Protecting the Protectors: Violence-Related Injuries to Hospital Security Personnel and the Use of Conducted Electrical Weapons

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Dedication

This thesis is dedicated to my bride, Mary Sullivan, and my three children, Gabriel Azul, Iona, and Sula for their love support and patience during my endeavors to earn a PhD.

Abstract

Healthcare workers suffer high rates of violence-related injuries compared to other industries, with wide variances in risk dependent upon location and role. Hospital security guards, demonstrated to have high risk levels, are tasked with protecting the safety of healthcare personnel, visitors, and patients, and are called on to help control violent situations, but little is known about their protective and risk factors for violence-related injuries. Two separate and complementary investigations were undertaken to learn more about the risk and protective factors and to find whether one intervention, carriage of conducted electrical weapons, decreases the rates of violence-related injuries or injury severity.

The first study was a mixed-methods design investigating the violence-related injuries and other violent events experienced by hospital security workers over the course of 1 year at an urban level 1 trauma center. Qualitative and quantitative analyses were performed on three existing data sources: the security officer narratives, occupational injury reports, and patient health records. There were 19 reported injuries over the course of a year, with an additional 300 violent incidents in 7 months. Most of the violent incidents involving security officers occurred at night, with most of the officer injuries taking place in the psychiatric departments. Qualitative analyses found that hospital policies may increase risk for violence.

The second study was a retrospective cohort analysis of all security and ED nursing staff violence-related injuries at the same institution for the time period 4 years prior and 7 years after security workers were armed with conducted electrical weapons. A violence-

related injury rate was calculated as all violence-related injuries incurred by each employee for the numerator and the productive hours worked by each individual during the study period of each model for the denominator. The hospital employed 98 security officers and 468 nursing staff over the 11 years of study. Security officers' injury rate was 13 times higher than nursing staff. The risk ratio was 1.0 (95% CI 0.7-1.4) between the 2 examination periods for security officers, with similar results for nurses. However, among security workers the severity of injuries may have decreased in the post-implementation period.

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Organization Statement

The organization of this thesis provides initial chapters including an introduction, a comprehensive literature review, and a comprehensive presentation of the research design and methods. These chapters are followed by two major papers (Chapters 4 and 5) that report the major findings from the study; because these papers are prepared for publication in peer-reviewed journals, there is some redundancy with the first three chapters, pertinent to the literature cited and the methods presented. A final chapter provides a discussion of study validity and the results of the study that ties all of the papers together.

Chapter I

Introduction

Workers in the health care and social assistance industry had the highest incidence rate of workplace violence-related injuries involving days away from work as compared to all other private industries in 2013 (Bureau of Labor Statistics, 2014). The rate of violence-related injuries resulting in lost workdays per 10,000 workers in the health care and social assistance industry was 16.2 relative to 4.2 for all private industry. The difference in rates of violence-related injuries per 10,000 state government employees was even greater: the rate specific to state workers in health care and social assistance was 146.0 relative to 35.3 for all state government workers. This violence-related injury rate for state health and social service workers is higher even than the violence-related injury rate of the states' justice, public order, and safety workers at 63.6.

Within the healthcare sector occupations vary greatly in their risk of workplace violence. For instance, mental health workers and other ancillary staff, such as occupational or physical therapists, in psychiatric health locations are frequently documented as having high rates of assault as compared to other health care workers (Arnetz, Aranyos, Ager, & Upfal, 2011; Bensley et al., 1997; Kraus & Sheitman, 2004; Lehmann, McCormick, & Kizer, 1999). The risk factors for violence-related injuries among nurses and physicians are also thoroughly described in the literature. Findorff, McGovern, Wall, Gerberich, and Alexander (Findorff, McGovern, Wall, Gerberich, & Alexander, 2004) found that among the 1751 respondents from a large health system, increased amount of patient contact was the most important factor to increase the odds for

violent injury. In an examination of the rates of violence-related injuries in the emergency departments in 50 New Jersey Hospitals, Blando, et al. (Blando et al., 2012) found that staff at smaller hospitals had injury rates two to five times higher than at large hospitals in high crime areas. Additionally, they found no difference in assault rates at large hospitals in high crime areas versus large hospitals in low crime areas. Younger age and working in the emergency department, psychiatric areas, and with geriatric populations increased the risk for assault injuries among 4,918 Minnesota nurse survey respondents Gerberich, et al. (Gerberich et al., 2004). In a survey of staff at 139 Veteran's Health Administration facilities, Hodgson, et al. (Hodgson et al., 2004) found that floating (being assigned to work an area outside of one's usual department) and mandatory overtime were both positively associated with assault injuries.

Work-related violence in health care has consequences for both injured employees and for the employer. The most obvious outcomes of workplace violence for staff are the physical injuries incurred which can lead to permanent disability (Findorff-Dennis, McGovern, Bull, & Hung, 1999). The most prevalent mental and emotional results of workplace violence include decreased job satisfaction, increased anxiety, symptoms of post-traumatic stress disorder, and feeling unsafe in the work environment (Fernandes et al., 1999; Gerberich et al., 2004; Kansagra et al., 2008). Although hospital shootings are rare as compared to other service sectors, such as fast food restaurant work, there is a risk of being a victim of gun violence in the hospital setting (Kelen, Catlett, Kubit, & Hsieh, 2012).

Workplace violence also has significant consequences for organizations.

Employers' direct costs can include employees' lost wages, health care utilization, legal services, and worker's compensation. Costs for injuries due to workplace violence can be burdensome; in 1996 dollars, they were estimated to cost on average $17,109 (McGovern et al., 2000). Indirect costs can often be costlier than direct costs to organizations, though harder to quantify. Burnout and stress are common outcomes of workplace violence, which lead to higher turnover of staff and the associated costs of hiring, onboarding, and training new staff to take their places (Estryn-Behar et al., 2008; Roche, Diers, Duffield, & Catling-Paull, 2010; Waschgler, Ruiz-Hernandez, Llor-Esteban, & Garcia-Izquierdo, 2013). Productivity among nurses who frequently face violence at work may also decrease (Gates, Gillespie, & Succop, 2011).

Hospital safety and security workers are often overlooked in the health care violence-related injury literature. The relatively few studies that do include hospital security workers demonstrate that these workers have some of the highest rates of violence-related injuries within the hospital setting, anywhere from 2 to 5 times as many injuries as nurses (Arnetz et al., 2011; Fernandes et al., 1999; Findorff, McGovern, Wall, & Gerberich, 2005; Lehmann et al., 1999; Pompeii et al., 2013; Sullivan & Yuan, 1995). However, almost no studies have been conducted that detail the risk and protective factors for hospital security personnel. Security guards at hospitals and other healthcare institutions face unique safety challenges given their role to protect others from work-related violence. They must protect institutional staff from patients and visitors, and protect patients from each other and themselves. Hospital patients are by definition a vulnerable population; their medical conditions or treatment regimens can sometimes

exacerbate an already agitated state. Security guards are in a precarious position of having to work with and manage violent people who are also in a vulnerable state. Lacking clinical expertise, security workers do not generally perceive violent individuals as vulnerable people who may lack complete control of their actions due to chemical, medical, physical, or psychological insults to their persons. Many hospital security personnel have had law enforcement education or military training, and some may only have had job-related security training in settings other than healthcare. There is also wide variability between health care institutions in how security personnel are generally trained, and specifically instructed to react to violent situations, what tools are at their disposal (TASERs, handcuffs, etc.), and the nature of the institutional relationships between security and other personnel and departments.

A literature search on the topic of workplace injuries to hospital security personnel found no scientific articles that specifically examined these injuries. As there is no scientific literature on the subject, a literature review was completed on three main topics addressing violence-related injuries to other healthcare personnel: an overview of the problem, including consequences for the injured staff; risk and protective factors for both staff and perpetrators of violence in the healthcare setting; and interventions undertaken to prevent violence from occurring in the healthcare setting. The existing articles on assault injuries to police officers that were identified were included to augment the knowledge of what may be important variables for assault injuries to hospital security officers.

One intervention that has been implemented and identified as potentially highly

useful to decrease violence-related injuries, is arming the hospital security staff with conducted electrical weapons (CEW), specifically TASERs (Ho et al., 2011). Ho, et al. found that among hospital security workers armed with TASERs for an injury prevention intervention, staff injuries decreased from 31 in the pre-implementation year to 20 in the year post-implementation. In addition, the severity of injuries apparently decreased: there were 18 days of lost employee time and 350 days of restricted work in the 12 months preceding, whereas there were no days of lost employee time and 16 days of restricted work in the first 12 months after CEW introduction.

Some studies of the use of CEW in criminal justice have found less injuries among both police officers and suspects after the implementation of CEW occurred (Kaminski et al., 2007; Paoline, Terrill, & Ingram, 2012; Taylor & Woods, 2010), though the risk for less severe injuries to suspects may increase with CEW use (Terrill & Paoline III, 2012). In addition, field studies of the use of CEW in law enforcement have not found risk of cardiac death or severe injury with deployment of CEW (Bozeman, Teacher, & Winslow, 2012; Strote, Walsh, Angelidis, Basta, & Hutson, 2010). However, some suspect deaths have occurred shortly after the use of CEW prompting some to suggest a causal association with CEW (Baldwin et al., 2010; Zipes, 2012), though a common pathophysiological course suggesting a causal association in cardiac-related deaths temporally close to CEW deployment is uncertain (Swerdlow, Fishbein, Chaman, Lakkireddy, & Tchou, 2009). Given the relative safety of CEW use has been questioned, their increased use in healthcare should be accompanied with research into their safety and effectiveness.

The overall objective of this dissertation is to increase our understanding of violence-related occupational injuries to hospital security officers. This research will identify the environmental and personal risk factors for security officers' violence-related injuries, and whether an intervention meant to decrease the burden of these injuries, arming security officers with CEW, has met this goal.

Specific Aims

The overall objective of this research will be addressed in two manuscripts that have the following specific aims:

Manuscript 1, A mixed methods inquiry into the injuries sustained by security guards at a Level 1 trauma hospital.

Specific aim: To investigate the occupational injury experience of the hospital security officers of a Level 1 Trauma Center centrally located in the urban core of Minneapolis, MN

Manuscript 2, Effectiveness of conducted electrical weapons to prevent violence-related injuries in the hospital.

Specific aim 1: Determine if the introduction of CEW carriage by hospital security officers affected the injury rates among the security staff in the seven years after introduction.

Specific aim 2: Determine if the introduction of CEW carriage by hospital security officers affected the injury rates among the ED nursing staff in the seven years after introduction.

This dissertation is organized as follows. Chapter II provides a review of the

literature as described above. Chapter III describes the research methods for both manuscripts. Chapter IV is the published manuscript from the pilot study which informed the design of the comprehensive empirical study. Chapter V is the manuscript for the comprehensive study. Chapter VI provides a discussion of the findings from both papers.

Sub-studies on Injuries to ED Nursing Staff

In addition to the two specific aims addressed in Manuscript 2, data was concurrently collected in order to undertake two sub-studies on violence-related injuries to ED nursing staff:

Aim for sub-study 1: Determine whether changes in staffing levels among emergency department nursing staff affected risk for violence-related injuries to those nursing staff. The description, methods, results, and discussion of this sub-study can be found in Appendix A.

Aim for sub-study 2: Determine whether violence-prevention training affected the risk for violence-related injuries among nursing staff. The description, methods, results, and discussion of sub-study 2 can be found in Appendix B.

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Chapter II

Literature Review of Workplace Violence in Healthcare

A literature search on the topic of violence-related occupational injuries to hospital security guards yielded no scientific articles on the topic. In lieu of literature on violence-related injuries to hospital security officers, a literature search on violence-related occupational injuries to other healthcare personnel was conducted. Chapter II comprises this literature search. Section A describes the problem including who is at risk for violent injuries in healthcare and the outcomes they, and the institutions they work for, experience. Section B details the risk factors for violence-related injuries in healthcare, in particular the factors associated with workers, perpetrators, and the environment. Section C discusses the effectiveness of training and other interventions to decrease violence-related injuries in the hospital. The literature matrix based upon the approach recommended by Garrard is Appendix A to this thesis (Garrard, 2013).

Problem Overview

Health care occupations at risk of violence. Within the healthcare sector, occupations vary greatly in their risk of workplace violence. Mental health workers and other staff in psychiatric health locations are frequently documented as having high rates of assault as compared to other health care workers (Arnetz, Aranyos, Ager, & Upfal, 2011; Bensley et al., 1997; Kraus & Sheitman, 2004; Lehmann, McCormick, & Kizer, 1999; Sullivan & Yuan, 1995). In addition, the emergency department has long been recognized as a location in the hospital where employees are at a higher risk for violent injury relative to most other areas of the hospital (Arnetz et al., 2011; Estryn-Behar et al.,

2008; Findorff, McGovern, Wall, Gerberich, & Alexander, 2004; Gerberich et al., 2004; Pane, Winiarski, & Salness, 1991; Shields & Wilkins, 2009). These studies document that nurses, physicians, and assistive staff such as nurses' assistants and other aides have a high risk of injury relative to those not providing direct care. Emergency medical service providers have also been documented as having high rates of occupational violence-related injuries (Heick 2009). The relatively few studies that do include hospital security workers demonstrate that these workers have some of the highest rates of violence-related injuries within the hospital setting, with anywhere from 2 to 5 times as many injuries as nurses (Arnetz et al., 2011; Fernandes et al., 1999; Findorff, McGovern, & Sinclair, 2005; Lehmann et al., 1999; Pompeii et al., 2013; Sullivan & Yuan, 1995).

The sum total of the research on violence in healthcare demonstrates high rates of workplace violence throughout the health sector, with the fourteen studies here that describe rates of employee injuries varying widely in approach. Three of these studies are retrospective cohort studies of healthcare workers over time (Arnetz et al., 2011; Pompeii et al., 2013; Sullivan & Yuan, 1995), with the other eleven studies being cross-sectional in nature. In terms of strategies to obtain information on workplace violence, half of the studies used a survey method and relied on self-report of incidents where recall bias can potentially interfere with accurate results. The other studies varied from using workers' compensation claims data (Bensley et al., 1997; Pompeii et al., 2013; Sullivan & Yuan, 1995), incident reports (Arnetz et al., 2011; Kraus & Sheitman, 2004; Lehmann et al., 1999), and police records of incidents (Pane et al., 1991). The most expansive studies generally focused on one occupational group, with large-scale surveys of all nurses in

Minnesota (Gerberich et al., 2004), all registered nurses (RN) in Canada (Shields & Wilkins, 2009), all RNs in 10 countries in Europe (Estryn-Behar et al., 2008), and all emergency medical service providers with emergency medical technician certification as the populations under study (Heick, Young, & Peek-Asa, 2009). None of these large-scale studies of survey information included security workers, though an examination of Veteran's Administration health facilities throughout the United States did include security workers (Lehmann et al., 1999). The other studies either included data that varied from one hospital department, to health systems that included up to six hospitals, to the population of county healthcare workers in Los Angeles. A full national investigation that includes injuries to hospital security workers does not yet exist.

Outcomes of violence. When violence occurs in the hospital setting, there are consequences for both the direct victims of violence and the institutions where the violence occurs.

