilize mask, gloves, and other PPEs appropriately displayed more knowledge regarding reducing the risk of an occupational exposures to infectious diseases along with compliance to Universal Precautions. Experience does not necessarily indicate more knowledge.

Firefighter EMS responder personnel should apply all necessary standards, guidelines and universal precautions with all patients regardless of what is and isn't known about the patient. It is essential that firefighter EMS responder personnel have an understanding of universal precautions and preventing the spread of infectious diseases thus, preventing an occupational exposure in the pre-hospital work environment. When used correctly, the standards, guidelines and universal precautions can reduce an occupational exposure to infectious diseases and pathogens. An occupational exposure to infectious diseases can have a negative consequence on the health of any firefighter EMS responder personnel.

Implications for Positive Social Change

Firefighter EMS responder personnel are at a higher risk of bloodborne and airborne infectious diseases than other health care workers because of their occupational duties in the pre-hospital work environment. With the resurgence threat and reemergence of infectious diseases such as Measles, Pertussis, Tuberculosis, Influenza and Methicillin-resistant Staphylococcus aureus (MRSA); knowledge through educational training is essential in implementing a social change in behaviors and occupational practice. Understanding the current occupational and behavioral practices of this population is essential in implementing educational training. The importance of the resources, standards and guidelines should be emphasized through the increased use of demonstration, modeling of behaviors, techniques and guided occupational skills supported by positive reinforcement of compliance with universal precautions.

In addition, the occurrence of infectious diseases, such as Ebola, that are new to EMS responder personnel in the United States; it is critical to be prepared to perform mandate infection prevention policies and procedures. An occupational exposure to any infectious disease is a major health concern to firefighter EMS responder personnel.

Implications for positive social change for this study is to increase innovative knowledge that will allow the firefighter EMS responder personnel to implement strategies to improve compliance with universal precautions. Strategies that include but are not limited to: (a) educating firefighter EMS about preventive measure that will reduce and or eliminate the risk of an occupational exposure to infectious diseases in the pre-hospital work environment, (b) take initiative in utilizing employee provided

equipment and proper PPE at all times, and (c) ensuring that firefighter EMS responder personnel understands that all human blood and body fluids are to be treated as if known to be infectious.

Conducting routine educational training classes in small intervals on the mandated OSHA, NIOSH, CDC, FDOH, IAFF, and NFPA standards and guidelines are practical to firefighter EMS responders' knowledge in the pre-hospital environment. By reinforcing compliance with universal precautions through continuous education along with comprehensive knowledge and improvement in skills will bring about a change in the occupational practice (Luo, et. al., 2010; Oliveira et. al., 2009; Vaz et. al., 2010). Ultimately the increase in knowledge as well as technical and clinical skills can improve EMS responder's behaviors and attitudes, thus reducing the risk of an occupational exposure to infectious diseases.

The findings in this study can be valuable to the fire service departments and provide data to address the benefits of having an infection control plan in place to appropriately educate firefighter EMS responder personnel on preventive measures of an occupational exposure in the pre-hospital work environment. Education and improvement in infection control practice is necessary to change the attitudes of the firefighter EMS personnel regarding compliance with universal precautions. Education, up-to-date immunizations, training, and familiarity with information on the latest developments of infectious diseases are significant in the prevention and management of an occupational exposure.

EMS personnel must be trained by their employer on appropriate and safe work practices, applicable engineering controls, and the proper use of personal protective equipment in order to reduce and prevent such exposures. According to OSHA's Title 29 of the Code of Federal Regulations, employers are required to: establish an exposure control plan, update the plan annually, implement the use of universal precautions, identify and use engineering controls, identify and ensure the use of work practice controls, provide PPE (gloves, gowns, eye protection and masks), make available hepatitis B vaccination to all workers with occupational exposure, provide information and training to workers, and maintain workers' medical and training records.
Providing the proper supervisory behaviors to reinforce safe occupational practices and can decrease the risk of an occupational exposure to an infectious disease. Continuous and ample improvement in the prevention / reduction in occupational exposures in the firefighter EMS responder personnel will require notable social change. Firefighter EMS responder profession must make every effort to improve compliance with all standards, guidelines and universal precautions.

Conclusion

Firefighter EMS responder personnel in the pre-hospital environment are at a higher risk of an occupational exposure to needelsticks, other body fluids, bloodborne and airborne infectious pathogens than any other health care worker. Although CDC, OSHA, NIOSH, IAFF, DOH and WHO have standards, guidelines, and polices in place to comply with Universal Precautions, wear appropriate PPEs, and prevent occupational exposures to bloodborne and airborne pathogens, some health care workers are non-

compliant. Firefighters, paramedics, firs-responders, and EMTs are a distinct group of health care personnel who are exposed to several different infectious pathogens while providing prehospital emergency medical care, which can potentially lead to disease transmission (Carillo et al., 1996). However, this population is often limited to the control over their own health because of the unpredictable nature of the occupational hazards associated with the firefighter EMS responder profession.

Several studies have shown that there is a lack of knowledge and non-compliant behaviors regarding Universal Precautions. The results in this study confirmed the importance of a positive attitude for the compliance with Universal Precautions and reduction of an occupational exposure to an infectious disease. The level of knowledge on compliance with Universal Precautions was significant among the participants in this study. Providing and enhancing educational information regarding compliance with universal Precautions, occupational exposures to infectious diseases, and proper donning of PPE can bring about a change in the occupational practice of firefighter EMS responder personnel in the pre-hospital work environment. The training environment for the firefighter EMS responder personnel should mimic and encourage universal precaution practice by positive role modeling; a format that can support positive behavior change and safe occupational practice (Labrague et al., 2012). Nevertheless, before the implementation of any educational training programs; the instructors must ensure that the content of their program meet the required standards / guidelines, and is both accurate and up to date.

Although many significant variables associated by way of compliance to Universal Precautions were evaluated in this study, the most surprising was that some EMS responder personnel are still recapping needles and others are not wearing gloves on each call. This study results indicated that there was 21.7% of the participants did not wear their gloves on each call. Additionally, 23.8% of the participants stated that they always recap needles; while most of the time (4.5%), sometimes (4.5%), and seldom (6.6%). With today's latest technology in biohazard equipment, syringe needles have antilock mechanisms on them to eliminate the need for recapping and reduce the chance of a needelstick injury. Policies and procedures are required by governed entities should be established throughout the fire service departments regarding training of equipment, in-service training for new biohazard equipment and reviewed on a regular bases.

This study demonstrated that compliance to Universal Precautions in the Fire Fighter EMS Responder Personnel is an occupational and health issue in the pre-hospital environment. The intentions to comply with Universal Precautions were significantly associated with high levels of knowledge, years of experience, and the participants' cognitive attempt to change their health attitudes and behaviors to comply with Universal Precautions (Floyd et al., 2000; Milne et al., 2000, Plotnikoff & Higginbotham, 2002). The intention to comply with Universal Precautions was associated positively with PSe-PSu and PRE-PSE of the Protection Motivation Theory. Actually, the PMT appears to be an appropriate theoretical model for this study. The PMT theoretical model supports continued research into the relationship between knowledge, attitudes, educational training, compliance with universal precautions, risk perception, and over all

occupational skills and techniques practice to reduce the risk of an occupational exposure to a bloodborne and airborne infectious pathogen. Fire Fighter EMS responder personnel must perceive that non-compliant practices, attitudes, and behaviors are an occupational health risk, and believe that universal precautions would be beneficial to their health and motivation to protect themselves from an occupational exposure to an infectious disease.

REFERENCES

Abraham, C. S., Sheeran, P., Abrams, D., & Spears, R. (1994). Exploring teenagers' adaptive and maladaptive thinking in relation to the threat of HIV infection. *Psychology and Health, 9*(4), 253-272. doi: 10.1080/08870449408407485.

Alam, M. (2002). Knowledge, attitude, and practices among health care works on needle-stick injuries. *Annals of Saudi Medicine, 22*(506), 396-399. Retrieved from http://www.annsaudimed.net

Allen, R. S., Phillips, L. L., Pekmezi, D., Crowther, M. R., & Prentice-Dunn, S. (2009). Living well with living wills: Application of protection motivation theory to living wills among older Caucasian and African American adults. *Clinical Gerontologist, 32*(1), 44-59. doi: 10.1080/07317110802474643.

Askarian, M., Aramesh, K., & Palenik, C.J. (2006). Knowledge, attitude, and practice toward contact isolation precautions among medical students in Shiraz, Iran. *American Journal of Infection Control, 34*(9), 593-596. doi: 10.1016/j.ajc.2006.03.005.