Physical and emotional outcomes for the staff victims. Work-related violence in health care has consequences for both injured employees and for the employer. The most obvious outcomes to the staff victims of workplace violence is the physical injuries incurred by the staff, which can lead to permanent disability (Findorff-Dennis, McGovern, Bull, & Hung, 1999). Mental and emotional results of workplace violence include decreased job satisfaction, increased anxiety and other symptoms of post-traumatic stress disorder, and feeling unsafe in their work environments, and are very prevalent among victims of workplace violence (Fernandes et al., 1999; Gerberich et al., 2004; Kansagra et al., 2008; Kowalenko, Gates, Gillespie, Succop, & Mentzel, 2013). In

addition, the number of assaults experienced over the career course has been found to be correlated with the emotional, biophysical, and social reactions of nursing staff (Croker & Cummings, 1995). Finally, although hospital shootings are rare as compared to some other service sectors such as fast food restaurant work, there is a risk of being a victim of gun violence in the hospital setting (Kelen, Catlett, Kubit, & Hsieh, 2012).

A variety of techniques were used to investigate outcomes for violently injured health care workers. Two of the survey-based studies asked participants to recall injuries and sequelae over a five-year period, lending themselves to a risk for recall bias (Croker & Cummings, 1995; Kansagra et al., 2008), while the other two asked about more proximal injuries (Fernandes et al., 1999; Gerberich et al., 2004). One study used in-depth qualitative interviews of injured subjects (Findorff-Dennis et al., 1999). The only longitudinally-designed study was a repeat-measure survey over the course of 9 months and asked participants about violent events over the past week, greatly reducing risk for recall bias (Kowalenko et al., 2013). The investigation into hospital-based shootings used search engines to seek out reports of shootings from several media sources (Kelen et al., 2012). None of these investigations included hospital security workers as subjects of interest; from these it is not possible to know with certainty how this population experiences violence-related injuries, though there are likely similarities between security workers' injuries and/or law enforcement, which were both investigated in these studies.

Financial outcomes for organizations. Workplace violence also has significant consequences for organizations. From a direct cost standpoint of lost wages for employees, costs of care, and costs of related activities such as legal costs, worker's

compensation costs for injuries due to workplace violence can be burdensome; in 1996 dollars, they were estimated to cost on average $17,109 (McGovern et al., 2000). Indirect costs can often be costlier to organizations, though harder to quantify. Burnout and stress are common outcomes of workplace violence, which lead to higher turnover of staff and the inherent costs with hiring, onboarding, and training new staff to take their places (Estryn-Behar et al., 2008; Roche, Diers, Duffield, & Catling-Paull, 2010). Productivity among nurses who frequently face violence at work may also decrease (D. M. Gates, Gillespie, & Succop, 2011; Roche et al., 2010).

These four studies that investigated outcomes for organizations from violence-related injuries are all cross sectional, though differed in some key areas. The one investigation that was not survey-based estimated the total direct and indirect costs from violence-related workplace injuries to Minnesota workers who lost at least four consecutive days due to a workplace injury over the course of a year, demonstrating a much greater burden to healthcare workers in Minnesota than other occupational groups (McGovern et al., 2000). The others relied on employees' estimation of loss in productivity and delivered services and correlate these results to workplace violence incidents, without objective empirical measurements of organizational losses. However, one study used an approach of asking each of the 2,487 participants, medical/surgical nurses in 21 hospitals across Australia, about injury experience over the previous 5 shifts and any incapacity to complete tasks (Roche et al., 2010); at least in this case there would be less risk for recall bias.

Worker and Perpetrator Risk Factors

Worker factors. Risk factors for workers include job-related factors as well as personal demographic risk factors.

Job-related factors. Different job-related factors have been identified as having a correlation to risk for violent incidents or assaults including amount of patient contact and years of professional experience. Findorff, et al. (Findorff et al., 2004) found that among the 1751 respondents from a large health system, increased amount of patient contact was the most important factor to increase the odds for violent injury. Similarly, within the psychiatric setting clinicians, those who provide direct cares and conduct assessments, have been found to have higher rates of assaults (Privitera, Weisman, Cerulli, Tu, & Groman, 2005). Studies that included experience level as a variable of interest have found that staff with more experience have less risk for violence-related injuries (Kowalenko, Walters, Khare, Compton, & Michigan College of Emergency Physicians Workplace Violence Task Force, 2005; Pompeii et al., 2013; Shields & Wilkins, 2009). Similar findings have been found in research of police officers (Kaminski & Sorensen, 1995). Though experience level is generally associated with a decreased risk of assaults, staff with more experience have been found to feel less safe (D. Gates et al., 2011).

The four articles above that report a correlation between employees' experience level and risk for violence-related injuries report similar findings with participants of interest including RNs in Canada (Shields & Wilkins, 2009), medical doctors in Michigan (Kowalenko et al., 2005), healthcare workers at three hospital sites (Pompeii et al., 2013), and police officers (Kaminski & Sorensen, 1995), suggesting this is a

pervasive phenomenon. Gates (D. Gates et al., 2011) used a convenience sample at 6 hospitals and found the result that more experienced staff were more likely to feel less safe, but this may be a case of self-selection bias due to the study's design of inviting any volunteers to participate. All of these studies were cross-sectional, which limits the capacity to identify how growth in experience level over time affects an individual's association with risk for occupational violence.

Personal characteristics. Personal characteristics including age, gender and race are also associated with violence risk. Younger age increased the risk for assault injuries among 4,918 Minnesota nurse survey respondents (Gerberich et al., 2004). A similar survey of 13,537 nurses in ten countries across Europe also found increased risk of violence for younger nurses (Estryn-Behar et al., 2008). Studies including gender as a risk factor for occupational violence have inconsistent findings. Kowalenko et al. (Kowalenko et al., 2013) found no relationship between the rates of assaults and gender of the victim of violence. Neither was there a difference in risk by gender among 263 returned surveys of emergency department physicians across the United States (Behnam, Tillotson, Davis, & Hobbs, 2011). In contrast, others have found male healthcare workers are at a higher risk for violence (Estryn-Behar et al., 2008; Gacki-Smith et al., 2010; Moylan & Cullinan, 2011; Pompeii et al., 2013; Shields & Wilkins, 2009). A study that included demographics of the assaulted and the assailant for each occurrence found that male patients are twice as likely to harm male staff with similar results for female patient on female staff violence (Flannery, Marks, Laudani, & Walker, 2007). In terms of the race of healthcare worker victims of violence, two studies found that minorities have

higher rates of violence (Pompeii et al., 2013; Sullivan & Yuan, 1995).

Most of the studies that evaluated the personal risk factors to experience workplace violence relied on self-reports in surveys. The two studies that used workers' compensation claims data, which would less likely have reporting bias with a specific group more or less likely to report violence in the workplace, found a correlation between minority status (Pompeii et al., 2013; Sullivan & Yuan, 1995). A variety of types of studies and populations found a positive association between male gender and risk for violence, and while a couple of them used convenience sample with low response rate (Gacki-Smith et al., 2010) or had a small sample size (Moylan & Cullinan, 2011), the others had robust sample sizes and covered a large variety of areas within healthcare. The study by Flannery et al. (Flannery et al., 2007), was a longitudinal collection of violent reports over the course of 15 years among one specific population. The study's design strengthens the case of finding a true association between the likelihood that violence is more likely when the victim and perpetrator are the same gender in this population, but this may be a unique association in psychiatric health settings as it was not reported in other study populations.

Perpetrator (patient) factors. Studies that have investigated patients who perpetrate violence have focused on their use of drugs and alcohol, gender and history of violence. One of the most common risk factors for perpetrating violence is the use of drugs or alcohol. In the psychiatric setting, it's been found that drug abusers are more likely to perpetrate violence (Amore et al., 2008). Similarly, across the Veteran's Administration healthcare systems most perpetrators of violence had substance abuse as

the primary or secondary diagnosis (Lehmann et al., 1999). It's also been found that in the emergency department and in psychiatric settings, assailants are more likely to be intoxicated (Behnam et al., 2011; Bowers et al., 2009). In the public safety sector, police are also more likely to be assaulted when offenders are perceived to have recently consumed alcohol (Covington, Huff-Corzine, & Corzine, 2014). However, as with the staff victims, investigators have not consistently found one gender to be more likely to be involved in perpetrating violence in the healthcare setting. Kraus and Sheitman (Kraus & Sheitman, 2004) found higher rates of violence on female psychiatric units than on male units and in the study of police assaults, women were more likely to assault officers than men (Covington et al., 2014). In contrast, others have found that men are more likely to be assailants of healthcare staff than women (Amore et al., 2008; James, Madeley, & Dove, 2006). Kowalenko (Kowalenko et al., 2013) found that women are as likely to perpetrate violence in the emergency department, while, as noted above, others have found women more likely to attack women and men to attack men (Flannery et al., 2007). Clearly, the association between gender and perpetrated violence is not clear. Finally, at least in psychiatric health environments if not other areas as well, most violent events are perpetrated by patients who have been violent in the past (Owen, Tarantello, Jones, & Tennant, 1998).

Investigations into the common aspects of the assailant mostly include data that is based on reviewing of patients' medical charts for demographic and medical features at one or a few departments, though there are exceptions. The two studies that demonstrated an increased likelihood that males are more likely to be violent were both retrospective

reviews in either one emergency department (James, Madeley, & Dove, 2006) or one psychiatric department (Amore et al., 2008). The investigation by Kowalenko (Kowalenko et al., 2013) was a prospective longitudinal repeat-measure survey in six emergency departments in two states, and the investigation by Flannery (Flannery et al., 2007) was a 15-year longitudinal investigation of violence at sixteen locations with psychiatric patients. The results of these two studies do not disagree in terms of association with gender and, due to the strength of study design, are likely close to approximating the true relationship. Most of the investigations in this section are cross-sectional or retrospective reviews of medical charts, though the study by Bowers et al. (Bowers et al., 2009) used a longitudinal design in its collection of data, with similar results found by investigators with study designs that included data collection by administrators of 166 Veteran's Administration facilities and a national survey of emergency medical doctors (Behnam et al., 2011). Thus, studies using a variety of research designs have all found drug and/or alcohol use to be associated with the risk for patients to become violent.

Environmental Factors

Staffing factors. Staffing levels likely affect the risk of violence in the healthcare settings in different ways dependent upon location within the hospital. In a study of 351 adult psychiatric units in 255 U.S. hospitals, totaling 3,397 unit-months, there was a strong positive association between staffing levels and assaults on staff (Staggs, 2013), though the same study found that a staffing mix that included higher numbers of RNs as compared to assistive staff (such as mental health workers) correlated to less assaults.

Similarly, a study of 136 acute psychiatric wards with attending patients and staff in 67 hospitals in the UK during 2004-2005 found a higher risk of assaults associated with higher staffing levels (Bowers et al., 2009). These authors thought the correlation could be attributed to more staff being assigned to areas where there was inherently more violence, but a follow up study of the same data set found that increased staffing levels preceded the risk of violence on the ward (Bowers & Crowder, 2012). A similar finding has been reported in research of police officers. Officers are twice as likely to be assaulted when there is more than one officer present (Covington et al., 2014). While some of these increased assaults are most likely due to the fact that more police respond when tensions are higher, the authors of the study also posit that the increased assaults could be due to officers feeling emboldened to confront a subject rather than try different tactics if alone- similar to the theory postulated by Bowers (Bowers et al., 2009).

In areas outside of the psychiatric units, higher staffing levels may be more protective against violent injuries. In a survey-based study of 12,218 nurses across Canada, the reported adequacy of staffing significantly strongly correlated to reports of assault (Shields & Wilkins, 2009). Roche (Roche et al., 2010) found in medical/surgical units staffed with more registered nurses and bachelor's-prepared nurses versus assistive staff less violence was experienced. In the emergency department, it's been found that nurse staffing levels have some impact on violence in the ED (less nurses staffed correlating with more patient to staff violence), but the effect is almost completely attenuated when adjusted for the occupancy level of beds in the emergency department, and the occupancy level becomes the most important correlation: the average ED bed

occupancy was 95% on days where at least one patient was violent towards staff whereas the average bed occupancy was 86% on days when no patients was violent towards staff. (Medley et al., 2012).

Study design is an important factor when evaluating the association between staffing levels and risk for violence. The perception of short-staffing may be quite different from the reality of how well an area is staffed relative to other institutions, or at one time versus another. The two investigations that reported a positive association between lower staffing levels both relied on surveys of nursing staff, where reporting bias may be an important contributing factor (Roche et al., 2010; Shields & Wilkins, 2009). In contrast, the two studies by Bower (Bowers et al., 2009; Bowers & Crowder, 2012) were a longitudinal design investigating staffing levels before, during, and after violent events. The investigation by Staggs (Staggs, 2013) was of data submitted by institutions into a national database, thus also do not have the bias risk inherent to a survey of actual conditions. Similarly, the study by Medley (Medley et al., 2012) relied on data from medical charts and was not created for an investigation into violence, but is not at risk for bias inherent with self-report.

Other environmental factors. Apart from staffing levels, other environmental factors have been found to be associated with violence including administrative support and policies for violence prevention, time of day, and the location of the hospital. In an examination of the Minnesota Nurses Study, it was found that nurses who felt there was more administrative involvement in preventing violence at the respective institutions experienced fewer assaults (Nachreiner, Gerberich, Ryan, & McGovern, 2007). In

addition to perceived support by administration, policies regarding how staff are deployed within the hospital may also affect the risk for violence-related injury. In a survey of 72,349 usable responses at 139 facilities in the Veteran's Administration System, floating, shift-switching, & mandatory overtime all increased risk of assaults among the participants (Hodgson et al., 2004). In a study of 16 inpatient psychiatric wards spanning two years, researchers found that negative staff morale was significantly associated with upturns in conflict and containment (restraint and/or seclusion) of patients (Papadopoulos, Bowers, Quirk, & Khanom, 2012). In terms of time of day, more violence has occurred at night in the emergency department than at other times of the day (Behnam et al., 2011).

The location of a health care facility in a high versus low crime area does not appear to be associated with the incidence of health care worker violence whereas facility size and resources may impact violence outcomes. In an examination of the rates of violence-related injuries in the emergency departments in 50 New Jersey Hospitals, Blando et al., (Blando et al., 2012) found that staff at smaller hospitals had injury rates two to five times higher than at large hospitals in high crime areas. Additionally, they found no difference in assault rates at large hospitals in high crime areas versus large hospitals in low crime areas. It is likely that larger hospitals are able to invest in security measures necessary to prevent violence-related injuries, whether they are in high-crime areas or not. One study provided more direct evidence of the role of resources in decreasing health care worker violence. Increased spending per patient was negatively associated with staff assaults across psychiatric institutions in the Veteran's

Administration system (Lehmann et al., 1999).

The investigations here which directly compared institutions were generally large studies. Blando et al. (Blando et al., 2012) randomly sampled within three strata of hospital sizes and then included all injuries deemed to be OSHA-recordable at each institution over a 10-year period. The study by Lehman et al. (Lehmann et al., 1999) may not have had the same depth in terms of years of investigation, but was broader in terms of facilities in all regions of the United States. Both studies found that hospitals that have more access to resources to devote to patient care have less incidents of violence. The studies by Nachreiner et al. (Nachreiner et al., 2007), Hodgson et al. (Hodgson et al., 2004), and Behnam et al. (Behnam et al., 2011) were all survey-based cross-sectional investigations into their respective areas of inquiry. Papadopoulos et al. (Papadopoulos et al., 2012) used an innovative longitudinal design method of combining qualitative and quantitative data over a 2-year period in sixteen psychiatric wards; staff were interviewed about key independent variables of interest and compared against the numbers of conflicts and containments in the following shifts.

Preventive Measures

Training. The most frequently reported activity to prevent violence in the hospital setting is to train staff to prevent and mitigate aggression and violence by hospital patients. Indeed, the US Department of Labor, through the Occupational Safety and Health Administration, has proposed a new set of rules to prevent violence in the healthcare setting, with staff training as one of the five essential elements to prevent healthcare violence (Occupational Safety and Health Administration (OSHA), 2016). In

2015, Minnesota promulgated a new statute to require hospital administrations to provide training programs to staff to prevent violence (State of Minnesota, 2016).

However, the evidence that staff training programs are effective at preventing violence in healthcare is questionable. In the survey of over 72,000 healthcare personnel across the Veteran's Administration, no relationship was found between proportion of individuals in each facility receiving training on managing and preventing disruptive behaviors and the proportion of assaults at those facilities (Hodgson et al., 2004). In one example of very intensive training where staff spent up to 24 total hours learning communication strategies to de-escalate aggressive individuals and prevent volatile situations, assaults on staff remained flat before and after training (Smoot & Gonzales, 1995). Others have found self-reported violence decreased in the three months following de-escalation and crisis intervention training, but by six months, the rate of violence-related injuries had returned to baseline (Fernandes et al., 2002). The 4-hour training described by Fernandes et al., focused on assessing and preventing aggressive behaviors among patients, through a variety of teaching techniques. Similar results were found after implementing an 8-hour nonviolent crisis intervention training in an emergency department, where a decrease in behavioral emergency calls was found in the 90 days after training, but by 150 days had returned to baseline (Gillam, 2014). Similar to Fernandes et al., this training included identifying crisis-related behaviors, both verbal and nonverbal techniques to defuse hostile behavior, and how to avoid injury if behavior becomes violent.

In contrast to studies showing short-term benefits of training, one study reported

that verbal de-escalation training may actually increase the number of violence-related injuries to hospital personnel and another study found that training increased staff knowledge but not confidence in the ability to prevent violence. In an examination of five psychiatric wards in England, three of which had staff training on de-escalation tactics and two of which included only tactics on how to physically control aggressive and violent individuals, the wards where there was de-escalation training staff experienced 48% more behavioral incidents (Lee, Gray, & Gournay, 2012). The authors proposed that staff may be more likely to try to verbally engage with disruptive and aggressive patients, where a strict and limiting physical approach is more appropriate. Others have examined the process rather than the outcome and have still found mixed results; after implementing a training program in an emergency department, staff reported a better understanding of factors that contribute to patient aggression, but felt no more confident to deter patient aggression (Wong, Wing, Weiss, & Gang, 2015).

Most articles on the effect of violence-prevention training in the literature are single intervention-based studies of one training or another. Four of the studies cited here on violence-reduction training were of this nature. Smoot and Gonzalez (Smoot & Gonzales, 1995) used a before/after design comparing differences between an intervention unit where all staff were trained in de-escalation tactics and a control unit where no training was implemented. Both Fernandes et al. (Fernandes et al., 2002) and Wong et al. (Wong et al., 2015) compared the results of the emergency department where the intervention was implemented in a pre-post manner. Gillam (Gillam, 2014) investigated whether there was correlation between percentage of staff trained in nonviolent crisis intervention and

the number of behavioral emergency calls, during a time when there were increased training activities. Similarly, Hodgson et al. (Hodgson et al., 2004) investigated in situ training; the 72,349 surveyed staff in Veteran's Health Administration hospitals were asked whether they had behavioral response training and the number of staff answering affirmatively at each respective hospital were compared against the number of injuries at that hospital. As all the facilities in the Veteran's Health Administration employ the same training for staff, more research is indicated comparing different facilities and different types of violence prevention training. Lee et al. (Lee et al., 2012) conducted a longitudinal study of five psychiatric intensive care units with different types of violence prevention training.

Other preventive measures. There is mixed success for other measures organizations take to decrease violence-related injuries in healthcare include state regulations, an institutional program to promote peers helping one another post-assault, the institutional use of metal detectors, and having staff carry TASERs as deterrents. In 1994, California promulgated a statute that directed healthcare organizations operating in the state to implement a variety of interventions to decrease violence in the hospital setting (California Occupational Safety and Health Administration, 1998). However, in an examination of the hospitals in California as compared to hospitals in new Jersey, where there was no equivalent state regulation, hospitals in New Jersey scored better in many of the areas of violence prevention that California's laws dictated for that state's hospitals (Peek-Asa et al., 2009). In three psychiatric hospitals, implementing a program involving peer-help intervention to reduce sequelae following patient to staff assaults,

decreases of patient to staff assaults occurred at those facilities (Flannery et al., 1998). The declines could be attributed to the capability of such a program to dispel the fatalism staff often have about patient to staff violence (Nachreiner et al., 2007). One facility implemented a new security program, with metal detection as one of the main interventions (Rankins & Hendey, 1999), and while there was a large positive difference in the number of weapons confiscated in the year following implementation, there was no reduction in number of assaults per 10,000 patients treated at the facility. Finally, at one facility, the introduction of arming hospital security officers with TASERs® was accompanied with a 50% reduction in injuries to the security workers at that hospital (Ho et al., 2011). In addition, the department went from having 18 days of lost time and 350 days of restricted or light-duty due to injuries in the year before implementation to 0 days lost time & 16 days restricted or light-duty in the year post-implementation.

While the intervention of arming hospital security officers with TASERs® appears to be an effective tool to reduce injury burden among security officers, the injuries were not investigated as violence-related injuries or not and no statistical analyses were performed. Thus a larger investigation is warranted into whether violence-related injury rates to hospital security workers are impacted by arming security workers with TASERs®. The investigation by Flannery et al. (Flannery et al., 1998) used a before/after intervention design to examine whether there was a reduction in injuries after implementation of the peer-help intervention. There were no other examples of this type of intervention found in the literature and replication of this type of intervention and examination of the affect is indicated.

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Chapter III

Research Designs and Methods

This dissertation produced two manuscripts that investigate violence-related injuries among hospital security staff. The first manuscript explored the phenomenon of violence-related injuries among hospital security staff. The second manuscript tested whether the intervention of arming the hospital security staff with conducted electrical weapons affected the rates of violence-related injury to hospital security staff and emergency department nursing staff. Both manuscripts are based on research conducted at Hennepin County Medical Center, a Level 1 Trauma center in Minneapolis, MN. Hennepin County Medical Center's hospital has 472 beds, 102 of which are designated for psychiatric patients. On average, 335 of all beds were occupied daily by patients in 2014. The emergency department, including urgent care, had 109,809 visits that same year.

Manuscript 1: A Mixed Methods Inquiry into the Injuries Sustained by Security Guards at a Level 1 Trauma Hospital

Specific aims. Many studies report injury rates from workplace violence for security workers at rates two to five times that of registered nurses, but none of these studies have explored the circumstances, risk or protective factors specific to this population (Arnetz, Aranyos, Ager, & Upfal, 2011; Fernandes et al., 1999; Findorff, McGovern, & Sinclair, 2005; Lehmann, McCormick, & Kizer, 1999; Pompeii et al., 2013; Sullivan & Yuan, 1995). The goal of this study was to describe the occupational injury experience of the medical center protection officers (MCPO) of Hennepin County Medical Center (HCMC).

Target population. The Medical Center employs 30 full time MPCOs and 10 additional security services employees including investigators, trainers, supervisors, and a manager. This investigation specifically targeted the population of the MPCOs.

Case data collection. The three data sources for the cases in this study were: the reports of hospital security personnel injuries from the hospital's occupational health and safety department, the database the security officers use to log events they experience, and patient electronic health records. The first data obtained were the MCPO injury events from the hospital's occupational health and wellness and safety departments. All security personnel injury reports that occurred from December 1st, 2010 to November 30th, 2011 were included; the occupational health nursing notes and injury descriptions were abstracted. After injury reports were obtained, the security officer database was reviewed to find security officer narratives of incidents where an officer was injured. Date, time, and location of the event were abstracted from the database as well as the officers' narrative notes, which included information on the use of tools of law enforcement. The involved patients' charts were then reviewed to retrieve information on the patients' diagnoses, healthcare provider perspectives on the violent events, and information on whether patients were injured in the events.

Control data collection. Control events for this study were defined as physically violent incidents involving MCPOs and either patients or visitors that did not result in a reported injury to the security officers involved. The security database was reviewed beginning December 1st, 2010 and included a pre-determined maximum of 300 incidents involving physically violent individuals; the 300th incident occurred on June 14th, 2011.

In order to find the control events, all patient support events and events that involved ejecting visitors were reviewed, as these were the types of events where injuries to officers occurred in the case events. There were between 50 and 200 patient support events on each day and on average one visitor eject event every third or fourth day. Events were determined to meet inclusion criteria if the text of the event included words indicating the security officers were dealing with a violent individual, such as: combative, uncooperative, fighting, swinging. On occasion a given patient was described in security officer notes as being cooperative, but the interventions described by the security officer did match those used for a cooperative individual, for example, restraining all four limbs of a patient. In these cases, the electronic health record was used as the primary method to determine if a patient was being violent in the presence of security officers. Instances where individuals physically threatened officers, but were unable to actually attack were included. Events where a patient or visitor was being physically violent before the arrival of security officers, but not violent in their presence, were excluded. Again, the electronic health records of the involved patients were used to obtain information about the diagnoses of the involved patients, healthcare providers' perspectives on the incidents, and to determine if any injuries to the patients occurred.

Analysis. This investigation used a mixed methods approach including both a qualitative analysis and a quantitative analysis exclusively using descriptive data. The objective of the qualitative analysis was to provide an understanding of the experience of the security officers in their dealings with violent individuals in the hospital. The objective of the quantitative analysis was to describe the injuries to these MCPOs in

terms of rates, locations of incidents, and timing of the incidents, and make comparisons between events where a security officer sustained a reported injury (cases) and those events where no injury to security officers occurred or was not reported (controls). Using a mixed methods approach, where both qualitative and quantitative analyses are undertaken, provides a more robust and complete picture of the study phenomenon (Denscombe, 2008; Doyle, Brady, & Byrne, 2009; Johnson, Onwuegbuzie, & Turner, 2007).

Qualitative analysis. The 317 MCPO narratives provided the qualitative data for this analysis. The notes were thoroughly reviewed several times to gain a sense of the overall themes and experiences of the MPCOs. The individual narratives were then categorized according to the most prominent theme in each narrative. While many of the narratives overlapped thematically, the decision was made to keep each narrative intact rather than cut the narratives down to individual components to be grouped, in order to retain the context of each narrative.

Quantitative analysis. The quantitative data comprised the location of the events, time, reported injuries to security officers, unreported injuries to security officers, injuries to patients, use of tools of law enforcement (conducted electrical weapons, handcuffs, pepper spray, and baton), and patients' diagnoses. There were a total of 19 injuries reported to the employee health department; two of which are excluded from most analyses, as they lack information other than a description of the type of injury. One of the two injuries was a sprained knee likely due to a fall and the other was a sprained hand/fingers that was likely due to a violent occurrence with an individual. Of the 17

remaining injuries reported, all were the direct result of conflict with a violent patient or visitor. Three hundred violent incidents that were of a similar nature to the 17 injury events were the control events for analysis, yielding a 1:18 case to control ratio. Chi-square tests and Fisher's Exact Tests were performed to compare the locations of where the cases and controls occurred within the hospital.

Manuscript 2: Effectiveness of Conducted Electrical Weapons to Prevent Violence-Related Injuries in the Hospital

Specific aims. This investigation was designed to evaluate the effectiveness of arming hospital security guards with TASERs to reduce the injury rates of security guards and emergency department (ED) nursing staff at Hennepin County Medical Center (HCMC). The ED is the primary location in the hospital where guards proactively intervene with potentially violent patients, which may deter violence from occurring. In contrast, in all other hospital locations the officers arrive after a violent episode has already occurred in order to secure the area and prevent further violence, and thus only hospital staff working in the ED are included in this investigation.

Target population. This was a retrospective cohort study of two unique, though related, hospital employee populations: the hospital security staff and nursing staff in the ED. It will involve analysis of multiple secondary data sets at HCMC and Hennepin County, which had direct administrative control over the Medical Center until March of 2007, and will include selected employees ranging from a total of 480-989 subjects, each with a varying duration of time worked during the period of interest from January 1, 2004 to December 31, 2014.

There are approximately 30 full-time security officers employed at any one time at the hospital and over 200 nursing staff employed in the ED. With turnover expected to be 10-30% per year in the population of interest, there will be a total of 480-989 subjects, each with a varying duration of time worked during the period of interest. The three job classes with direct patient care within the security department are: Protection Officer,

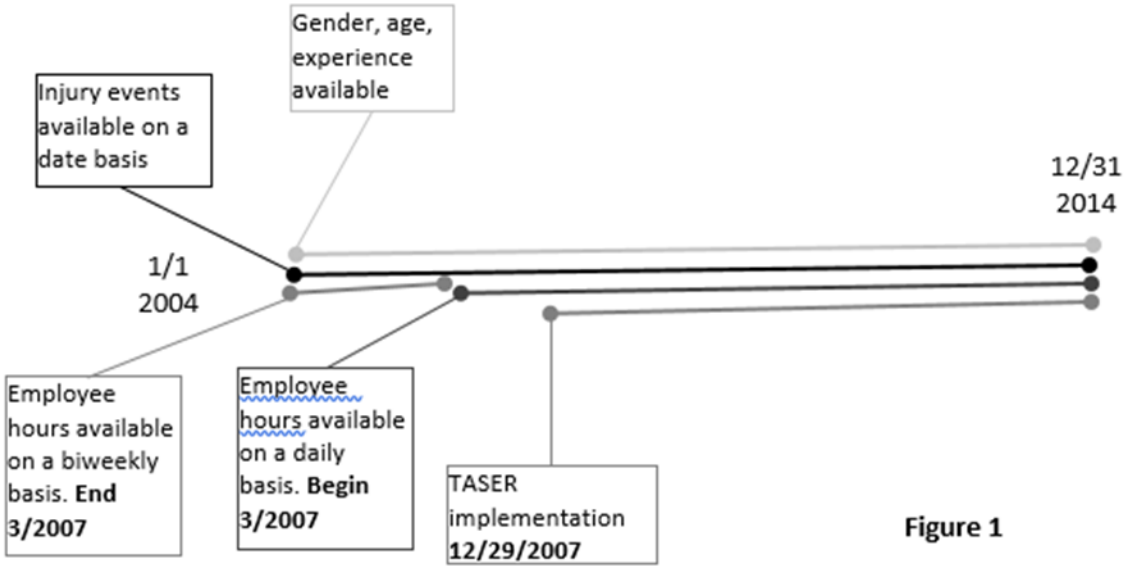

Figure 1

Protection Officer Senior, and Security Supervisor. The three job classes among the nursing staff in the ED with direct patient care are: Staff Nurse, Senior Staff Nurse, & Health Care Assistant.