Askarian, M., McLaws, M., and Meylan, M. (2007). Knowledge, attitude, and practices related to standard precautions of surgeons and physicians in university-affiliated hospitals of Shiraz, Iran. *International Journal of Infectious Diseases, 11*(3), 213-219. doi: 10.1016/j.ijid.2006.01.006.

Askarian, M., Yadollahi, Kouchak, F., Danaei, M., Vakili, V., and Momeni, M. (2011). Precautions for healthcare workers to avoid Hepatitis B and C virus infection.

The International Journal of Occupational and Environmental Medicine, *2*(4), 191-198. http://www.theioem.com

Askew, S. (2007). Occupational exposures to blood and body fluid- A study of medical students and health professions students in Virginia. *American Association of Occupational Health Nurses Journal*, *55*(9), 36-371. Retrieved from http://www.aaohn.org

Association for Professionals in Infection Control and Epidemiology, Inc. [APIC]. (2013). Guide to infection prevention in emergency medical services. Washington, D.C., 1-86. Retrieved from www.apic.org/implementationguides

Au, T., Destache, C., and Vivekanandan, R. (2015). Hepatitis C therapy: Looking toward interferon-sparing regiments. *Journal of American Pharmacist Association*, *55*(2), e-72-e86. doi: 10.1331/JAPhA.2015.15508

Baghianimoghadam, M. H., Mohammadi, S., Noorbala, M. T., & Mahmoodabad, S. S. (2011). An intervention based on protection motivation theory in reducing skin cancer risk. *Journal of Pakistan Association of Dermatologists*, *21*(3), 141-148. Retrieved from http://www.jpad.org.pk

Bassett, S. F. & Prapavessis, H. (2011). A test of an adherence-enhancing adjunct to physiotherapy steeped in the protection motivation theory. *Physiotherapy Theory and Practice*, *27*(5), 360-372. doi: 10.3109/09593985.2010.507238.

Beltrami, E., Williams, I., Shapiro, C., & Chamberland, M. (2000). Risk and management of bloodborne infections in health care workers. *Clinical Microbiology Reviews*, *12*(3), 385-407. doi: 10.1128/CMR.13.3.385-407.2000.

Bennett, P., Rowe, A., & Katz, D. (1998). Reported adherence with preventive asthma medication: A test of protection motivation theory. *Psychology, Health & Medicine*, *3*(4), 347-354. doi: 10.1080/13548509808400609

Bergh, D., Hanke, R., Balkundi, P., Brown, M. & Chen, X. (2004). An assessment of research designs in strategic management research: The frequency of threats to internal validity. *Research Methodology in Strategy and Management*, 1, 347-363. doi: 10.1016/S1479-838(04)01112-9

Bianco, A., Bova, F., Nobile, C., Pileggi, C., & Pavia, M. (2013). Healthcare workers and prevention of hepatitis C virus transmission: exploring knowledge, attitudes and evidence-based practices in hemodialysis units in Italy. *BioMedical Central Infectious Diseases*, *13*(76), 1-11. Retrieved from http://www.biomedcentral.com/1471-2334/13/76.

Boal, W., Leiss, J., Sousa, S., Lyden, J., Li, J., & Jagger, J. (2008). The national study to prevent blood exposure in paramedics: Exposure reporting. *American Journal of Industrial Medicine*, *51*(3), 213-222. doi: 10.1002/ajim.20558

Boer, H. & Seydel, E. R. (1995). Protection motivation theory, Chapter 4. In Connor, M., & Norman, P. (Eds.), *Predicting health behavior* (pp. 95-120). Buckingham, England: Open University Press.

Bosques-Padilla, F., Vazquez-Elizondo, G., Villasenor-Todd, A., Garza-Gonzalez, E., Gonzalez-Gonzalez, J., & Maldonado-Garza, H. (2010). Hepatitis C virus infection in health-care settings: Medical and ethical implications. *Annals of*

Hepatology, 9(Suppl. 1), S132-S140. Retrieved from http://www.annalsofhepatology.com/old/PDF/vol9s1/HP-S101-22.pdf

Brouwers, M.C. & Sorrentino, R.M. (1993). Uncertainty orientation and protection motivation theory: The role of individual differences in health compliance. *Journal of Personality and Social Psychology, 65*(1), 102-112. doi: 10.1037/0022-3514.65.1.102

Bui, L., Mullan, B., & McCaffery, K. (2013). Protection motivation theory and physical activity in the general population: A systematic literature review. *Psychology, Health and Medicine, 18*(5), 522-542. doi: 10.1080/13548506.2012.749354.

Bureau of Labor Statistics & U.S. Department of Labor. (2013). Occupational outlook handbook, 2012-13 edition (fire fighters). Retrieved from http://www.bls.gov/ooh/protective-service/firefighters.htm

Cardo, D., & Bell, D. (1997). Bloodborne pathogen transmission in health care workers – risk and prevention strategies. *Infectious Disease Clinics of North America, 11*(2), 331-345. Retrieved from http://www.id.theclinics.com

Carrillo, L., Fleming, L., & Lee, D. (1996). Bloodborne pathogens risk and precautions among Urban fire rescue workers. *Journal of Occupational & Environmental Medicine, 38*(9), 920-924. Retrieved from http://journals.lww.com/joem/toc/1996/09000

Centers for Disease Control and Prevention. (2013). About NIOSH. Retrieved on April 20, 2013 from http://www.cdc.gov/niosh/about.html.

Centers for Disease Control and Prevention. (2013). What is HIV? Retrieved on April 20, 2013 from http://www.cdc.gov/hiv/basics/whatishiv.html

Centers for Disease Control and Prevention. (2013, March 22). Trends in tuberculosis – United States, 2012. *Morbidity and Mortality Weekly Report, 62*(11), 201-205. Retrieved from http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6211a2.htm

Centers for Disease Control and Prevention. (2012). Emergency medical services workers. Retrieved on April 17, 2013 from http://ww.cdc.gov/noish/topics/ems

Centers for Disease Control and Prevention. (2011). Core curriculum on tuberculosis: What the clinician should know (fifth edition). Retrieved in May 7, 2012 from http://www/cdc/gov/tb.

Centers for Disease Control and Prevention. (2010). Hepatitis B general information. Retrieved on January 17, 2013 from www.cc.gov/hepatitis/HBV/index.htm

Centers for Disease Control and Prevention. (2008). Recommendations for postexposure interventions to prevent infection with Hepatitis B virus, Hepatitis C virus, or Human Immunodeficiency Virus, and tetanus in persons wounded during bombings and similar mass-casualty events – United States, 2008. *Morbidity and Mortality Weekly Report, 57* (RR-6), 1-19. Retrieved from http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5706a1.htm?s_cid=rr5706a1_e

Centers for Disease Control and Prevention. (2006). A comprehensive immunization strategy to eliminate transmission of Hepatitis B virus infection in the United Sates. *Morbidity and Mortality Weekly Report, 55*(RR-16), 1-33. Retrieved from http://www.cdc.gov/mmwr/pdf/rr/rr5516.pdf

Centers for Disease Control and Prevention. (2005). Updated U.S. public health service guidelines for the management of occupational exposures to HIV and recommendations for postexposure prophylaxis. *Morbidity and Mortality Weekly Report, 54*(RR-09), 1-17. Retrieved from http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5409a1.htm

Centers for Disease Control and Prevention. (2005). Guidelines for preventing the transmission of Mycobacterium tuberculosis in health-care settings, 2005. *Morbidity and Mortality Weekly Report*, 54(RR-17), 1-9. Retrieved from http://www.cdc.gov/mmwr/pdf/rr/rr5417.pdf

Centers for Disease Control and Prevention. (2001). Updated U.S. Public Health service guidelines for the management of occupational exposures to HBV, HCV, and HIV and recommendations for postexposure prophylaxis. *Morbidity and Mortality Weekly Report (MMWR),* 50(RR-11), 1-52. Retrieved from http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5011a1.htm

Center for Disease Control and Prevention. (2000). Hepatitis C virus infection among firefighters, emergency medical technicians, and paramedics --- selected locations, United States, 1991-2000. *Morbidity and Mortality Weekly Report (MMWR), 49*(29), 660-605. Retrieved from http://www.cdc.gov/mmwr/preview/mmwrhtml/mm4929a3.htm

Christakou, A. & Lavallee, D. (2009). Rehabilitation from sports injuries: From theory to practice. *Perspectives in Public Health, 129*(3), 120-126. doi: 10.1177/1466424008094802

Cole, M. (2008). Compliance and infection control guidelines: a complex phenomenon. *British Journal of Nursing*, *17*(11), 700-704. Retrieved from http://www.britishjournalofnursing.com/

Corless, I. (2007). HIV/AIDS, Chapter 13. In Lashley, F. & Durham, J. (Eds.), *Emerging infectious diseases: Trends and issues, 2nd edition* (pp. 209-220). New York, NY: Springer Publishing Company.