Data sources. The study relies solely on secondary data which was abstracted from several sources at the study hospital, HCMC, and Hennepin County. Variables to be estimated across the two models are listed below with a description of the level of measurement, specific source of the data, and dates each variable is available in respective formats (See also Figure 1).

Dependent variable. For both analyses the dependent variable is an injury rate for the security guards and nursing staff, respectively. The numerator will be the number of violence-related injuries incurred by each employee and the denominator will be the productive hours worked by each individual. The number of injuries is a ratio level variable (0-15) identified from workers' compensation claims data. The injury information is unique to an individual employee and describes the type of injury and cause of injury. The occupational health record of each injury will be reviewed to determine whether it was violence-related or not; if the text of the narrative includes language that the employee was bit, hit, kicked, slapped, pushed, elbowed, scratched, spit upon, punched, and/or injured during the restraint process of an uncooperative patient, this injury will be determined to be violence-related.

The denominator of number of hours worked comes from two data sources. From 1/1/2004-3/10/2007, the hospital was directly administered by Hennepin County and all human resource records are held at the County. The data for 2004-2007 is available on a pay-period basis, where the total hours worked is in increments of two weeks. From 3/11/2007-12/31/2014, the payroll data is available on a daily basis and it will be converted to 2-week pay periods to match the pre-3/2007 data. Only productive hours worked will be included in the denominator, as those are the only hours where an employee could be at risk of being injured. Hours spent in educational activities, meetings, sick leave, etc., will be excluded from the data.

Independent variables:

CEW carriage by security staff. The primary independent variable of interest will

be the presence or absence of CEW carriage measured as a pre/post variable with '0' value for the 4 years prior to the introduction of CEW carriage by security officers and '1' for the 7 years after.

Age. Derived from human resources data, age was measured as a discrete variable in respective quartiles for each group, security guards and nursing staff. Age was treated as a dynamic variable that was measured at each instance during the duration of the study time period, in relation to the instant of analysis to the year of birth.

Experience. Similar to age, experience was also derived from human resources data and was measured as a dynamic variable against the date of hire by the organization to the instant of analysis. Also similar to the variable of age, experience level was analyzed in respective quartiles for each group.

Gender. Gender was measured as a discrete variable (0-1) to compare males to females using self-report data from human resources files.

Theoretical application. The Haddon Matrix was used as a theoretical model for the research. Commonly applied in public health as a tool to understand the origins of injuries and to identify prevention strategies, the Haddon Matrix displays the timeline of an injury event: pre-event, during event, and after event by the intervention targets: host, agent, physical environment, and social norms (Runyan, 1998). Figure 2 applies the Haddon Matrix to the problem of violent injuries among security officers and ED nursing staff. In this case, the host is the hospital staff member (i.e., security officer or ED nursing staff), the agent is the offending individual (usually a hospital patient) committing the assault, the physical environment is the hospital, and social norms include

hospital policies, applicable laws, and societal norms around violence against health care workers. Figure 2 identifies that the implementation of TASER carriage by security officers deters violent injuries to staff via two methods. The introduction of a policy for officers to carry TASERs enables potentially violent individuals to see the TASERs who then may be less likely to engage in violent behaviors in the pre-event phase, but the TASERs may also decrease the severity of some violent events and prevent other persons in the area from being injured. (Additional interventions listed in the Matrix are for illustrative purposes.)

Haddon Matrix *Underlined items are ones investigated in this study*	***Host*** *(the healthcare worker who is attacked)*	***Agent*** *(the violent individual- usually the hospital patient)*	***Physical Environment*** *(the hospital location)*	***Social norms*** *(hospital policies, laws, community norms)*
Pre-Event *(before a violent injury occurs)*	Educate staff on de-escalation techniques to prevent violence	Search any new intoxicated or psychiatric patients for weapons Provide services quickly and well so individuals feel cared for (sufficient staff)	Place security cameras in visible locations Position security booths near 'hotspots' of violence Separate acutely ill psychiatric and intoxicated patients from others	Post hospital policies in regards to violence Educate staff on the need to call security as conditions escalate (change the norm that workers should expect violence to occur) Arm security officers to deter violence (Agent sees TASER-bearing officers and decides not to escalate)
During Event *(during the violent interaction)*	Educate staff on personal safety techniques that reduce the potential of harm Ongoing education of current best practices in use of force in health care (for security officer Hosts)	Arm security officers with TASERs to stop events of severe violence from continuing	Remove items that could be used as weapons from areas for intoxicated and acutely psychiatric patients	Change the organizational culture for staff to feel justified to defend themselves
After Event *(after the injury occurs)*	Provide post-event counseling and support	Restrain/separate violent individuals Flag violent occurrence in individual's health record to alert future providers	Prioritize injured employees who need medical attention	Call external police forces and press charges when assaults occur Require individuals to report violent incidents

Figure 2

Use of a directed acyclic diagram (DAG). To determine how other variables influence the outcome of violence-related injuries, and the potentially confounding effects of these variables, DAGs were constructed. DAGs are created through a process of identifying the predominant variables that affect the outcome for the subjects of interest. They are especially useful at identifying the causal structure of the association of the exposure variable to the outcome and its relationship to covariates (Greenland, Pearl, & Robins, 1999). Figure 3 displays the DAG which provides a conceptual structure of the

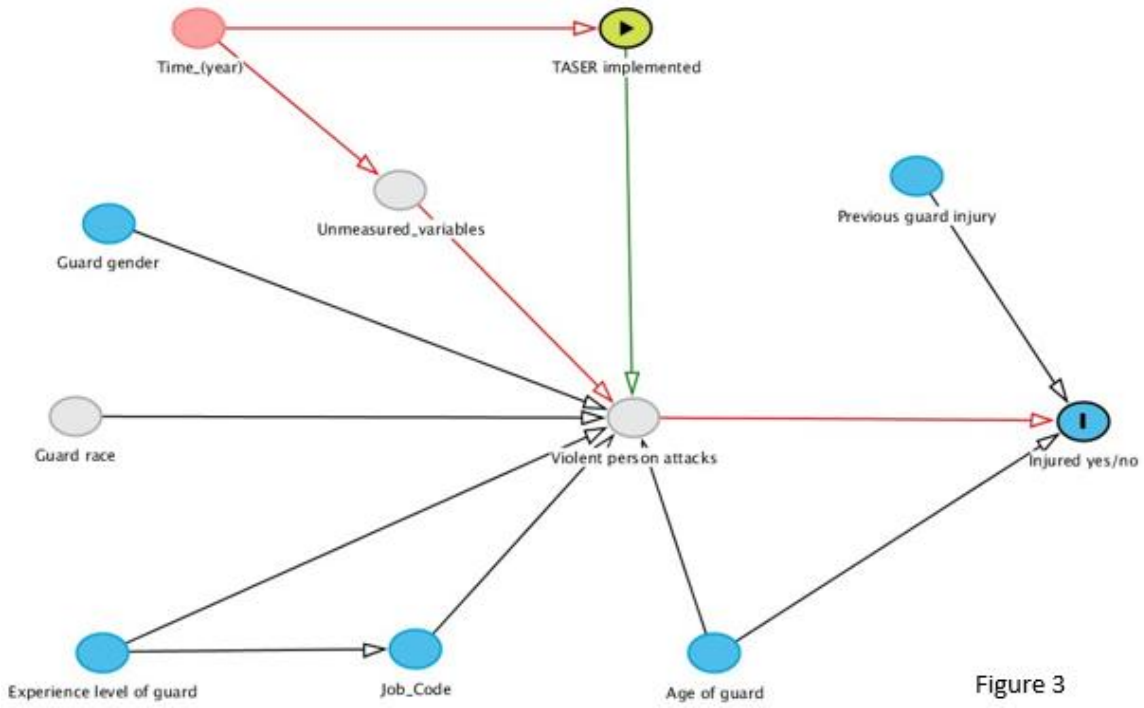

Figure 3

causal hypothesis of the effect of TASER carriage on violence-related injuries to hospital security workers; the DAG for ED nursing staff is identical.

Analyses. Both bivariate and multivariate analyses of the data were performed.

Descriptive and bivariate analyses. Apart from the mixed methods study described above, there have been no prior investigations into the factors associated with rates of

violence-related injuries among hospital security personnel, and so descriptive and bivariate analyses were completed with available demographic variables. To perform the analyses, a Poisson-like regression was used to compare rates of injuries associated with specific independent variables. The dependent variable is an injury rate where the numerator is violence-related injuries incurred by each employee and the denominator is the productive hours worked by each individual during the study period of each model. A structured correlation matrix was used to account for the correlated observations within subject. As opposed to an unstructured correlation matrix, the assumption regarding the subjects is that there is either constant variance within each subject, as with exchangeable or compound symmetry matrices, or that the variance increases as time progresses, as in an auto-regressive matrix (Jennrich & Schluchter, 1986). While an unstructured correlation matrix may be justified for any longitudinal logistic analysis that requires within-subject adjustment, each subject and covariate combination requires a new parameterization and greatly increases the error to the point of making results unachievable. The robust variance (empirical) estimate was used, as this accounts for greater or smaller variance in the data than is assumed with Poisson modeling where the variance is the mean (Armitage & Berry, 1994; Zou, 2004). SAS 9.4 was used to run all statistical models using PROC GENMOD for comparative analyses.

Multivariate analyses. As with bivariate analyses for security workers, Poisson-like regression was used to analyze the data for differences in injury rates for the two respective populations, security personnel and nursing personnel, before and after the implementation of TASER carriage by the security personnel. Both of the full models are

based on the following general calculation:

$$\log[Injuries_{security\ or\ nursing}] = \beta_0 + \beta_{taser} + \beta_{gender} + \beta_{age} + \beta_{experience} + \beta_{hours}$$

The SAS code for the two multivariate analyses and bivariate analyses can be found in Appendices D and E.

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Chapter IV

A Mixed Methods Inquiry into the Injuries Sustained by Security Guards at a Level 1 Trauma Hospital

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Abstract

Hospital security guards are tasked with protecting the safety of healthcare personnel, visitors to the hospitals, and patients. They are called on to help control violent situations and are thus at a high risk to sustain violence-related injuries, but little is known about the protective and risk factors for injuries to hospital security guards. Qualitative and quantitative analyses were performed on three existing data sources from an urban 462-bed Level I Trauma Center in the Midwest: the security officer narratives, occupational health department data, and the patient electronic health records. There were 19 reported injuries over the course of a year, with an additional 300 violent incidents reviewed from that year. Most of the violent incidents that involved security officers occurred between 8pm and 4am, with a greater proportion of the officer injury events taking place in the psychiatric departments. Of the 317 incidents reviewed, the officers used a tool of law enforcement (TASER and/or handcuff) on 11 occasions. There were 11 patients injured during the violent incidents, 4 of which occurred with the use of a tool of law enforcement. Security officers are at a high risk for violence-related injuries in the hospital, with most injuries in this group being blood and body fluid exposures and strains and sprains. Staffing and patrol patterns and can be optimized when the location and timing of violent incidences are known.

Background

Security personnel in hospital settings suffer injuries from workplace violence at rates two to three times that of registered nurses (Sullivan & Yuan, 1995; Arnetz, Aranyos, Ager, & Upfal, 2011; Lehmann, McCormick, & Kizer, 1999), yet little is known about the associated risk and protective factors for these workers. Security guards at hospitals and other healthcare institutions face unique safety challenges given their role to protect others from work-related violence. They must protect institutional staff from patients and visitors, and protect patients from each other and themselves. Hospital patients are by definition a vulnerable population; their medical conditions or treatment regimens can sometimes exacerbate an already agitated state. Security guards are in a precarious position of having to work with and manage violent people who are also in a vulnerable state. Lacking clinical expertise, security workers do not generally perceive violent individuals as vulnerable people not in complete control of their actions due to chemical, medical, physical, or psychological insults to their persons. Many hospital security personnel have had law enforcement education or military training, and some may only have had job-related training in different settings of security employment. There is also wide variability between health care institutions in how security personnel are generally trained, and specifically instructed to react to violent situations, what tools are at their disposal (TASERs, handcuffs, etc.), and the nature of the institutional relationships between security and other personnel and departments.

A literature search on this topic found no scientific articles that specifically examined injuries to hospital security personnel. A few articles investigated injury rates

for all hospital employees, including security personnel, but did not focus on this occupational group (Sullivan & Yuan, 1995; Arnetz, Aranyos, Ager, & Upfal, 2011; Lehmann, McCormick, & Kizer, 1999). While these studies reported injury rates from workplace violence for security workers at rates two to three times that of registered nurses, none of these studies explored the circumstances, risk or protective factors specific to this population.

Some researchers have investigated the effect of security guard interventions, such as the use of law enforcement weapons. Ho, et al. (2010) investigated the safety and efficacy of the use of Conducted Electrical Weapons (CEW), such as the TASER, by hospital security guards when confronted with potentially violent patients and visitors at a 420-bed county tertiary care center. These authors found a 33% decrease in the number of injuries to security workers in the 12 months after the implementation of CEW as compared to the 12 months prior; injuries to the 40 full-time civilian Medical Center Protection Officers (MCPOs) declined from 31 to 20. They also found a reduction from 350 to 16 days of modified or light duty in a comparison of the year prior to the 12 months post-implementation of CEW. This decrease in injuries happened despite a 6.5% increase in the number of calls for the officers to respond to behavioral situations in the 12 months post-implementation. The authors only investigated incidences when CEW were used and thus do not provide more information on other interactions with potentially violent patients and others.

The goal of this paper is to describe the occupational injury experience of the MCPOs of a Level 1 Trauma Center centrally located in an urban city in the Midwest.

Methods

The case hospital is a 462-bed hospital, with 100,066 emergency department (ED) visits and 10,946 visits to acute psychiatric services in 2012. The medical center employs 30 full time MPCOs and 10 additional security services employees including investigators, trainers, supervisors, and a manager. A mixed methods research design was chosen to explore the injury experience of these employees through secondary analysis of three distinct sets of records at the medical center. Approval for this research was gained from Institutional Review Board of both the University of Minnesota and the case hospital for this study. All data were de-identified prior to analysis.

Case data collection

The three data sources for the cases in this study were: the reports of hospital security personnel injuries from the hospital's occupational health and safety department, the database the security officers use to log events they experience, and patient electronic health records. The first data obtained were the MCPO injury events from the hospital's occupational health and wellness and safety departments. All security personnel injury reports that occurred from December 1st, 2010 to November 30th, 2011 were included; the occupational health nursing notes and injury descriptions were abstracted. After injury reports were obtained, the security officer database was reviewed to find security officer narratives of incidents where an officer was injured. Date, time, and location of the event were abstracted from the database as well as the officers' narrative notes, which included information on the use of tools of law enforcement. The involved patients' charts were then reviewed to retrieve information on the patients' diagnoses, healthcare

provider perspectives on the violent events, and information on whether patients were injured in the events.

Control data collection

Control events for this study were defined as physically violent incidents involving MCPOs and either patients or visitors. The security database was reviewed beginning December 1st, 2010 and included a pre-determined maximum of 300 incidents involving physically violent individuals; the 300th incident occurred on June 14th, 2011. In order to find the control events, all patient support events and events that involved ejecting visitors were reviewed, as these were the types of events where injuries to officers occurred. There were between 50 and 200 patient support events on each day and on average one visitor eject event every third or fourth day. Events were determined to meet inclusion criteria if the text of the event included words indicating the security officers were dealing with a violent individual, such as: combative, uncooperative, fighting, swinging. On occasion a given patient was described in security officer notes as being cooperative, but the interventions described by the security officer did match those used for a cooperative individual, for example, four-point restraining a patient. In these cases, the electronic health record was used as the primary method to determine if a patient was being violent in the presence of security officers. Instances where individuals physically threatened officers, but were unable to actually attack were included. Events where a patient or visitor was being physically violent before the arrival of security officers, but not violent in their presence, were excluded. Again, the electronic health records of the involved patients were used to obtain information about the diagnoses of the involved

patients, healthcare providers' perspectives on the incidents, and to determine if any injuries to the patients occurred.

Analysis

The objective of the qualitative analysis was to provide an understanding of the experience of the security officers in their dealings with violent individuals in the hospital. The objective of the quantitative analysis is to describe the injuries to these MCPOs in terms of rates, locations of incidents, and timing of the incidents, and make comparisons between events where a security officer sustained a reported injury (cases) and those events where no injury to security officers occurred or was not reported (controls). Using a mixed methods approach, where both qualitative and quantitative analyses are undertaken, provides a more robust and complete picture of the study phenomenon (Doyle, Brady, & Byrne, 2009; Johnson, Onwuegbuzie, & Turner, 2007; Denscombe, 2008)

Qualitative analysis

The 317 MCPO narratives provided the qualitative data for this study. The notes were thoroughly reviewed several times to gain a sense of the overall themes and experiences of the MPCOs. The individual narratives were then categorized according to the most prominent theme in each narrative. While many of the narratives overlapped thematically, the decision was made to keep each narrative intact rather than cut the narratives down to individual components to be grouped, to retain the context of each narrative.

Quantitative analysis

The quantitative data comprised the location of the events, time, reported injuries to security officers, unreported injuries to security officers, injury to patient, use of tools of law enforcement (TASERs, handcuffs, pepper spray, and baton), and patient diagnosis type. There were a total of 19 injuries reported to the employee health department; two of which are excluded from most analyses, as they lack information other than a description of the type of injury, one of the two was a sprained knee likely due to a fall and the other was a sprained hand/fingers that was likely due to a violent occurrence with an individual. Of the 17 remaining injuries reported all were the direct result of conflict with a violent patient or visitor. Three hundred violent incidents that were of a similar nature to the 17 injury events were the control events for analysis, yielding a 1:18 case to control ratio. Chi-square tests and Fisher's Exact Tests were performed to compare the locations of where the cases and controls occurred within the hospital.

Qualitative Results

Three main categories of themes emerged from the MCPO narratives: themes of protection, themes of threat, and perceived causes of patient and visitor aggression. In the narratives that follow, "***" is meant to represent the name of a staff member and "+++" represents the name of a patient or visitor.

Themes of protection

Much of what the officers are called on duty to do is to protect. In regards to the agitated and violent patient, most of this protection is for the health care team; 33 of the 317 violent events in this study involved protecting other staff members. Often the officers were called in response to a violent occurrence that has already taken place and

were only able to contain the individual from attacking staff any further.

> *SOC was informed that a patient had pinned a Nurse in Special Care #5. Officers ***, *** and myself ran to Special Care. On arrival to Special Care, we found patient +++ standing in the back hall, dressed in only her underpants & swearing at staff. We attempted to engage her verbally but she only swore at us in return. Myself and *** took an arm each and escorted patient +++ to Special Care #4 - where we placed her in four point restraints. After patient +++ was safely restrained I talked with RN *** - she had a cut/scratch to her forehead and she looked disheveled. *** informed me that she had been struck by patient +++ and that the patient had also grabbed her hair and kept hold of it while she struck & scratched her. I prepared a citizen's arrest form for RN *** and a trespass notice. When police arrived they interviewed RN *** and other members of staff. Officer *** then informed me that they did not need the citizen's arrest form as this was a felony assault. As they continued to work with staff on getting patient +++ cleared for jail, I read the trespass notice to patient +++. While I was reading she spat at me and some of her spittle landed on my left cheek & eye. I was treated for exposure.*

Other times, security personnel are called to control the escalating individual before a staff member is attacked.

> *Assist nursing staff with an agitated patient that was threatening to staff. Staff requested that the patient be placed back in holding room 4 and two point restrained. Officer *** and myself began to restrain +++ when he attempted to*

get off the cart and strike me with a closed fist. +++ was then four point restrained while fighting with security attempting to bite and punch. I sustained minor abrasion on my right forearm.

The officers are also called on to protect other patients as well as to help keep patients from hurting themselves.

Placed patient in 5 point restraints and stood by for meds per nurses request, RN was present. The patient had been found in the restroom inside of her room attempting to cut her wrists with the metal cap from a make-up pen.

*The patient actively resisted and at one point spit in Officer ***'s face. The patient was restrained, medicated by staff, and we then cleared without further incident.*

In fact the most common statement throughout the 317 narratives was that a given patient was being placed in restraints at the direction of the medical staff to ensure the safety of both patients and staff.

Themes of threat

Many of the narratives included references to patients directly threatening, being abusive, and attacking staff members.

*I spoke with mental health worker [MHW] *** regarding what happened. He said it started over the patient being upset over some cigarettes. The patient, Mr. +++, was yelling at MHW *** saying ""Fuck you, I will fuck you up"". At that point MHW *** walked from behind the desk over to where the patient was standing, in front of Acute Psychiatric Services [APS] Room #3. MHW *** continues talking*

*with the patient, trying to figure out what is going on. MHW *** then told me the patient continued being verbally abusive towards him and then got into a fighting stance. MHW **** said the patient then took a swing at him in which MHW *** caught the arm. MHW *** said they then went to the ground as a result. When they were on the ground, the patient continued to try and fight MHW ***. ***, ***, and I arrived soon after.*

*When I arrived, I observed the patient being cooperative with security but still being verbally abusive towards MHW ***. The patient was laying on the ground with a wound on the back of his head. There was also blood drops on the floor from the altercation.*

In cases such as these, it appeared the presence of security helped calm a situation down and patients become more cooperative. On other occasions, the presence of security provoked a given individual into becoming more violent or aggressive.

*On the night of 1-1-10 at 3:40am I, Officer ***, Officer *** and Officer ***, arrived to CT and was told the patient was in the restroom. We went down the hall to the restroom. The male came out of the restroom and started yelling at the staff and was upset that we were called. We walked back to the CT room and the patient was getting back into the bed, still yelling at the staff. I then told the patient that he needed to calm down. The patient said no. I said yes he did. The patient then stood by and launched himself at me, upset and ready to fight. I then pushed the patient back into the bed and Officer *** and *** grabbed his arms. The patient was trying to kick me and pull away still yelling and very upset. We*

called for more officers and restraints. We placed the patient into four point restraint, with the staff and doctor nearby. The patient was medicated and brought back to ED 1. No injuries occurred. Clear call.

While security officers were often responding to protect staff who felt threatened by a given patient, the security guards themselves sometimes then became the target of the threat.

*New arrival Special care patient was brought in (by) local Police in handcuffs. He was making threats to Officer *** stating she better not touch him or he was going to shoot her. He called me a Spik many times over. He also made threats to kill me as soon as he was released from the hospital.*

Causes of aggression

The officer reports also assisted with understanding the reasons some patients felt provoked to become aggressively violent. Many patients appeared to feel confined and reacted negatively to being kept in the hospital against their will.

*On 5/15/11 at approximately 02:00 I officer *** along with Officer *** responded to ED 2 for a patient standby. Upon our arrival medical staff was speaking with patient +++ who wanted to leave the hospital against medical advice. Medical staff advised myself *** and Officer *** that the patient was brought in by paramedics for a cut on his right hand and was under the influence of alcohol.*

Patient +++ was very agitated and failed to comply with direction given by medical staff while consistently threatening to call his lawyer.

*For patient safety, medical staff had decided to administer medication to patient. Once medication was administered the patient stood up and made an attempt to run through staff and elope the Emergency Department room. Officer *** and myself *** gained control of the patient and directed him back onto his bed before medical staff directed us to place patient +++ in four point restraints. As Officer *** placed the first restraint on the left leg, the patient kicked his leg in attempt to strike Officer *** in the chest. I officer *** then gained control of both of the patients arms while Officer *** controlled both legs and applied the restraints.*

Conversely, the critical moment where a patient or visitor becomes violent sometimes happened while he or she was being escorted out by security and was in defiance of leaving.

*Mr. +++ was in ED 2 and was refusing to leave per staff nurse at time of arrival. We Officer *** and I were told to escort Mr. +++ out of hospital premises. Mr. +++ walked with us without any problems until we arrived to triage, that's when he stopped and said, "Call the fucken Police? I am not going anywhere." We told him sir you need to leave so walk out with us. He refused to move and again repeated his words "Call the fucken Police?" I asked him again to walk with us, he refused again and was standing at a firm position. I took hold of his right hand to try and walk him out he pulled away and kicked Officer *** and struck him on the right side of his face. We then assisted him down to the ground where he continued to resist and refused to listen to verbal commands on placing his hands*

behind his back.

The third most common reason a given patient escalated into a violent act was in reaction to hospital protocols. When new patients with injuries came into the emergency department, they were asked to disrobe from their street clothes and put on a hospital gown. They were also often searched for dangerous items if they arrived to the ED intoxicated or were being transferred to the acute psychiatric ward. If a given patient arrived at the ED and was heavily intoxicated, he or she was usually restrained in an attempt to prevent that person from falling off of the hospital gurney or bed.

*Assisted medical staff with the new arrival that went into S/C #1. The patient was cooperative in getting into a gown. When he was in a gown, the patient was not cooperative in getting into the bed. He tried to take a swing with his right hand at me when I was informing him to get into the bed. *** took control of his right hand, as I did his left. We placed him onto the bed. I controlled the right and left hand as *** placed the restraint on the patient's right leg. *** arrived and placed the restraint on the patients left arm as I controlled both arms. The patient was then searched. Nurse was present for the call. Cleared call.*

Quantitative Results

Locations of events

While violent incidents can and do happen throughout the hospital system, there are areas where violent incidents are more likely to occur. Locations where events occurred were grouped according to their relation with one another (Table 1). Emergency services included stabilization rooms, “Special Care” where heavily intoxicated individuals are

managed, emergency team centers, entrances to the hospital, triage, and the emergency radiology department. Psychiatric services included the psychiatric intensive care units, other psychiatric inpatient areas, and acute psychiatric services. The medical surgical and ICU included all inpatient medical and surgical areas, including pediatrics. The final category included one event that occurred in the post-anesthesia care unit and two events where the location was not specified.

For both cases and controls, the majority of violent incidents took place in the emergency department and in psychiatric service areas. Case events were equally likely to occur in the emergency department as the psychiatric services; however, more of the control events occurred in the emergency department. There were relatively few violent events in the adult medical surgical areas, though the majority of hospital patients are located at any time in these areas; there are 271 inpatient hospital beds in the adult medical surgical areas versus 102 inpatient psychiatric beds.

Timing of events

To examine the timing of violent incidents for trends, the times of incidents and MPCO injuries were categorized into one hour increments (Figure 1). All of the violent incidents that involved a reported injury to a security officer took place between 12pm and 4am, with 76% of those occurring between 8pm and 4am. While there was a more even distribution of violent incidents overall, 60% of all violent incidents occurred in the 8 hours between 8pm and 4am, with a fairly steady rise in violent events beginning at 3pm and ending at 4am.

Differences between reported injuries and non-reported injuries

The MPCO narratives were also examined for instances where a security officer appeared to sustain an injury that was not reported to the occupational health department. These were determined to be injuries if they were described as such in the narratives. For instance, one MCPO described straining his back during an altercation with a violent patient and did not report it, presumably it went unreported as the officer described his back pain to improve over the course of the shift. Another officer's arm was injured to the point that the police officers who came to arrest the individual photographed the MCPO's arm as evidence, but the officer neglected to report this to the occupational health department. A comparison between injuries that were reported to the employee health department and those that weren't is displayed in Table 2. A statistical analysis was not completed to compare these two groups, as the 19 injuries that were reported to the hospital's occupational health department occurred over the course of 12 months versus the 6.5 months in which the 19 injuries that went unreported occurred.

Most of the body fluid exposures (BFE) were from a patient or visitor spitting into the MPCOs face and/or eyes. Of the reported BFEs, four of them were spit in the officers' eyes, whereas five of the BFEs among the non-reported injuries were spit to the face and it is unclear if the sputum made contact with mucous membranes or eyes. While 5 of the 19 (26%) patients or visitors involved in altercations with security resulting in a reported injury had a primary presenting diagnosis of drug and/or alcohol intoxication, 14 of the 19 (74%) patients or visitors incurring the non-reported injuries had a presenting diagnosis of intoxication. The following MPCO quote is not from one of the nineteen unreported injuries in Table 2, but it gives some indication as to why many

of these injuries may have gone unreported: “As he was on his right side, the patient started to kick, hitting me in the right side of my torso. Again, because of the patient's intoxication, the kick was not strong or coordinated.”

Tools of law enforcement and patient injuries

In the 317 recorded events of security officers interacting with violent individuals, there were 11 incidents when security officers used a tool of law enforcement. Five of those incidents resulted in an injury to a security officer (Table 2). During the 11 conflicts involving tools of law enforcement, there were 4 instances where a patient was injured, as ascertained from the medical record. One patient had a reddened puncture wound from being TASERed, one patient suffered a dislocated shoulder from handcuff application, one patient’s previously incurred lip laceration worsened through the interaction with security, and one patient developed a small wrist laceration from fighting against the handcuffs. In total, there were 11 incidents where a patient was injured out of the 317 (3.5%) violent events. The most severe injury was the dislocated shoulder; all other injuries required minimal medical intervention, such as the application of gauze and tape.

Discussion

Security officer play a key role in protecting patients, healthcare providers, and visitors from aggressive and violent individuals in the hospital setting. The narrative reports described in this study help gain some understanding of the relationship between these security officers and the violent individuals with which they deal.

Security officers often place themselves in harm’s way in order to provide protection to others in the hospital setting. As derived from the security officer narratives,

officers are called both before a violent event has occurred, and are thus able to manage the situation to prevent an injury from occurring, and after an injury has occurred. In both instances, the officers appeared to be able to help prevent further injuries. There were times when the security officers described their presence as provoking individuals to violent behaviors as well as times where the presence of the security officers helped to de-escalate an individual. The most common intervention seen in these reports was of the security officers restraining individuals to keep them from harming others. However, some of the violent behaviors described by the security officers appeared to be a direct consequence of these and other interventions, such as searching and disrobing individuals. It is unclear from these reports whether there is a definitive guideline as to which individuals should be restrained for their and others' protection, and which individuals should only be further monitored. Further research on the efficacy of restraining potentially violent hospital patients to prevent injuries to other patients and staff is indicated.

In this study period at the case hospital, there was an average of two violent incidents per day in which security officers were called to intervene. The narrative notes describe ways in which the security officers receive physical threats and verbal abuse on a daily basis. While often these threats do not culminate in physical violence, serious personal threats can have lasting effects on victims of such threats (McCaslin, Rogers, Metzler, Best, Weiss, et al., 2006). These threats and other forms of non-physical violence may cause more lasting harm to the individuals suffering such violence than those who are victims of physical violence (Gerberich, Church, McGovern, Hansen,

Nachreiner, et al., 2004).