Courneya, K. S. & Hellsten, L. A. M. (2001). Cancer prevention as a source of exercise motivation: An experimental test using protection motivation theory. *Psychology, Health & Medicine*, *6*(1), 59-64. doi: 10.1080/13548500020021928

Cuming, R., Rocco, T., and Mceachern, A. (2008). Improving compliance with Occupational Safety and Health Administration Standards. *Association of Perioperative Registered Nursing Journal*, *87*(2), 347-360. Retrieved from http://www.aornjournal.org

Davey, V. (2007). Hepatitis C, Chapter 12. In Lashley, F., & Durham, J. (Eds.), *Emerging infectious diseases: Trends and issues, 2nd edition* (pp. 197-208). New York, NY: Springer Publishing Company.

Department of Health and Human Services, Centers for Disease Control and Prevention, & National Institute for Occupational Safety and Health. (2010). Preventing exposures to bloodborne pathogens among paramedics. *Workplace Solutions, 2010*-139, 1-4. Retrieved from http://www.cdc.gov/niosh/docs/wp-solutions/2010-139/pdfs/2010-139.pdf

Dietchman, S. (2002). Managing infectious risks to first responders. *Clinics in Occupational and Environmental Medicine, 2*(2), 427-442. Retrieved from http://www.occmed.theclinics.com/issues

Doebbeling, B., Vaughn, T., McCoy, K., Beekmann, S., Woolson, R., Ferguson, K., & Torner, J. (2003). Percutaneous injury, blood, exposure, and adherence to standard precautions: Are hospital-based health care providers still at risk? *Clinical of Infectious Diseases, 37*(8), 1006-1013. doi: 10.1086/377535

Donnelly, E., & Diebert, D. (2009). Occupational risk factors in the emergency medical services. *Prehospital and Disaster Medicine, 24*(5), 422-429. Retrieved from http://www.pdm.medicine.wise.edu

Efstathiou, G., Papastavrou, E., Raftopoulos, V., & Merkouris, A. (2011). Factors influencing nurses' compliance with standard precautions in order to avoid occupational exposure to microorganisms: A focus group study. *BioMedical Central (BMC) Nursing, 10*(1), 1-12. Retrieved from http://www.biomedicentral.com/1472-6955/10/1

Erdfelder, E., Faul, Fl., & Buchner, A. (1996). GPower: A general power analysis program. *Behavior Research Methods, Instruments, & Computers, 28*(1), 1-11. Retrieved from http://www.link.springer.com/content/pdf/10.3758%2FBF03203630.pdf

Exposure Prevention Information Network (EPINet). (2011). EPINet 2011 blood and body fluid exposures report. Charlottesville, VA: International Health Care

Worker Safety Center, University of Virginia. Retrieved from http://www.healthsystem.virginia.edu/pub/epinet/epinetdatareports.html

Exposure Prevention Information Network (EPINet). (2011). EPINet 2011 Needlestick and sharp-object injuries report. Charlottesville, VA: International Health Care Worker Safety Center, University of Virginia. Retrieved from http://www.healthsystem.virginia.edu/pub/epinet/epinetdatareports.html

Florida Department of Health Division of Disease Control. (2013, March). Monthly surveillance report (Hepatitis, HIV/AIDS, STD and TB). Retrieved from http://www.doh.state.fl.us/disease_ctrl/aids/trends/msr/2013/MSR0313.pdf

Florida Department of Health. (2011, April). 2010 Florida emergency medical providers' licensure and call volume report. Retrieved from http://www.doh.state.fl.us/demo/ems/Providers/DataPDFs/Final2010LicensureandCallVolumeReport.pdf

Floyd, D. L., Prentice-Dunn, S., & Rogers, R. W. (2000). A meta-analysis of research on protection motivation theory. *Journal of Applied Social Psychology*, *30*(2), 407-429. doi.10.111/j.1559-1816.2000.tb02323x

Frankfort-Nachmias, C., & Nachmias, D. (2008). Research designs: Cross-Sectional and quasi-experimental designs, Chapter 6. In Frankfort-Nachmias, C., & Nachmias, D. (Eds.), *Research Methods in the Social Sciences, Seventh Edition* (pp. 113-133). New York, NY: Worth Publishers.

Frankfort-Nachmias, C., & Nachmias, D. (2008). Measurement, Chapter 7. In Frankfort-Nachmias, C., & Nachmias, D. (Eds.), *Research Methods in the Social Sciences, Seventh Edition* (pp. 137-160). New York, NY: Worth Publishers.

Gammon, J., Morgan-Samuel, H., & Gould, D. (2007). A review of the evidence for suboptimal compliance of healthcare practitioners to standard/universal infection control precautions. *Journal of Clinical Nursing, 17*(2), 157-167. doi: 10.1111/j.1365-2702.2006.01852.x

Gaston, A. & Prapavessis, H. (2012). Using a combined protection motivation theory and health action process approach intervention to promote exercise during pregnancy. *Journal of Behavior Medicine, 35*(6), 1-12. doi: 10.1007/s10865-012-9477-2

Gebresilassie, A., Kumel, A., & Yemane, D. (2014). Standard precautions practice among health care workers in public health facilities of Mekelle special zone, Northern Ethiopia. *Journal of Community Medicine & Health Education, 4*(3), 1-5. doi: 10.4172/2161-0711.1000286

Ghalya, H. & Ibrahim, Y. (2014). Knowledge, attitudes and sources of information among nursing students toward infection control and standard precautions. *Life Science Journal, 11*(9), 249-260. Retrieved from http://www.lifesciencesite.com

Godin, Gaston, Naccache, H., Morel, S., & Ebacher, M. (2000). Determinants of nurses' adherence to universal precautions for venipunctures. *American Journal of Infection Control, 28*(5), 359-364. doi: 10.1067/mic.2000.107594

Gould, D., & Chaberlain, A. (1997). The use of a ward-based educational teaching package to enhance nurses' compliance with infection control procedures. *Journal of Clinical Nursing, 6*(1), 55-67. doi: 10.1111/j.1365-2702.1997.tb00284.x

Grindley, E. J., Zizzi, S. J., & Nasypany, Alan M. (2008). Use of protection motivation theory affect, and barriers to understand and predict adherence to outpatient rehabilitation. *Physical Therapy, 88*(12), 1529-1540. Retrieved from http://www.ptjournal.org

Harris, S. (2012). OSHA in health care: Out of sight & out of mind? *Occupational Safety and Health Administration*. Retrieved from http://ohsonline.com/articles/2012/04/01/osha-in-health-care.aspx

Harris, S., & Nicolai, L. (2010). Occupational exposures in emergency medical service providers and knowledge of and compliance with universal precautions. *American Journal of Infection Control, 38*(2), 86-94. doi: 10.1016/j.ajic.2009.05.012

Heron, M. (2012). Deaths: Leading causes for 2009. *National Vital Statistics Reports, 61*(7), 1-96. Retrieved from http://www.cdc.gov/nchs/data/nvsr/nvsr61/nvsr61_07.pdf

Hill, A., Becerra, J., & Castro, K. (2012). Modelling tuberculosis trends in the USA. *Epidemiology Infections, 40*(10), 1862-1872. doi: 10.1017/S09502688110026X.

Hodgkins, S., & Orbell, S. (1998). Can protection motivation theory predict behavior? A longitudinal test exploring the role of previous behavior. *Psychology and Health, 13*(2), 237-250. doi: 10.1080/08870449808406749.

Hoy, J., & Richmond, J. (2008). Standard precautions and infection control. In Bradford, D., Dore, G., Grulich, A., Kidd, M., Hoy, J., McCoy, R., Matthews, G., Mijch, A., Strasser, S. & Sinclair, M. (Eds.), *HIV, viral hepatitis and STIs: A guideline for primary care* (pp. 146-151). Victoria, Australia: Australasian Society for HIV Medicine Inc. Publications.

Hoyert, D. L. & Xu, J. (2012). Deaths: Preliminary data for 2011. *National Vital Statistics Reports*, *61*(6), 1-52. Retrieved from http://www.cdc.gov/nchs/data/nvsr/nvsr61/nvsr61_06.pdf

Institute of Medicine [IOM]. (2012). *Adverse effects of vaccines: Evidence and causality*. Washington, D.C.: The National Academics Press.