The 30 security officers at the case hospital reported 19 injuries over the course of the 12 months of this study; 18 of which were due to an interaction with a violent individual. There were a further 19 suspected injuries over the course of 6.5 months study of the control events. Many of the reported and unreported injuries were exposures to blood or body fluid, with most of those being spit in the eyes. While the risk of HIV, HBV, or HCV infection via contact with mucosa such as the eyes is almost negligible, other pathogens splashed to the eye may be of greater concern (Tarantola, Abiteboul, & Rachline, 2006). Herpes simplex virus type I is a very common oral pathogen, infecting up to 90% of the population by age 60, and can cause keratitis, an ocular infection that results in ulceration of the eye and blurred vision in severe cases (Lewis, 2004). Thus while the risk of common bloodborne infections from saliva to the eye is rare, these workers are at a risk for other infections from being spit at in the face and eyes by hospital patients.

There are a few ways this study can help hospitals when planning policies and procedures for an internal security department, especially in regards to staffing levels based on time of day and patrol areas. Most of the events occurred nocturnally, with a rise in violent events beginning at 4pm and ending at 4am. Often there is a greater number of back up professionals for the security officers to rely on, such as supervisors, trainers, and manager during the normal business hours and it may therefore be helpful to schedule more security officers on the off shifts to help contain these violent behaviors. Similar to other research on violence in healthcare (e.g., Arnetz, Aranyos, Ager, & Upfal,

2011; Colling & York, 2009; Findorff, McGovern, Wall, Gerberich, & Alexander, 2004) most of the events occurred in the ED and the psychiatric services areas. Thus determinations of where security professionals are located within the medical center can be strategically planned relative to the locations of reported violence incidents so that response times can be minimized, and violence can be more rapidly contained.

The potential limitations to this study are related to the size of this study. As the study was carried out at only one medical center with one set of policies and procedures for security officers, it is unclear how well the experiences of the officers at this case hospital relate to those of officers at other facilities. In addition, statistical analyses were only carried out on one set of variables due to a deficit of data. It is also difficult to determine whether the use of tools of law enforcement are protective or harmful in any way without a comparison group. In the case events versus the control events, presumably only the most severe events would require the use of handcuffs or TASERs, and thus inherent bias would be introduced in any statistical comparisons between events that included the use of such tools and those that did not.

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Table 1. Locations of violent incidents			
Location	Case Events (*n*=17)	Control Events (*n*=300)	Fisher's Exact Test *p*-value
Emergency Services*	8 (47%)	201 (67%)	0.0797
Psychiatric Services*	8 (47%)	76 (25%)	0.0503
Medical Surgical and ICU	1 (6%)	20 (7%)	0.6874
Other	-	3 (1%)	0.8471
Total	17 (100%)	300 (100%)	
*Statistically significant difference in Chi square analysis at $p<0.05$ in comparing event occurring in location vs. not.			

Figure 1. Injuries to hospital security officers and violent incidents by hour of the day

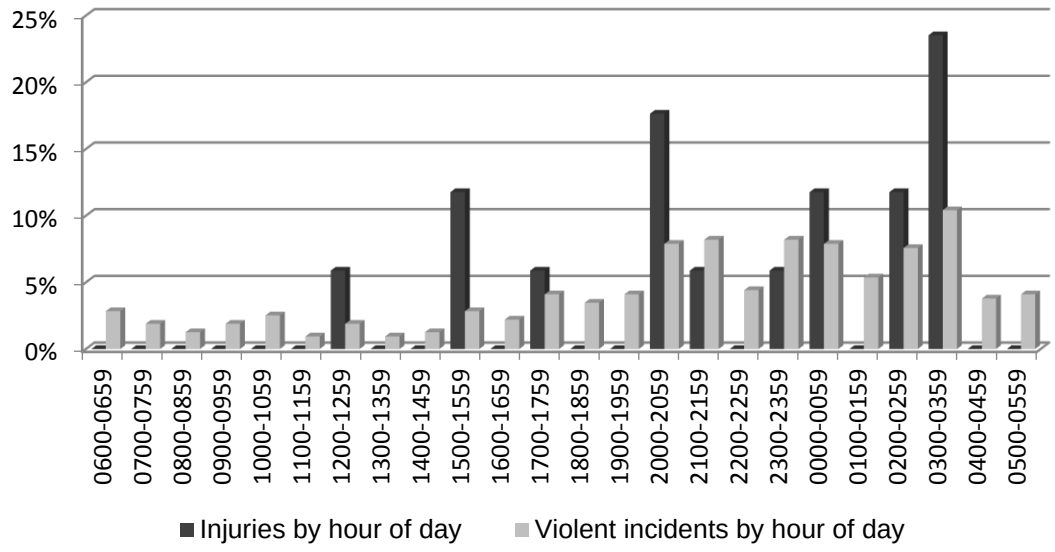

Table 2. Differences between reported and unreported injury incidents		
Variable of interest	**Reported injuries to hospital security officers (*n*=19)[1]**	**Non-reported injuries to hospital security officers (*n*=19)[2]**
Type of Injury[1] [2] a. BFE b. Strain/sprain c. Laceration d. Bruise/contusion	 a. 6 b. 6 c. 3 d. 4	 a. 6 b. 2 c. 5 d. 6
Injury to patient[3]	3 (puncture wound from TASER, lip laceration, laceration to finger)	2 (dislocated shoulder, scratch to nose)
Primary presenting diagnosis of patient[3] a. Intoxication b. Psychiatric c. Medical d. Visitor e. No info	 a. 5 b. 8 c. 3 d. 1 e. 2	 a. 14 b. 2 c. 2 d. 0 e. 1
Tool of Law enforcement used[2]	3 (TASER used twice, TASER pulled once)	2 (handcuffs)
Data sources: [1]From occupational health department, [2]From security officer report, [3]From patient electronic health record		

Chapter V

Effectiveness of Conducted Electrical Weapons to Prevent Violence-Related Injuries in the Hospital

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Abstract

Introduction

Healthcare workers suffer high rates of violence-related injuries compared to other industries, with hospital security officers and ED personnel at particularly high risk for injury. Arming hospital security workers with conducted electrical weapons, such as TASERs®, has been suggested as an intervention to decrease violence-related injuries in the hospital.

Methods

A retrospective cohort of all security and ED nursing staff at an urban, level 1 trauma center was identified from human resources data for the time period 4 years prior and 7 years after security workers were armed with conducted electrical weapons. A violence-

related injury rate was calculated as all violence-related injuries incurred by each employee for the numerator and the productive hours worked by each individual during the study period of each model for the denominator.

Results

The hospital employed approximately 30 security staff and 200 nursing staff at any time, with 98 total security officers and 468 nursing staff over the 11 years of study. Security officers' violence-related injury rate was 13 times higher than nursing staff. The risk ratio was 1.0 (95% CI 0.7-1.4) between the 2 examination periods for security officers, with similar results for nurses. However, among security workers the cost of the injuries decreased in the post-implementation period.

Conclusion

Conducted electrical weapon carriage by hospital security staff appear to have limited capacity to decrease overall violence-related injury rates, but may decrease the severity of violence-related injuries. The latter could decrease costs to healthcare organizations as well as morbidity of injured staff.

1 Introduction

Workers in health care had the highest incidence rate of workplace violence-related injuries involving days away from work when compared to all other private industries in 2013 (1). The rate of violence-related injuries resulting in lost workdays per 10,000 workers in the health care and social assistance industry was 16.2 relative to 4.2 for the entire private industry. Within the healthcare sector occupations vary greatly in their risk of workplace violence. Mental health workers and other ancillary staff in psychiatric

health are frequently documented as having high rates of assault as compared to other health care workers (2-5), and the emergency department (ED) has long been recognized as a location in the hospital where nurses and medical doctors are at a higher risk for violent injury relative to other areas of the hospital (2; 6-9).

Hospital safety and security workers are often overlooked in the health care violence-related injury literature. The relatively few studies that do include hospital security workers demonstrate that these workers have some of the highest rates of violence-related injuries within the hospital setting, with anywhere from 2 to 5 times as many injuries as nurses (2; 5; 10-13). However, while there are many investigations of risk factors and interventions to decrease risk for violent injuries among health care staff (6; 7; 14-24), almost no studies were conducted that specifically detail the risk and protective factors for violent injury to hospital security personnel.

One intervention that has been implemented and identified as potentially highly useful to decrease violence-related injuries is the arming of hospital security staff with conducted electrical weapons (CEW), such as TASERs® (25). Ho, et al. found that among hospital security workers, staff injuries decreased from 31 in the pre-implementation year to 20 in the year post-implementation. In addition, the severity of injuries apparently decreased: there were 18 days of lost employee time and 350 days of restricted work in the 12 months preceding, whereas there were 0 days of lost employee time and 16 days of restricted work in the first 12 months after CEW introduction. Some studies of the use of

CEW in criminal justice have found less injuries among both police officers and suspects following the implementation of CEW (26-28), although the risk for less severe injuries to suspects may increase with CEW use (29). In addition, field studies of the use of CEW in law enforcement have not found risk of cardiac death or severe injury with deployment of CEW against suspects (30; 31). However, some suspect deaths have occurred shortly after the use of CEW prompting some to suggest a causal association with CEW (32; 33), though a common pathophysiological course suggesting a causal association in such instances is questionable (34). While the relative safety of CEW use has been questioned, there is no doubt that the increased use of CEWs in healthcare should be accompanied with research into the safety and effectiveness of such strategies (35).

The goals of this current study were to determine if the introduction of CEW carriage by hospital security officers: a) affected the injury rates among the security staff in the seven years after their introduction, and b) affected the injury rates among the ED nursing staff in the seven years after their introduction. In addition, other factors related to injuries to security staff were explored, including the severity of injury, demographic factors associated with violence-related injuries to security staff, and organizational factors that may influence the outcome of reported violence-related injuries.

2 Methods

This investigation is a retrospective cohort study of two hospital employee populations: the hospital security staff and nursing staff in the ED in one urban hospital from January

1, 2004 to December 31, 2014. The hospital is a Level 1 Trauma Center located in the metropolitan core of a Midwestern city. The hospital has 472 beds, 102 of which are designated for psychiatric patients. On average, 335 of all beds were occupied daily by patients in 2014. The ED, including urgent care, had 109,809 visits that same year.

The study is based on several hospital data sources: demographic data and productive hours worked were obtained from the county's human resources departments, which until 2007 had retained direct control over the hospital, and from the hospital's human resources department from 2007 forward. Specific dates of initiation of CEW carriage were obtained from the security department, injury data from the hospital's workers' compensation administrator, and injury details from the hospital's occupational health department. From 2004 until March of 2007, the hours worked by each employee were available in a biweekly (pay period) format, whereas the hours worked from March 2007 until December 2014 were the hours contributed by each individual on a given day. The injury data received from the hospital's workers' compensation administrator did not include information as to whether a given injury was violence-related. The occupational health record of each injury was reviewed by the author (*initials*) and if the text of the narrative included language that the employee was bit, hit, kicked, slapped, pushed, elbowed, scratched, spit upon, punched, and/or injured during the restraint process of an uncooperative patient, the injury was determined to be violence-related. Finally, the workers' compensation administrator supplied data on the total cost of each injury to the organization (medical and indemnity costs).

The research was approved by the institutional review boards at the study hospital and the researchers' university. Funding for this research was provided by the Midwest Center for Occupational Health and Safety-Education and Research Center Pilot Research Training Program, OH008434, funded by the National Institute for Occupational Safety and Health.

2.1 Study population

There are approximately 30 full-time security officers employed at any one time at the hospital and over 200 nursing staff employed in the ED. Over the course of the 11- year study period, 98 security officers contributed 452,901 hours, 265 registered nurses from the ED contributed 1,535,044 hours, and 203 health care assistants contributed 624,805 hours. The health care assistants and registered nurses are grouped together as nursing staff for the purposes of the analyses. Demographic information on the study participants are included in Table 1.

Table 1. Demographics of Subjects

Occupational group	Total	Female n (%)	Male n (%)	Median age at observation (Range: Quartile 1, Quartile 4)	Median experience level (years) at observation (Range: Quartile1, Quartile4)
Security Personnel	98	13 (13)	85 (87)	38 (21-31, 44-61)	7 (0-2, 14-33)
Registered Nurses	265	210 (79)	55 (21)	44 (23-36, 51-69)	7 (0-3, 13-34)
Health Care Assistants	203	121 (60)	82 (40)	30 (18-26, 40-64)	2 (0-1, 7-21)
Nursing Staff	468	331 (71)	137 (29)	40 (18-31, 49-69)	5 (0-2, 11-34)

2.2 Theory

The Haddon Matrix was used as a theoretical model for the research. Commonly applied in public health as a tool to understand the origins of injuries and to identify prevention strategies, the Haddon Matrix displays the timeline of an injury event: pre-event, during event, and after event by the intervention targets: host, agent, physical environment, and social norms (36). Figure 1 applies the Haddon Matrix to the problem of violent injuries among security officers and ED nursing staff. In this case, the host is the hospital staff member (i.e., security officer or ED nursing staff), the agent is considered the offending individual (usually a hospital patient) committing the assault, the physical environment is the hospital, and social norms include hospital policies, applicable laws, and societal norms around violence against health care workers. Figure 1 identifies that the implementation of CEW carriage by security officers deters violent injuries to staff via two methods. The introduction of a policy for officers to carry CEW enables potentially violent individuals to see the CEW who then may be less likely to engage in violent behaviors in the pre-event phase, but the CEW may also decrease the severity of some violent events and prevent other persons in the area from being injured. (Additional interventions listed in the Matrix are for illustrative purposes.)

Haddon Matrix Underlined items are ones investigated in this study	**Host** (the healthcare worker who is attacked)	**Agent** (the violent individual- usually the hospital patient)	**Physical Environment** (the hospital location)	**Social norms** (hospital policies, laws, community norms)
Pre-Event (before a violent injury occurs)	Educate staff on de-escalation techniques to prevent violence	Search any new intoxicated or psychiatric patients for weapons Provide services quickly and well so individuals feel cared for	Place security cameras in visible locations Position security booths near 'hotspots' of violence Separate acutely ill psychiatric and intoxicated patients from others	Post hospital policies in regards to violence Educate staff on the need to call security as conditions escalate (change the norm that workers should expect violence to occur) Arm security officers to deter violence (Agent sees CEW-bearing officers and decides not to escalate)
During Event (during the violent interaction)	Educate staff on personal safety techniques that reduce the potential of harm Ongoing education of current best practices in use of force in health care (for security officer Hosts)	Arm security officers with CEW to stop events of severe violence from continuing	Remove items that could be used as weapons from areas for intoxicated and acutely psychiatric patients	Change the organizational culture for staff to feel justified to defend themselves
After Event (after the injury occurs)	Provide post-event counseling and support	Restrain/separate violent individuals When appropriate, debrief with the violent individuals and make a plan for future prevention of escalation	Prioritize injured employees who need medical attention	Call external police forces and press charges when assaults occur Require individuals to report violent incidents Flag violent occurrence in individual's health record to alert future providers

Figure 1. Haddon Matrix of Violence-Related Injuries in the Hospital

2.3 Analytic approach

2.31 Use of the DAGs

To determine how other variables influence the outcome of violence-related injuries and the potentially confounding effects of these variables, directed acyclic diagrams (DAGs) were constructed to aid in the effort of understanding these relationships. DAGs are constructed through a process of identifying the predominant variables that affect the outcome for the subjects of interest. They are especially useful at identifying, in a qualitative sense, the causal structure of the exposure variable to the outcome and its relationship to covariates (37). Figure 2 displays the DAG which provides a conceptual structure of the causal hypothesis of the effect of CEW carriage on violence-related injuries to hospital security workers; the DAG for ED nursing staff is identical.