Institute of Medicine [IOM]. (2010). *Hepatitis and Liver Cancer: A National strategy for prevention and control of Hepatitis B and C*. Washington, D.C.: The National Academics Press.

International Association of Fire Fighters. (2004). *IAFF infectious diseases and the fire fighters and emergency services*. Washington, DC: International Association of Fire Fighters. Retrieved from http://www.iaff.org

International Association of Fire Fighters. (2001). *IAFF infectious diseases and the fire fighters and emergency services* (pp. 1-52). Washington, DC: International Association of Fire Fighters Department of Occupational Health & Safety.

International Health Care Worker Safety Center, University of Virginia. (2011). U.S. EPINet sharps injury and blood ad body fluid exposure surveillance research group. Sharps injury data report for 2011; 32 hospitals contributing data, 263 total injuries. Retrieved from http://www.healthsystem.virginia.edu/pub/epinet/epinetdatareports.html

Jafari, N., Farajzadegan, Z., & Ataei, B. (2012). Surveillance system for hepatitis C infection: A practical approach. *International Journal of Preventive Medicine*, *3*(suppl1), S48-S57. Retrieved from http://www.ncbi.nlm.nh.gov/mc/articles

Jawaid, M., Iqbal, M., & Shahbaz, S. (2009). Compliance with standard precautions: A long way ahead. *Iranian Journal of Public Health*, *38*(1), 85-88. Retrieved from http://www.journals.tums.acir/uploac_files/pdf/_/12875.pdf

Jensen, J., Croskerry, P., & Travers, A. (2009). Paramedic clinical decision making during high acuity emergency calls: Design and methodology of a Delphi study. *BioMedical Central Emergency Medicine*, *9*(17), 1-4. doi: 10.1186/1471-2227X-9-17.

Johnson, O., Asuzu, M., & Adebiyi, A. (2012). Knowledge and practice of universal precautions among professionals in public and private health facilities in Uyo, Southern Nigeria –a comparative study. *Ibom Medical Journal*, *5*(1), 9-19. Retrieved from http://www.ibommedicaljournal.com

Kim, L., Evanoff, B., Parks, R., Jeffe, D., Mutha, S., Haase, C., & Frasier, V. (1999). Compliance with universal precautions among emergency room personnel:

Implications for prevention programs. *American Journal of Infection Control*, *27*(5), 453-455. Retrieved from http://www.ajicjournals.org

Ko, N.-Y., Yeh, S.-H., Tsay, A.-L., Ma, H.-J., Chen, C.-H., Pan, S.-M., Feng, M.-C., Chiang, M.-C., Lee, Y.-W., Chang, L.-H., & Jang, J.-F. (2011). Intention to comply with post-exposure management among nurses exposed to blood and body fluids in Taiwan: Application of the theory of planned behavior. *Journal of Hospital Infection, 77*, 321-326. doi: 10.1016/j.jhin.2010.08.025

Kuhar, D., Henderson, D., Struble, K., Heneine, W., Thomas, V., Cheever, L., Gomaa, A., & Panlilio, A. (2013). Updated US Public Health Service Guideline for the management of occupational exposures to Human Immunodeficiency Virus and recommendations for postexposure prophylaxis. *Infection Control and Hospital Epidemiology, 34*(9), 875-892. doi: 10.1086/672271

Labrague, L. J., Rosales, R.A., & Tizon, M.M. (2012). Knowledge of and compliance with standard precautions among student nurses. *International Journal of Advanced Nursing Studies 1*(2), 84-97. Retrieved from www.sciencepubco.com/index.php/IJANS

Lashley, F.R. & Durham, J.D. (2007). Emerging infectious diseases. Trends and Issues Second Edition. Springer Publishing Company, New York, N.Y.

Laxmisan, A., Hakimzada, F., Sayan, O., Green, R., Zhang, J., & Patel, V. (2007). The multitasking clinician: Decision-making and cognitive demand during and after team handoffs in emergency care. *International Journal of Medical Informatics*, *76*(11-12), 801-811. doi: 10.1016/j.ijmedinf.2006.09.019

Lee, T. S., Kilbreath, S. L., Sullivan, G., Refshauge, K. M., & Beith, J. M. (2007). The development of an arm activity survey for breast cancer survivors using the protection motivation theory. *Bio Med Central Cancer*, *7*(75), 1-6. doi: 10.1186/1471-2407-7-75.

Leiss, J. (2009). Management practices and risk of occupational blood exposure in U.S. paramedics: Non-intact skin exposure. *Annals of Epidemiology, 19*(12), 844-890. doi: 10.1016/j.annepidem.2009.08.006

Levin, K. (2006). Study design III: Cross-sectional studies. *Evidence-Based Dentistry*, *7*(1), 24-25. doi: 10.1038/sj.ebd.6400375

Livshiz-Riven, I., Nativ, R., Borer, A., Kanat-Maymon, Y., & Anson, O. (2014). Nursing students' intentions to comply with standard precautions: An Exploratory Prospective Cohort Study. *American Journal of Infection Control*, *42*, 744-749.

Luo, Y., He, G., Zhou, J., & Luo, Y. (2010). Factors impacting compliance with standard precautions in nursing, China. *International Journal of Infectious Diseases*, *14*, e1106-e1114. doi: 10.106/j.iid.209.03.037

Lwin, M., Stanaland, A., & Chan, D. (2010). Using protection motivation theory to predict condom usage and assess HIV health communication efficacy in Singapore. *Journal of Health Communications*, *25*(1), 69-79. doi: 10.1080/10410230903473540.

Maguire, B., Hunting, K., Guidotti, T., & Smith, G. (2005). Occupational injuries among emergency medical services personnel. *Prehospital Emergency Care*, *9*(4), 405-411. doi: 10:1080/10903120500255065

Maguire, B.J., & Walz, B. (2004). Current emergency medical services workforce issues in the United States. *Journal of Emergency Management*, *2*(3), 17-26.

Markelj, J. (2009). Using protection motivation theory to examine environmental communications: The review of in-home energy saving advertisements. *International Journal of Sustainability Communication*, *4*, 113-124. Retrieved from http://www.ijsc-online.org

Mathews, R., Leiss, J., Lyden, J., Sousa, S., Ratcliffe, J., & Jagger, J. (2008). Provision and use of personal protective equipment and safety devices in the National study to prevent blood exposure in paramedics. *American Journal of Infection Control*, *36*(10), 743-749. doi: 10.1016/j.ajic.2008.04.250

Mayr, S., Erdfelder, E., Buchner, A., & Faul, F. (2007). A short tutorial of GPower. *Tutorials in Quantitative Methods for Psychology*, *3*(2), 51-59. Retrieved from http://www.tqmp.org

McClendon, B. T. & Prentice-Dunn, S. (2001). Reducing skin cancer risk: An intervention based on protection motivation theory. *Journal of Health Psychology*, *6*(3), 321-328. doi: 10.1177/135910530100600305

McGovern, P., Vesley, D., Kochevar, L., Gershon, R., Rhame, F., & Anderson, E. (2000). Factors affecting universal precautions compliance. *Journal of Business and Psychology*, *15*(1), 149-161. doi: 10.1023/A: 1007727104284

McGraw-Hill Concise Dictionary of Modern medicine. (2002). Retrieved from http://medical-dictionary.thefreedictionary.com/high-risk+group

Miller, N., Gudmestad, T., & Eisenberg, M. (2005). Development of model infectious disease protocols for fire and EMS personnel. *Prehospital Emergency Care*, *9*(3), 326-332. doi: 10.1080/10903120590961950.

Milne, S., Sheeran, P., & Orbell, S. (2002). Combining motivational and volitional interventions to promote exercise participation: Protection motivation theory and implementation intentions. *British Journal of Health Psychology*, *7*(Pt. 2), 163-184. Retrieved from http://www.bps.org.uk

Milne, S., Sheeran, P., & Orbell, S. (2000). Prediction and intervention in health related behavior: A meta-analytic review of protection motivation theory. *Journal of Applied Social Psychology*, 30(1), 106-143. doi: 10.1111/j.1559-1816.2000.tb02308x

Mish, F. G. (Ed.). (2008). *Merriam-Webster's Collegiate Dictionary Eleventh Edition*. Springfield, MA: Merriam-Webster Incorporated.

Moloughney, B. (2001). Transmission and postexposure management of bloodborne virus infections in the health care setting: Where are we now? *Canadian Medical Association Journal*, *165*(4), 445-451. Retrieved from http://www.cmaj.ca/content/65/4.toc

Moran, G. (2000). Emergency department management of blood and body fluid exposures. *Annals of Emergency Medicine*, *35*(1), 47-61. Retrieved from http://www.annemergmed.com

Murgraff, V., White, D., & Phillips, K. (1999). An application of protection motivation theory to riskier single-occasion drinking. *Psychology and Health*, *14*(2), 339-350. doi: 1080/08870449908407332

Myers, J., Myers, R., Wheat, M., & Yin, M. (2012). Dental students and bloodborne pathogens: Occupational exposures, knowledge, and attitudes. *Journal of Dental Education*, *76*(4), 479-486. Retrieved from http://www.jdentaled.org

National Fire Protection Agency. (2013). National Fire Protection Association overview. Retrieved on June 3, 2013 from http://www.nfpa.org/categoryList.asp?categoryID=495

National Fire Protection Agency. (2009). NFPA 1581 standard on fire department infection control program, 2010 Edition. Retrieved on January 27, 2012 at http://www.nfpa.org

National Highway Traffic Safety Administration. (2007). National EMS scope of practice model. DOT HS 810 657. Retrieved on April 24, 2013 from http://www.nhtsa.gov

National Institute of Allergy and Infectious Disease [NIAID] / National Institute of Health [NIH]. (2012). Hepatitis C research, NIAID profile FY 2003. Retrieved from http://www.niaid.nih.gov/about/shoWeAre/profile/fy2003/Documents/ssar_hepatitis.pdf

National Institute of Environmental Health Science and the National Institute of Health. (2012). International Association of Fire Fighters. Retrieved on June 3, 2013 from http://www.niehs.nih.gov/careers/hazmat/programs/awardees/iaff/

National Institute for Occupational Safety and Health [NIOSH]. (1999). NIOSH alert: Preventing needlestick injuries in health care settings. DHHS publication no. (NIOSH) 2000-108. Retrieved from http://www.cdc.gov/niosh

Norman, P., Boer, H., & Seydel, E. R. (2005). Protection motivation theory, Chapter 3. In Connor, M., & Norman, P. (Eds.), *Predicting health behavior: Research and practice with social cognition models, 2nd edition* (pp. 82-126). Maidenhead, England: Open University Press.

Occupational Safety and Health Administration [OSHA]. (2011). OSHA Fact Sheet: OSHA's Bloodborne Pathogens Standard. Retrieved from www.osha.gov/OshDoc/data_BloodborneFacts/bbfact01.pdf

Occupational Safety and Health Administration [OSHA] / United States Department of Labor. (2003). Personal Protective Equipment: OSHA 3151-12R-2003. Retrieved from http://www.osha.gov

Occupational Safety and Health Administration [OSHA]. (2001). Occupational exposure to bloodborne pathogens; needlesticks and other sharps injuries; final rule (29CFR Part 1910). Washington, DC: Department of Labor, Occupational Safety and Health Administration. Available at: http://www.osha.gov/FedReg_osha_pdf/FED20010118a.pdf

Oliveira, A., Marziale, M., Paiva, M., & Lopes, A. (2009). Knowledge and attitude regarding standard precautions in a Brazilian public emergency service: A cross-sectional study. *Revista da Escola de Enfermagem da USP*, *43*(2), 313-319. Retrieved from http://dx.doi.org/10.1590/S0080-62342009000200009

Osborne, S. (2003). Influences on compliance with standard precautions among operating room nurses. *American Journal of Infection Control*, *31*(7), 415-423. doi: 10.1067/mic.2003.68

Osborne, S. (2003). Perceptions that influence occupational exposure reporting. *Association of periOperative Registered Nurses Journal*, *78*(2), 262-272. Retrieved from http://www.aornjournal.org

Peate, W. (2001). Preventing needlesticks in emergency medical system workers. *Journal of Occupational and Environmental Medicine*, *43*(6), 554-557. Retrieved from http://www.journals.lww.com/joem/toc/2001/06000

Pechmann, C., Zhao, G., Goldberg, M. E., & Reibling, E. T. (2003). What to convey in antismoking advertisements for adolescents: The use of protection motivation theory to identify effective message themes. *Journal of Marketing*, *67(2)*, 1-18. doi: http://dx.doi.org/10.1509/jmkg.67.2.1.187607

Pellegrin, L., Gaudin, C., Bonnardel, N., Texier, G., Meynard, J., & Chaudet, H. (2009, June). *Formalizing collaboration in decision-making: a case study in military epidemiological early warning*. Paper presented at the Ninth Bi-annual International Conference on Naturalistic Decision Making (NDM9), London,

England. Paper retrieved from http://www.bcs.org/upload/pdf/ewic_ndm09_s2paper27.pdf

Perry, J. & Jagger, J. (2003). Healthcare worker blood exposure risks: Correcting some outdated statistics. *Advances in Exposure Prevention, 6*(3), 28-31. Retrieved from http://www.healthsystem.virginia.edu/pub/epinet/aep/index66.pdf

Picheansathian, W. (1995). Compliance with universal precautions by emergency room nurses at Maharaj Nakorn Chiang Mai hospital. *Journal of the Medical Association of Thailand, 78*(Suppl 2), S18-122. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/7561585

Plotnikoff, R. C. & Higginbotham, N. (2002). Protection motivation theory and exercise behaviour change for the prevention of coronary heart disease in a high-risk, Australian representative community sample of adults. *Psychology, Health & Medicine, 7*(1), 87-98. doi: 10.1080/13548500120101586.

Plotnikoff, R. & Higginbotham, N. (1998). Protection motivation theory and the prediction of exercise and low-fat diet behaviours among Australian cardiac patients. *Psychology and Health, 13*(3), 411-429. doi: 10.1080/08870449808407300.

Prentice-Dunn, S. & Rogers, R. W. (1986). Protection motivation theory and preventive health: beyond the health belief model. *Health Education Research, 1*(3), 153-161. Retrieved from http://her.oxfordjournals.org/

Reed, E., Daya, M., Jue, J., Grellman, K., Gerber, L., & Loveless, M. (1993). Occupational infectious disease exposure in EMS personnel. *The Journal of*

Emergency Medicine, *11*(1), 9-16. Retrieved from http://www.jem-journal.com/issues

Reichard, A., & Jackson, L. (2010). Occupational injuries among emergency responders. *American Journal of Industrial Medicine*, *53*(1), 1-11. doi: 10.1002/JIM.20772

Rinnert, K., O'Connor, R., & Delbridge, T. (1998). Risk reduction for exposure to bloodborne pathogens in EMS. *Prehospital Emergency Care*, 2(1), 62-66. doi: 10.1080/10903129808958842

Rodis, J. (2007). Chronic hepatitis C virus infection: A review for pharmacists. *Journal of American Pharmacist Association*, *47*(4), 508-520. doi: 10.1331/JAPhA.2007.06136

Rogers, R.W. (1983). Cognitive and physiological processes in fear appeals and attitude change: A revised theory of protection motivation. In J. Cacioppo & R. Petty (Eds.), *Social psychophysiology* (pp. 153-176). New York, NY: Guilford Press.

Rogers, R. W. (1975). A protection motivation theory of fear appeals and attitude change 1. *The Journal of Psychology: Interdisciplinary and Applied*, *91*(1), 93-114. doi: 10.1080/00223980.1975.9915803.

Roome, A., Hadler, J., Thomas, A., Migicovsky, B., Roth, R., Boraz, M., & Kuzajewksi, B. (2000). Hepatitis C virus infection among firefighters, emergency medical technicians. *Morbidity and Mortality Weekly Report*, *49*(29), 660-665. Retrieved from http://www.cdc.gov/mmwr/preview/mmwrhtml/mm4929a3.htm

Rosen, H. (2011). Chronic Hepatitis C infection. *The New England Journal of Medicine*, *364*(25), 2429-2437. Retrieved from http://www.nejm.org/doi/full/10.1056/NEJMcp1006613

Rupp, T., & Christensen, K. (2008). Infection protection: A review of post-exposure prophylaxis. *Journal of Emergency Medical Services, 33*(9), 68-77. Retrieved from http://www.jems.com

Sadoh, W., Fawole, A., Sadoh, A., Oladimeji, A., & Sotiloye, O. (2006). Practice of universal precautions among healthcare workers. *Journal of the National Medical Association*, *98*(5), 722-726. Retrieved from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2569287/pdf/jnma00192-0062.pdf

Saia, M., Hofmann, F., Sharman, J., Abiteboul, D., Campins, M., Burkowitz, J.,Choe, Y., & Kavanagh, S. (2010). Needlestick injuries: Incidence and cost in the United States, United Kingdom, Germany, France, Italy, and Spain. *Biomedicine International, 1*(2), 41-49. Retrieved from http://www.bmijournal

Salleh, N., Hussein, R., Mohamed, N., Karim, N. S. A., & Aditiawarman, U. (2012). Examining information disclosure behavior on social network sites using protection motivation theory, trust and risk. *Journal of Internet Social Networking & Virtual Communities*, *2012*, 1-11. doi: 10.5171/2012.281869.