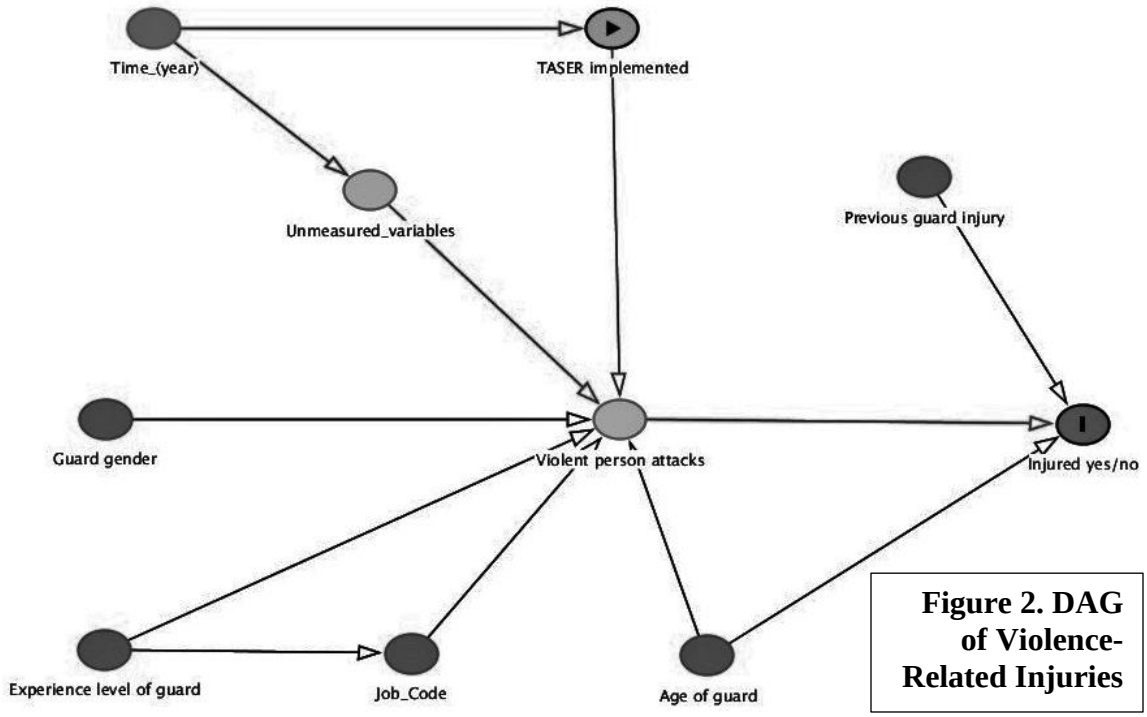


Figure 2. DAG of Violence-Related Injuries

2.32 Descriptive and bivariate analyses

Because there have been no prior investigations into the factors associated with rates of violence-related injuries among hospital security personnel, descriptive and bivariate analyses were completed with available demographic variables, in addition to the hypotheses addressed by the multivariate models. To perform the analyses, a Poisson-like regression was used to compare rates of injuries associated with specific independent variables. The dependent variable is an injury rate where the numerator is violence-related injuries incurred by each employee and the denominator is the productive hours worked by each individual during the study period of each model. A structured correlation matrix was used to account for the correlated observations within subject. As opposed to an unstructured correlation matrix, the assumption regarding the subjects is that there is either constant variance within each subject, as with exchangeable or compound symmetry matrices, or that the variance increases as time progresses, as in an auto-regressive matrix (38). While an unstructured correlation matrix may be justified for any longitudinal logistic analysis that requires within-subject adjustment, each subject and covariate combination requires a new parameterization and greatly increases the error to the point of making results unachievable. The robust variance (empirical) estimate was used, as this accounts for greater or smaller variance in the data than is assumed with Poisson modeling where the variance is the mean (39; 40). SAS 9.4 was used to run all statistical models using PROC GENMOD for comparative analyses.

2.33 Multivariate analyses

As with bivariate analyses for security workers, Poisson-like regression was used to analyze the data for differences in injury rates for the two respective populations, security personnel and nursing personnel, before and after the implementation of CEW carriage by the security personnel. Both of the full models are based on the following general calculation:

$$\log[Injuries_{security\ or\ nursing}] = \beta_0 + \beta_{taser} + \beta_{gender} + \beta_{age} + \beta_{experience} + \beta_{hours}.$$

3 Results

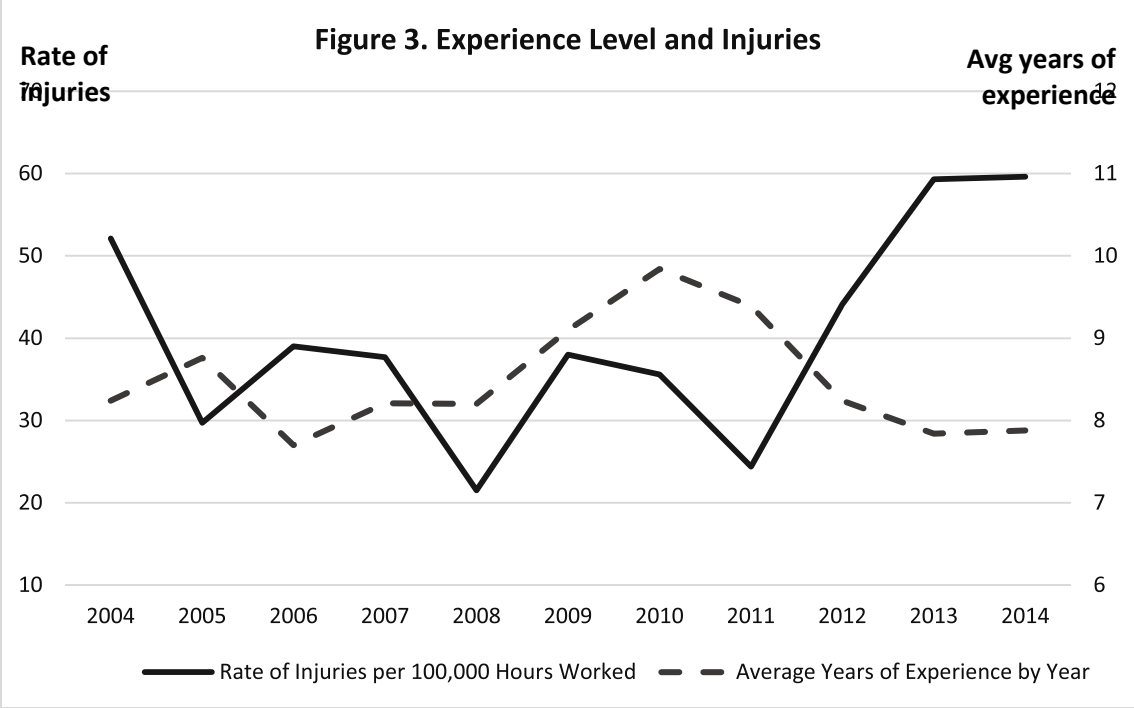
3.1 Descriptive analyses of injuries

3.11 Summary of injuries

There were a total of 279 violence-related injuries among security workers over the 11-year study period, with an annual range of injuries from a high of 41 in 2013 to 14 in 2008. Among ED nursing staff, there were 66 violence-related injuries in the 11 years, with an annual range of injuries from 9 in 2004 to 1 in 2010.

3.12 Trends over the time period of study among security workers

The numbers of security workers' injuries reported to the hospital's worker's compensation administrator varied widely between 2004 and 2014. The highest rate of injuries was 59.6 injuries per 100,000 hours worked in 2014 and the lowest rate was 21.5 injuries per 100,000 hours worked in 2008. The years when the highest numbers of injuries were reported were also years where the average experience level among the security staff were relatively low, as demonstrated in Figure 3.



3.13 Workers' compensation costs of the injuries over time

While severity of injuries is not a part of the multivariate models in this as the information was not explicitly available, it is relevant to examine the injury-specific worker's compensation costs to the organization as a surrogate for severity. Table 2 reveals a wide variation in the costs of worker's compensation claims from year to year with single injuries driving most of the costs in years where there was a high cost (41). For instance, in 2007, the most expensive year to the organization in terms of worker's compensation costs for violence-related injuries to security officers, 95% of the total costs were from two injuries, with 80% of the total cost to the organization coming from one injury.

Table 2. Worker's Compensation Costs for Security by Year				
Year	**Number of injuries**	**Workers' compensation costs**	**Adjusted to 2014 dollars (41)**	**Costliest injury (2014 dollars)**
2004	31	$ 67,836.86	$ 85,015.49	$ 71,282.63
2005	17	$ 3,911.16	$ 4,740.97	$ 961.10
2006	24	$ 6,419.15	$ 7,537.92	$ 1,929.25
2007	25	$ 98,766.14	$112,767.80	$ 90,508.21
2008	14	$ 2,278.09	$ 2,504.87	$ 441.37
2009	24	$ 8,964.71	$ 9,892.32	$ 2,574.96
2010	22	$ 35,222.48	$ 38,239.85	$ 23,332.66
2011	16	$ 4,724.57	$ 4,972.35	$ 623.30
2012	30	$ 35,850.63	$ 36,965.84	$ 17,685.64
2013	41	$ 30,204.70	$ 30,694.68	$ 6,428.70
2014	34	$ 20,497.78	$ 20,497.78	$ 4,302.92

3.2 Bivariate analyses of demographic variables among security workers

Bivariate analyses of the demographic variables for the security workers demonstrate significantly correlated associations. Table 3 demonstrates that security staff who have more years of experience have lower rates of violence-related injuries than the staff with fewer years of experience.

Table 3. Analysis of Experience Level and Risk for Injury to Security						
Years of experience	**Rate of injuries per 100,000 hours worked**	**Rate ratio as compared to 14-33 (reference category)**	**Mean 95% confidence limits**		**Chi-Square**	**Probability of Chi-Square test statistic**
0-1	54.9	2.3	1.5	3.5	15.19	<.0001
2-6	51.4	2.2	1.4	3.2	14.07	0.0002
7-13	29.2	1.2	0.8	2.0	0.73	0.3934
14-33	23.7	1	---	---	---	---

Similarly, Table 4 reveals that the youngest quartile of security staff are at a much higher risk of violence-related injury when compared to older security staff.

Table 4. Analysis of Age Group and Risk for Injury to Security						
Age (years)	**Rate of injuries per 100,000 hours worked**	**Rate ratio as compared to 44-61 (reference category)**	**Mean 95% confidence limits**		**Chi-Square**	**Probability of Chi-Square test statistic**
21-30	69.8	2.7	1.6	4.6	13.04	0.0003
31-37	40.1	1.5	0.9	2.5	2.78	0.0956
38-43	27.8	1.1	0.6	1.9	0.04	0.8338
44-61	26.1	1	---	---	---	---

However, when comparing male and female security staff in Table 5, no significant difference was found.

Table 5. Analysis of Gender and Risk for Injury to Security						
Gender	**Rate of injuries per 100,000 hours worked**	**Rate ratio of male to female**	**Mean 95% confidence limits**		**Chi-Square**	**Probability of Chi-Square test statistic**
Female	35.2	1.1553	0.8	1.8	0.44	0.5063
Male	40.7	-	-	-	-	-

3.3 Full model results by occupational group

From the start of the study period, January 1, 2004, until the implementation of CEW carriage by security officers (December 28, 2007), the rate of violence-related injuries among security officers was 39.9 injuries per 100,000 hours worked. In the post-implementation period (December 29, 2007 to December 31, 2014), the rate of violence-related injuries was 40.2 injuries per 100,000 hours worked. The violence-related injury rate for ED nursing staff in the pre-implementation phase was 3.3 injuries per 100,000 hours worked, and the injury rate in the 7 years of investigation the security officers were armed with CEW was 2.9 injuries per 100,000 hours worked. Results from the full models are in Tables 6 and 7.

Table 6. Full Multivariate Analysis for Security Workers						
Security Officers	**Comparison**	**Rate ratio**	**Mean 95% confidence limits**		**Chi-Square**	**Probability of Chi-Square test statistic**
CEW implementation	Post-CEW v. Pre-CEW	1.0	0.7	1.4	0.02	0.8995
Years of experience at observation	0-1 vs. 14-33	1.4	0.6	3.0	0.68	0.4103
	2-6 vs. 14-33	1.5	0.7	3.2	1.11	0.2923
	7-13 vs. 14-33	1.1	0.6	2.0	0.08	0.7799
Age at observation	21-30 vs. 44-61	2.0	0.9	4.6	2.82	0.0932
	31-37 vs. 44-61	1.3	0.6	2.7	0.40	0.5289
	38-43 vs. 44-61	0.9	0.5	1.7	0.04	0.8338
Gender	M vs. F	1.2	0.8	1.9	0.99	0.3207

Table 7. Full Multivariate Analysis for Nursing Staff						
Nursing Staff	**Comparison**	**Rate ratio**	**Mean 95% confidence limits**		**Chi-Square**	**Probability of Chi-Square test statistic**
CEW implementation	Post-CEW v. Pre-CEW	0.9	0.5	1.6	0.10	0.7515
Years of experience at observation	0-1 v. 11-34	2.0	0.9	4.2	3.09	0.0789
	2-4 v. 11-34	1.3	0.6	2.6	0.54	0.4632
	5-10 v. 11-34	0.8	0.4	1.7	0.34	0.5625
Age at observation	18-30 v. 49-69	1.2	0.5	2.8	0.16	0.6894
	31-39 v. 49-69	1.2	0.6	2.5	0.25	0.6176
	40-48 v. 49-69	0.8	0.4	1.8	0.19	0.6652
Occupation	HCA v. RN	1.0	0.5	1.7	0.01	0.9095
Gender	M v. F	1.0	0.6	1.8	0.03	0.8604

4 Discussion

The study findings did not demonstrate a significant difference in the rates of violence-related injuries among either security officers or ED nursing staff by time period before implementation of a policy for security officers to carry CEW as compared to after. While there was a decrease in the year post-implementation, the decrease was not sustained throughout the time period when the security officers carried CEW. The rate was essentially unchanged for both security officers and nursing staff. This was especially so for the security workers who had a rate in the first four years of the study of 39.9/100,000 hours worked compared to 40.2/100,000 hours worked in the seven years following implementation. The lack of a meaningful difference in injury rates may relate to changes in the hospital's social norms. Beginning in 2013, the department leads began to strongly encourage all staff to report all injuries. This practice was evident when examining study findings from model estimates excluding data from 2013 and 2014, when there were possibly inflated numbers of injuries as compared to other years due to increased reporting. The results of a regression excluding these two years indicated a slight, non-significant decrease in the rate of injuries among security workers in the post-implementation phase (results not shown).