Sax, H., Perneger, T., Hugonnet, S., Herrault, P., Chraiti, M., & Pittet, D. (2005). Knowledge of standard and isolation precautions in a large teaching hospital. *Infection Control and Hospital Epidemiology*, *26*(3), 298-304. Retrieved from http://www.jstor.org/stable/10.1086/502543

Sharbaugh, R. (1999). The risk of occupational exposure and infection with infectious disease. *The Nursing Clinics of North America, 34*(2), 493-508. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/10318737

Shute, N., Licking, E., & Schultz, S. (1998). Hepatitis C: A silent killer. *U.S. News & World Report, 124*(24), 60-65. Retrieved from http://health.usnews.com/usnews/health/articles/980622/archive_004202_4.htm

Siegel, J.D., Rhinehart, E., Jackson, M., Chiarello, L., & the healthcare Infection Control Practices Advisory Committee. (2007). 2007 Guidelines for isolation precautions: Preventing transmission of infectious agents in healthcare settings. Retrieved from http://www.cdc.gov/ncidod/dhap/pdf/isolation2007.pdf

Smith, M., Higgs, J., & Ellis, E. (2008). Chapter 8: Factors influencing clinical decision making. In Higgs, J., Jones, M., Loftus, S., & Christensen, N. (Eds.), *Clinical reasoning in the health professions 3rd edition* (pp. 89-100). New York: NY, Elsevier Health Science.

Stackler, A. & McLeroy, K. (2008). The importance of external validity. *American Journal of Public Health, 98*(1), 9-10. doi: 10.2105/AJPH.2007.126847

Stanley, M. A. & Maddux, J. E. (1986). Cognitive processes in health enhancement: Investigation of a combined protection motivation and self-efficacy model. *Basic and Applied Social Psychology, 7*(2), 101-113. doi: 10.1207/s15324834basp0702_2.

Stein, A., Makarawo, T., & Ahmad, M. (2003). A survey of doctors' and nurses' knowledge, attitudes and compliance with infection control guidelines in

Birmingham teaching hospitals. *Journal of Hospital Infection, 54*(1), 68-73. doi: 10.1016/S0195-6701(03)00074-4

Sutton, A. (2002). Health behavior: Psychosocial theories. University of Cambridge U.K. Retrieved from http://www.userpage.fu-berline.de/~schuez/folien/Sutton.pdf

Tan, S. (2006). Hepatitis C viruses genomes and molecular biology. Norfolk, UK: Horizon Bioscience.

Tanner, J. F., Day, E., & Crask, M. R. (1989). Protection motivation theory: An extension of fear appeals theory in communication. *Journal of Business Research*, *19*(4), 267-276. doi: 10.1016/0148-2963(89)90008-8

Thompson, C., Cullum, N., McCaughan, D., Sheldon, T., & Raynor, P. (2004). Nurses, information use, and clinical decision making – the real world potential for evidence-based decisions in nursing. *Evidence Based Nursing*, *7*(3), 68-72. doi: 10.1136/ebn.7.3.68.

Tulloch, H., Reida, R., D'Angeloa, M. S., Plotnikoff, R. C., Morrina, L., Beatona, L., Pipe, A. (2009). Predicting short and long-term exercise intentions and behaviour in patients with coronary artery disease: A test of protection motivation theory. *Psychology and Health*, *24*(3), 255-269. doi: 10.1080/08870440701805390

Umeh, K. (2004). Cognitive appraisals, maladaptive coping, and past behavior in protection motivation. *Psychology and Health*, *19*(6), 719-735. doi: 10.1080/0887044042000196692.

United States Census Bureau. (2013). Quick facts Miami-Dade County Florida. Retrieved from http://quickfacts.census.gov/qfd/states/12/12086.html

United States Department of Health and Human Services [USDHHS] / Centers for Disease Control and Prevention [CDC]. (Nov. 2, 2011). Implementation of Section 2695 (42 U.S.C. 300ff-131) of Public Law 111-87: Infectious Diseases and Circumstances Relevant to Notification Requirements. Fed. Reg. Doc. 2011-28402. Volume 76, No. 212, pages 67736-67743. Retrieved from http://www.federalregister.gov/articles/

United States Department of Labor, and Occupational Safety & Health Administration. (2013). *SEC. 3. Definitions* (Pub. L. 105-241). Retrieved on May 5, 2013 from http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=OSHACT&p_id=3357

United States Department of Labor, and Occupational Safety & Health Administration. (2010, May 6). *Infectious Diseases* (Docket No. OSHA-2010-0003). Federal Register 75(87). Pages 24835-24844. Retrieved from http://www.gpo.gov/

United States Department of Labor, and Occupational Safety & Health Administration. (2003). *Model plans and programs for the OSHA bloodborne pathogens and hazard communications standards* (OSHA Publication No. 3186-06N). Retrieved from http://www.osha.gov/index.html

United States Department of Labor, and Occupational Safety & Health Administration. (2001). *Enforcement procedures for the occupational exposure to bloodborne pathogens* (OSHA Publication No. CPL 02-02-069; formerly CPL 2-2-69).

Retrieved from http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=DIRECTIVES&p_id=2570

United States Department of Labor, and Occupational Safety & Health Administration. (1998). *Occupational exposure to bloodborne pathogens – precautions for emergency responders* (OSHA Publication No. 3130; Revised). Retrieved from http://www.osha.gov

Vaz, K., McGrowder, Alexander-Lindo, R., Gordon, L., Brown, P., & Irving, R. (2010). Knowledge, awareness and compliance with universal precautions among health care workers at the University Hospital of West Indies, Jamaica. *The International Journal of Occupational and Environmental Medicine, 1*(4), 171-181. Retrieved from www.theijoem.com

Van der Velde, F. W. & Van der Pligt, J. (1991). AIDS-related health behavior: Coping, protection motivation, and previous behavior. *Journal of Behavioral Medicine, 14*(5), 429-451. Retrieved from http://dare.uva.nl/document/5566

Venes, D. (Ed.). (2009). *Tabers' cyclopedic medical dictionary 22th edition.* F.A. Davis Company: Philadelphia, PA.: F.A. Davis Company.

Visentin, L., Bondy, S., Schwartz, B., & Morrison, L. (2009). Use of personal protective equipment during infectious disease outbreak and nonoutbreak conditions: a survey of emergency medical technicians. *Canadian Journal of Emergency Medicine, 11*(1), 44-56. Retrieved from http://www.cjem-online.ca/v11/n1/p44

Ward, D. (2006). Compliance with infection control precautions in primary care. *Primary Health Care*, *16*(10), 35-39. Retrieved from http://rcnpublishing.com/loi/phc

Wilburn, S., & Eijkemans, G. (2004). Preventing needlesticks injuries among healthcare workers: A WHO-ICN collaboration. *International Journal of Occupational and Environmental Health*, *10*(4), 451-456. Retrieved from http://www.ijoeh.com

Williams, C., Campbell, S., Henry, K., & Collier, P. (1994). Variables influencing worker compliance with universal precautions in the emergency department. *American Journal of Infection Control*, *22*(3), 138-148. Retrieved from http://www.ajicjournal.org

World Health Organization. (2011). Hepatitis B. Retrieved on May 14, 2013 from http://www.who.int/csr/disease/hepatitis/whocdscsrlyo20022/en/indexl.html

World Health Organization. (2011). Hepatitis C. Retrieved on May 14, 2013 from http://www.who.int/csr/disease/hepatitis/whocdscrlyo2003/en/index3.html

World Health Organization. (2011). HIV/AIDS. Retrieved on May 15, 2013 from http://www.who.int/hiv/data/en/index.html

World Health Organization. (2010). Infection prevention and control in health care: time for collaborative action. Retrieved on May 15, 2013 from http://applications.emro.who.int/docs/EM_RC57_6_en.pdf

World Health Organization. (2006). Universal precautions including injection safety. Retrieved on May 15, 2013 from http://www.who.int/hv/topics/precautions/universal/en/

World Health Organization. (2003). Aide memoire for a strategy to protect health workers from infections with blood borne viruses (pp. 1-2). Geneva: Switzerland, World Health Organization. Retrieved on May 14, 2013 from http://www.who.int/occupational_health/activities/1am_hcw.pdf

Yassi, A., & Warshaw, L. (2011). Health care: It's nature and its occupational health problems, Chapter 97-Health care facilities and services. In Yassi, A., & Warsha, L. (Eds.), *International Labour Organization Encyclopedia of Occupational Health & Safety*. Retrieved from http://www.ilo.org/oshenc/part-xvii/health-care-facilities-and-services/item/433-health-care-its-nature-ad-its-occupational-health-problems

Appendix A: Dissertation Research Survey

EMS OCCUPATIONAL EXPOSURES WITH COMPLIANCE TO UNIVERSAL PRECAUTIONS QUESTIONNAIRE

Directions: Please check the appropriate boxes or circle the appropriate response that apply to you.

1. Have you received any training or standard precaution / universal precaution knowledge?

   ☐Yes ☐No

   If yes, when was your last training session?

   ☐<1 year ☐1-5 years ☐6-10 years ☐ > 10 years

   If no, do you want training on standard precaution / universal precaution knowledge?

   ☐Yes ☐No

2. In your opinion, what are Universal Precautions? (check **all** that apply)

   ☐Use of face masks & protective eyewear ☐Monitoring patient's vitals

   ☐Placement of needles in puncture-resistant containers ☐Use of gloves

Questions: Check the appropriate box. On a scale of 1-5 with 1 being never and 5 always.	**Never 1**	**Seldom 2**	**Sometimes 3**	**Most of the time 4**	**Always 5**
3.In your opinion, proper universal precautions are expected to be used by all EMS providers at your agency					
4. In your opinion, do your agency's units have adequate equipment and supplies?					
5. How regularly have you started an IV in the past month?					
6. How regularly have you intubated a patient in the past month?					
7. Do you treat every patient as if they are carrying a bloodborne virus? (i.e. HIV or Hepatitis)					

8. Would you wear a facemask when transporting a patient with tuberculosis?					
9. Would you wear a mask when transporting a patient with other airborne illnesses, such as influenza?					
10. Would you use a protective device (such as a bag valve mask) when performing resuscitation?					
11. Do you clean your hands ***before*** contact with each patient?					
12. Do you clean your hands ***after*** contact with each patient?					

Questions: Check the appropriate box. On a scale of 1-4 with 1 being Not Important and 4 being Extremely Important.	**Not Important 1**	**Somewhat Important 2**	**Important 3**	**Extremely Important 4**
13. How important do you think it is to clean your hands ***before*** any contact with each patient?				
14. How important do you think it is to clean your hands ***after*** any contact with each patient?				

15. Do you wear gloves on each call you go on? (circle one)

1----------2----------3----------4----------5
Never Seldom Sometimes Most of the time Always

16. What are your reasons for not wearing gloves at all times? (check **all** that apply)

☐Forget ☐Gloves aren't always available or close by

☐Don't have time ☐Don't wear gloves when patients aren't bleeding

☐Patient appears to be low risk (i.e. elderly or very young) for transmission of disease

☐Other (please specify)

17. In the last month, how many calls did you go on? (check one)

☐0-50 ☐51-100 ☐101-150 ☐151-200 ☐>200

18. In the last month, how many of your patients were bleeding? (check one)

☐0-5 ☐6-10 ☐11-15 ☐16-20 ☐>20

19. Do you handle needles as part of your duties as an EMS provider? (check one)

☐Yes ☐No

Questions: Check the appropriate box. On a scale of 1-5 with 1 being never and 5 always.	**Never 1**	**Seldom 2**	**Sometimes 3**	**Most of the time 4**	**Always 5**
20. Do you recap the needles after use?					
21. Do you dispose of all needles in a marked red biohazard container?					
22. Do you dispose of other contaminated materials in a marked red biohazard container?					

23. Have you **ever** been stuck with a ***contaminated lancet*** (for blood glucose testing) in your experiences as an EMS provider? (check one)

☐Yes → a) How many times have you been ***stuck in the last year***? (check one)

☐0-5 ☐6-10 ☐11-15 ☐16-20 ☐>20

b) How many times have you been ***stuck in the last month***? (check one)

☐0-5 ☐6-10 ☐11-15 ☐16-20 ☐>20

c) Did you report it? ☐Yes ☐No

☐No

24. Have you ***ever*** been stuck with a ***contaminated hypodermic needle*** (for IVs) in your experiences as an EMS provider? (check one)

☐Yes →a) How many times have you been ***stuck in the last year***? (check one)

☐0-5 ☐6-10 ☐11-15 ☐16-20 ☐>20

b) How many times have you been ***stuck in the last month***? (check one)

☐0-5 ☐6-10 ☐11-15 ☐16-20 ☐>20

c) Did you report it? ☐Yes ☐No

☐No

25. Do you know the Department of Health and CDC guidelines relating to post-exposure prophylaxis after an occupational exposure to HIV and Hepatitis B / C? (check one)

☐Yes ☐No

26. According to the Department of Health, CDC, and OSHA, if you are exposed to HIV following a needlestick injury, ideally how soon afterwards should post-exposure prophylaxis commence for optimum efficacy?(check one)

☐ Within 1 hr. /As soon as possible ☐Within 24 hours ☐24 – 72 hours

27. Have you ***ever*** been exposed to ***blood*** as an EMS provider?(check one)

☐Yes → a) How many times ***in the last month*** have you been exposed to? blood? (check one)

☐0-5 ☐6-10 ☐11-15 ☐16-20 ☐>20

☐No

28. Have you ***ever*** been exposed to ***other body fluids*** as an EMS provider? (check one)

☐Yes → a) How many times ***in the last month*** have you been exposed to other

body fluids? (check one)

☐0-5 ☐6-10 ☐11-15 ☐16-20 ☐>20

☐No

29. Which of the following ***body fluids*** (presuming that they are not blood-stained) should be handled with the same precautions as blood? (check appropriate boxes)

☐breast milk ☐peritoneal fluid ☐saliva ☐feces ☐urine

☐cerebrospinal fluid ☐pleural fluid ☐synovial fluid ☐vomit

Questions: Check the appropriate box. On a scale of 1-5 with 1 being extreme risk and 5 being no risk.	**Extreme Risk 1**	**Great Risk 2**	**Moderate Risk 3**	**Minor Risk 4**	**No Risk 5**
30. In your opinion, what are the risks of acquiring HIV as a result of EMS work?					
31. In your opinion, what are the risks of acquiring hepatitis as a result of EMS work?					

32. Have you been vaccinated for HBV?

☐ Yes ☐No ☐Not sure

Demographics - Directions: Please check the appropriate boxes that apply to you.

33. Please indicate the type of EMS agency with which you are currently affiliated.

☐City of Hialeah Fire Department ☐City of Miami Fire Rescue

☐City of Miami Beach Fire Department ☐City of Key Biscayne Fire Rescue

☐Coral Gables Fire Department ☐Miami-Dade Fire Rescue

☐American Ambulance Response DBA AMR☐Medics Ambulance Service Inc.

☐Florida Med-Van Ambulance Service ☐Medi-Car Ambulance Service, Inc.

☐MCT Express, Inc. DBA Miami-Dade ☐Randle-Eastern Ambulance Service

34. Please indicate the type of shift work worked in the pre-hospital environment.

☐24 hours on 48 hours off ☐24 hours on 72 hours off ☐24 hours on 24 hours off

☐12 hours days ☐12 hours nights ☐8 hours per day

35. What is your current EMS certification level?

☐Fire Fighter EMT-B ☐Fire Fighter EMT-P ☐EMT-B ☐EMT-P

36. How many years have you been an EMS provider?

☐1-5 years ☐6-10 years ☐11-15 years ☐16-20 years ☐21-25 years ☐> 25 years

37. What is your highest level of education?

☐Less than 12 years ☐High school / GED ☐Some college

☐Trade school ☐College degree ☐Graduate school, etc.

38. What is your gender? ☐Female ☐Male

39. What is your age?

☐18-20 ☐21-30 ☐31-40 ☐41-50 ☐51-60 ☐>60

40. How satisfied are you with your present EMS paid position? (circle one)

1----------2----------3----------4----------5

Extremely Dissatisfied	Somewhat Dissatisfied	Neutral	Somewhat Satisfied	Extremely Satisfied

Appendix B: Pilot Study Survey

EMS OCCUPATIONAL EXPOSURES
DISSERTATION RESEARCH PILOT SURVEY

The following questions are for statistical purposes only. All data will be reported in the aggregate and no individual level data will be reported.

1. Please indicate the type of EMS agency with which you are currently affiliated (check one):

   ☐City of Hialeah Fire Department ☐City of Miami Fire Rescue

   ☐City of Miami Beach Fire Department ☐City of Key Biscayne Fire Rescue

   ☐Coral Gables Fire Department ☐Miami-Dade Fire Rescue

   ☐American Ambulance Response DBA AMR☐Medi-Car Ambulance Service,

   ☐Medics Ambulance Service Inc. ☐MCT Express, Inc. DBA Miami-Dade

   ☐Florida Med-Van Ambulance Service ☐Randle-Eastern Ambulance Service,

2. What is your current EMS certification level?(check one)

   ☐Fire Fighter EMT-B ☐Fire Fighter EMT-P ☐EMT-B ☐EMT-P

3. How many years have you been an EMS provider? (check one)

   ☐1-5 years ☐6-10 years ☐11-15 years ☐15-20 years ☐21-25 years ☐>20years

4. Have you received any training or standard precaution / universal precaution knowledge? (check one)

   ☐Yes ☐No

   If yes, when was your last training session? (check one)

   ☐<1 year ☐1-5 years ☐5-10 years ☐ > 10 years

   If no, do you want training on standard precaution / universal precaution knowledge? (check one)

   ☐Yes ☐No

5. In your opinion, do your agency's units have adequate equipment and supplies? (circle one)

   1----------2----------3----------4----------5
   Never Seldom Sometimes Most of the time Always

6. In your opinion, what are Universal Precautions? (check **all** that apply)

   ☐Use of face masks & protective eyewear ☐Monitoring patient's vitals

   ☐Placement of needles in puncture-resistant containers ☐Use of latex gloves

7. In your opinion, proper universal precautions are expected to be used by all EMS providers at your agency (circle one)

   1----------2----------3----------4----------5
   Never Seldom Sometimes Most of the time Always

8. How regularly have you started an IV in the past month? (circle one)

   1----------2----------3----------4----------5
   Never Seldom Sometimes Most of the time Always

9. How regularly have you intubated a patient in the past month? (circle one)

   1----------2----------3----------4----------5
   Never Seldom Sometimes Most of the time Always

10. Do you treat every patient as if they are carrying a bloodborne virus? (i.e. HIV or Hepatitis)…(circle one)

    1----------2----------3----------4----------5
    Never Seldom Sometimes Most of the time Always

11. How important do you think it is to clean your hands ***before*** any contact with each patient? (circle one)

    1----------2----------3----------4
    Not Important Somewhat Important Important Extremely Important

12. Do you clean your hands ***before*** contact with each patient? (circle one)

    1----------2----------3----------4----------5
    Never Seldom Sometimes Most of the time Always

13. How important do you think it is to clean your hands ***after*** any contact with each patient? (circle one)

1----------2----------3----------4
Not Important Somewhat Important Important Extremely Important

14. Do you clean your hands ***after*** contact with each patient?(circle one)

1----------2----------3----------4----------5
Never Seldom Sometimes Most of the time Always

15. Do you wear gloves on each call you go on? (circle one)

1----------2----------3----------4----------5
Never Seldom Sometimes Most of the time Always

16. What are your reasons for not wearing gloves at all times? (check **all** that apply)

☐Forget ☐Gloves aren't always available or close by

☐Don't have time ☐Don't wear gloves when patients aren't bleeding

☐Patient appears to be low risk (i.e. elderly or very young) for transmission of disease

☐Other (please specify)

17. In the last month, how many calls did you go on? (check one)

☐0-50 ☐51-100 ☐101-150 ☐151-200 ☐>200

18. In the last month, how many of your patients were bleeding? (check one)

☐0-5 ☐6-10 ☐11-15 ☐16-20 ☐>20

19. Do you handle needles as part of your duties as an EMS provider? (check one)

☐Yes ☐No

20. Do you recap the needles after use? (circle one)

1----------2----------3----------4----------5
Never Seldom Sometimes Most of the time Always

21. Do you dispose of all needles in a marked red biohazard container? (circle one)

1----------2----------3----------4----------5
Never Seldom Sometimes Most of the time Always

22. Do you dispose of other contaminated materials in a marked red biohazard container?
(circle one)

1----------2----------3----------4----------5
Never Seldom Sometimes Most of the time Always

23. Have you **ever** been stuck with a ***contaminated lancet*** (for blood glucose testing) in your experiences as an EMS provider? (check one)

☐Yes → a) How many times have you been ***stuck in the last year***? (check one)

☐0-5 ☐6-10 ☐11-15 ☐16-20 ☐>20

b) How many times have you been ***stuck in the last month***? (check one)

☐0-5 ☐6-10 ☐11-15 ☐16-20 ☐>20

c) Did you report it? ☐Yes ☐No

☐No

24. Have you ***ever*** been stuck with a ***contaminated hypodermic needle*** (for IVs) in your experiences as an EMS provider? (check one)

☐Yes →a) How many times have you been ***stuck in the last year***? (check one)

☐0-5 ☐6-10 ☐11-15 ☐16-20 ☐>20

b) How many times have you been ***stuck in the last month***? (check one)

☐0-5 ☐6-10 ☐11-15 ☐16-20 ☐>20

c) Did you report it? ☐Yes ☐No

☐No

25. Do you know the Department of Health and CDC guidelines relating to post-exposure prophylaxis after an occupational exposure to HIV and Hepatitis B / C? (check one)

☐Yes ☐No

26. According to the Department of Health, CDC, and OSHA, if you are exposed to HIV following a needlestick injury, ideally how soon afterwards should post-exposure prophylaxis commence for optimum efficacy?(check one)

☐Within 1 hour/As soon as possible ☐Within 24 hours ☐24 – 72 hours

27. Have you ***ever*** been exposed to ***blood*** as an EMS provider?(check one)

☐Yes → a) How many times ***in the last month*** have you been exposed to? blood? (check one)

☐0-5 ☐6-10 ☐11-15 ☐16-20 ☐>20

☐No

28. Have you ***ever*** been exposed to ***other body fluids*** as an EMS provider? (check one)

☐Yes → a) How many times ***in the last month*** have you been exposed to other body fluids? (check one)

☐0-5 ☐6-10 ☐11-15 ☐16-20 ☐>20

☐No

29. Which of the following ***body fluids*** (presuming that they are not blood-stained) should be handled with the same precautions as blood? (check appropriate boxes)

☐breast milk ☐peritoneal fluid ☐saliva ☐feces ☐urine

☐cerebrospinal fluid ☐pleural fluid ☐synovial fluid ☐vomit

30. Would you wear a facemask when transporting a patient with tuberculosis? (circle one)

1----------2----------3----------4----------5
Never Seldom Sometimes Most of the time Always

31. Would you wear a mask when transporting a patient with other airborne illnesses, such as influenza?(circle one)

    1----------2----------3----------4----------5
    Never Seldom Sometimes Most of the time Always

32. Would you use a protective device (such as a bag valve mask) when performing resuscitation?

    1----------2----------3----------4----------5
    Never Seldom Sometimes Most of the time Always

33. In your opinion, what are the risks of acquiring HIV as a result of EMS work? Mark your answer on a scale of 1-5 with one being extreme risk and 5 being no risk? (circle one)

    1----------2----------3----------4----------5
    Extreme Risk Great Risk Moderate Risk Minor Risk No Risk

34. In your opinion, what are the risks of acquiring hepatitis as a result of EMS work? (circle one)

    1----------2----------3----------4----------5
    Extreme Risk Great Risk Moderate Risk Minor Risk No Risk

35. Have you been vaccinated for HBV?

    ☐ Yes ☐No ☐Not sure

The following questions are for statistical purposes only.

36. What is your age?(check one)

    ☐18-20 ☐21-30 ☐31-40 ☐41-50 ☐51-60 ☐>60

37. What is your gender?(check one) ☐Female ☐Male

38. What is your highest level of education? (please check one)

    ☐less than 12 years ☐high school / GED ☐some college

    ☐trade school ☐college degree ☐graduate school, etc.

39. How satisfied are you with your present EMS paid position? (circle one)

1	2	3	4	5
Extremely Dissatisfied	Somewhat Dissatisfied	Neutral	Somewhat Satisfied	Extremely Satisfied

Thank you for your valuable assistance in completing this questionnaire.