Though the injury rates were not found to decrease with this study's populations, the burden of severe injury among security officers appears to decrease after officers began

carrying CEW, as indicated by the lack of high-cost injuries related to violence among security workers in the seven years' post-deployment as compared to the four years prior. This was substantiated by the hospital's director of security who reported that the hospital security staff had not experienced the life-changing injury events previously in the years before staff carried CEW. Using CEW in a conflict situation may impede the aggressor from being able to severely harm security officers, and potentially, other staff when major conflicts arise, though it may not impede the aggressive act from occurring in the first place. As found in other studies of violence-related injuries in healthcare, this investigation demonstrates higher rates of injuries among hospital security staff as compared to other hospital staff. However, the degree to which the security staff are injured as compared to ED nursing staff is startlingly high; security staff had a violence-related injury rate approximately 13 times higher than the violence-related injury rate for ED nursing staff in this study. The next highest difference found in the literature between nursing staff and security was approximately 5 times higher (13); other investigations found security workers to have rates approximately 2 to 3 times higher (2; 5; 10-12). It is unclear why the relative rates of violence-related injuries between security officers and ED nursing staff is greater in this study relative to other studies. It may be that security officers are more likely to intervene early at the study hospital when hospital patients become aggressive as compared to facilities in other investigations. Further study would be required to assess whether there are commensurate decreases in violence-related injuries among other hospital staff when there are increases of violence-related injuries among hospital security workers, though facilities that lack a security infrastructure have

been shown to have higher rates of violence-related injuries (42).

This is the first study analyzing the demographic features of hospital security workers associated with violence-related workplace injuries. Similar to studies on medical doctors, registered nurses, and ancillary health staff, younger and less experienced security officers have higher rates of violence-related injuries (3; 12; 19; 23; 43; 44). Bivariate analysis of these two variables, age and experience level, demonstrate highly significant correlations with older age and increased experience and decreased risk of violence-related injuries. Results of the multivariate analysis also show a two-fold increase in risk for injury among the youngest age-group security staff as compared to the oldest age group, though the results failed to reach statistical significance at the $p<0.05$ level.

One study that investigated situational risk factors for violent incidents involving hospital security officers found that 92% of all violent incidents that involved security occurred either in psychiatric departments or the ED and 82% of these incidents occurred between 4pm and 4am (45). In most cases, staff with less experience are required to work shifts outside of the normal day shift hours. Because the current study did not include information on which shift each respective worker was working when injured and not, it is not possible to determine whether and how shift work relates to the apparent protective effects of experience level among hospital security workers. Further research in this area is indicated.

Most studies that include an investigation into the gender of the recipients of violence-related injuries in healthcare find that males are more likely to experience these injuries than females (2; 7; 9; 12; 19; 22). This is not always the case and others have found no difference in rates based on the victims' gender (24; 46). In the present study, there was no significant difference in the rates of violence-related injuries among male security workers and female security workers. In addition, there was no difference among nursing staff; the rate of injuries for male nursing staff was 3.1 per 100,000 hours worked, while the rate for female nursing staff was 3.0 per 100,000 hours worked.

4.1 Limitations

One limitation of this study is that job experience may be underestimated for some participants. Employees' experience level was based on information supplied by the human resources department, and only demonstrates the number of years an individual was employed at this institution. Many of the staff may have years of experience in the same field prior to their employment at this hospital.

Another issue is that of omitted variables and the classification of such. There may be differences in reporting of injuries based on omitted variables such as cultural changes within the institution, as suggested by the director of the security department. Over time there has been greater recognition of the problem of violence-related injuries in the hospital setting, with an accompanying understanding that violence directed at the staff

should not be tolerated. This may have increased staff reporting of injuries over time, and artificially raised the injury rates over time and also artificially increased or decreased the association between injuries and other key variables of interest. However, when the analyses were run without the last two years of data, the associations found in the full models remained. Access to the data in the electronic health records for the employee injuries was limited to one author and thus an inter-rater reliability examination as to the determination of whether an injury was violence-related per the established definition could not be accomplished.

Another limitation is that the present study is restricted to one institution and thus may not have the number of subjects needed to detect a difference in risk nor have an external comparison group. However, the advantage to investigating the topic at one institution is that the hours of work, and thus exposure, are available for each individual at a level not easily obtained in a larger multi-site study.

Comparing the time period pre-CEW against post-CEW implementation cannot identify whether any individual event is linked to CEW usage. If an injury is avoided because of a CEW being used, or because the CEW is simply available, there is no record of this non-event. Similarly, there is no data available as to which individual used the CEW and whether that person was injured in a CEW event. While CEW usage is available on an annual basis, no CEW event can be linked to any injury or non-injury event. CEW deployment is rare: there are only 3-5 CEW events at the hospital each year and

conclusions could not be drawn from these low numbers.

5 Conclusion

This is the first study to examine whether carrying conducted electrical weapons, such as the TASER®, affects the violence-related injury rates among hospital staff. Comprehensive analysis of 11 years of data at an urban level 1 trauma center revealed no differences in the rates between the time period before CEW were carried by the hospital's security staff to the time after. However, the severity of injuries may have decreased in that same time period, based on workers' compensation claims.

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Chapter VI

Discussion

The mixed methods study

Security officers play a key role in protecting patients, healthcare providers, and visitors from aggressive and violent individuals in the hospital setting. The narrative reports described in this study help gain some understanding of the relationship between these security officers and the violent individuals with which they deal.

Security officers often place themselves in harm's way in order to provide protection to others in the hospital setting. As derived from the security officer narratives, officers are called both before a violent event has occurred, and are thus able to manage the situation to prevent an injury from occurring, and after an injury has occurred. In both instances, the officers appeared to be able to help prevent further injuries. There were times when the security officers described their presence as provoking individuals to violent behaviors as well as times where the presence of the security officers helped to de-escalate an individual. The most common intervention seen in these reports was of the security officers restraining individuals to keep them from harming others. However, some of the violent behaviors described by the security officers appeared to be a direct consequence of these and other interventions, such as searching and disrobing individuals. It is unclear from these reports whether there is a definitive guideline as to which individuals should be restrained for their and others' protection, and which individuals should only be further monitored. Further research on the efficacy of restraining potentially violent hospital patients to prevent injuries to other patients and

staff is indicated.

Burden of violent events to the security officers. In this study period at the case hospital, there was an average of two violent incidents per day in which security officers were called to intervene. The narrative notes describe ways in which the security officers receive physical threats and verbal abuse on a daily basis. While often these threats do not culminate in physical violence, serious personal threats can have lasting effects on victims of such threats (McCaslin, Rogers, Metzler, Best, Weiss, et al., 2006). These threats and other forms of non-physical violence may cause more lasting harm to the individuals suffering such violence than those who are victims of physical violence (Gerberich, Church, McGovern, Hansen, Nachreiner, et al., 2004).

The 30 security officers at the case hospital reported 19 injuries over the course of the 12 months of this study; 18 of which were due to an interaction with a violent individual. There were a further 19 suspected injuries over the course of 6.5 months study of the control events. Many of the reported and unreported injuries were exposures to blood or body fluid, with most of those being spit in the eyes. While the risk of HIV, HBV, or HCV infection via contact with mucosa such as the eyes is almost negligible, other pathogens splashed to the eye may be of greater concern (Tarantola, Abiteboul, & Rachline, 2006). Herpes simplex virus type I is a very common oral pathogen, infecting up to 90% of the population by age 60, and can cause keratitis, an ocular infection that results in ulceration of the eye and blurred vision in severe cases (Lewis, 2004). Thus while the risk of common bloodborne infections from saliva to the eye is rare, these workers are at a risk for other infections from being spit at in the face and eyes by

hospital patients.

Locations and timing of violent events. There are a few ways this study can help hospitals when planning policies and procedures for an internal security department, especially in regards to staffing levels based on time of day and patrol areas. Most of the events occurred nocturnally, with a rise in violent events beginning at 4pm and ending at 4am. Often there is a greater number of back up professionals for the security officers to rely on, such as supervisors, trainers, and manager during the normal business hours and it may therefore be helpful to schedule more security officers on the off shifts to help contain these violent behaviors. Similar to other research on violence in healthcare (e.g., Arnetz, Aranyos, Ager, & Upfal, 2011; Colling & York, 2009; Findorff, McGovern, Wall, Gerberich, & Alexander, 2004) most of the events occurred in the ED and the psychiatric services areas. Thus, determinations of where security professionals are located within the medical center can be strategically planned relative to the locations of reported violence incidents so that response times can be minimized, and violence can be more rapidly contained.

Limitations. The potential limitations to this study are related to the size of this study. As the study was carried out at only one medical center with one set of policies and procedures for security officers, it is unclear how well the experiences of the officers at this case hospital relate to those of officers at other facilities. In addition, statistical analyses were only carried out on one set of variables due to a deficit of data. It is also difficult to determine whether the use of tools of law enforcement are protective or harmful in any way without a comparison group. In the case events versus the control

events, presumably only the most severe events would require the use of handcuffs or conducted electrical weapons (CEW), and thus inherent bias would be introduced in any statistical comparisons between events that included the use of such tools and those that did not. However, the results of this mixed methods investigation helped prompt the investigation into the capacity of CEW to decrease the number of injuries to the hospital security officers.

The CEW investigation

Full model results. The study findings did not demonstrate a significant difference in the rates of violence-related injuries among either security officers or ED nursing staff by time period before implementation of a policy for security officers to carry CEW as compared to after. While there was a decrease in the year post-implementation, the decrease was not sustained throughout the time period when the security officers carried CEW. The rate was essentially unchanged for both security officers and nursing staff. This was especially so for the security workers who had a rate in the first four years of the study of 39.9/100,000 hours worked compared to 40.2/100,000 hours worked in the seven years following implementation. The lack of a meaningful difference in injury rates may relate to changes in the hospital's social norms. Beginning in 2013, the department leads began to strongly encourage all staff to report all injuries. This practice was evident when examining study findings from model estimates excluding data from 2013 and 2014, when there were possibly inflated numbers of injuries as compared to other years due to increased reporting. The results of a regression excluding these two years indicated

a slight, non-significant decrease in the rate of injuries among security workers in the post-implementation phase (results not shown).

Burden of severe injury among security officers. Though the injury rates were not found to decrease with this study's populations, the burden of severe injury among security officers appears to decrease after officers began carrying CEW, as indicated by the lack of high-cost injuries related to violence among security workers in the seven years' post-deployment as compared to the four years prior. This was substantiated by the hospital's director of security who reported that the hospital security staff had not experienced the life-changing injury events previously in the years before staff carried CEW. Using CEW in a conflict situation may impede the aggressor from being able to severely harm security officers, and potentially, other staff when major conflicts arise, though it may not impede the aggressive act from occurring in the first place.

Comparison of security injuries to nursing injuries. As found in other studies of violence-related injuries in healthcare, this investigation demonstrates higher rates of injuries among hospital security staff as compared to other hospital staff. However, the degree to which the security staff are injured as compared to ED nursing staff is startlingly high; security staff had a violence-related injury rate approximately 13 times higher than the violence-related injury rate for ED nursing staff in this study. The next highest difference found in the literature between nursing staff and security was approximately 5 times higher (Sullivan & Yuan, 1995); other investigations found security workers to have rates approximately 2 to 3 times higher (Arnetz, Aranyos, Ager, & Upfal, 2011; Fernandes et al., 1999; Findorff, McGovern, Wall, & Gerberich, 2005;

Lehmann, McCormick, & Kizer, 1999; Pompeii et al., 2013). It is unclear why the relative rates of violence-related injuries between security officers and ED nursing staff is greater in this study relative to other studies. It may be that security officers are more likely to intervene early at the study hospital when hospital patients become aggressive as compared to facilities in other investigations. Further study would be required to assess whether there are commensurate decreases in violence-related injuries among other hospital staff when there are increases of violence-related injuries among hospital security workers, though facilities that lack a security infrastructure have been shown to have higher rates of violence-related injuries (Blando et al., 2012).

Bivariate analyses for security officers. This is the first study analyzing the demographic features of hospital security workers associated with violence-related workplace injuries. Similar to studies on medical doctors, registered nurses, and ancillary health staff, younger and less experienced security officers have higher rates of violence-related injuries (Behnam, Tillotson, Davis, & Hobbs, 2011; Bensley et al., 1997; Gerberich et al., 2004; Kowalenko, Walters, Khare, Compton, & Michigan College of Emergency Physicians Workplace Violence Task Force, 2005; Pompeii et al., 2013; Privitera, Weisman, Cerulli, Tu, & Groman, 2005). Bivariate analysis of these two variables, age and experience level, demonstrate highly significant correlations with older age and increased experience and decreased risk of violence-related injuries. Results of the multivariate analysis also show a two-fold increase in risk for injury among the youngest age-group security staff as compared to the oldest age group, though the results failed to reach statistical significance at the $p<0.05$ level.

The mixed methods study described above investigated situational risk factors for violent incidents involving hospital security officers found that 92% of all violent incidents that involved security occurred either in psychiatric departments or the ED and 82% of these incidents occurred between 4pm and 4am. In most cases, staff with less experience are required to work shifts outside of the normal day shift hours. Because the current study did not include information on which shift each respective worker was working when injured and not, it is not possible to determine whether and how shift work relates to the apparent protective effects of experience level among hospital security workers. Further research in this area is indicated.

Most studies that include an investigation into the gender of the recipients of violence-related injuries in healthcare find that males are more likely to experience these injuries than females (Arnetz et al., 2011; Estryn-Behar et al., 2008; Gacki-Smith et al., 2010; Gerberich et al., 2004; Pompeii et al., 2013; Shields & Wilkins, 2009). This is not always the case and others have found no difference in rates based on the victims' gender (Flannery, Marks, Laudani, & Walker, 2007; Kowalenko, Gates, Gillespie, Succop, & Mentzel, 2013). In the present study, there was no significant difference in the rates of violence-related injuries among male security workers and female security workers. In addition, there was no difference among nursing staff; the rate of injuries for male nursing staff was 3.1 per 100,000 hours worked, while the rate for female nursing staff was 3.0 per 100,000 hours worked.

Limitations. One limitation of this study is that job experience may be underestimated for some participants. Employees' experience level was based on

information supplied by the human resources department, and only demonstrates the number of years an individual was employed at this institution. Many of the staff may have years of experience in the same field prior to their employment at this hospital. In addition, both experience and age of the subjects were significantly associated with injury rate in independent bivariate models, but when both variables were entered into the full model, neither retained a significant association. Stratified models of both experience level within different age groups and age groups within experience levels were run and are resulted in Appendix I. While the numbers were too small to demonstrate any significant findings, the rate ratios were generally smaller within each stratum than when each variable was independently assessed. However, between each stratum there were dramatic differences in injury rates. For instance, the highest rate of injuries (77.1/100,000 hours worked) were among security officers with 2-6 years of experience and of 21-30 years of age, and the lowest rate of injuries (13.7/100,000 hours worked) among those with 7-13 years of experience and 38-43 years old. On the other hand, workers 31-37 years old had negligible differences in rates between experience levels. While age and experience both appear to generally affect injury rates, there were no workers aged 21-30 in either of the two more-experienced quartiles and this may have helped to decrease the strength of association when both variables were combined.

Another issue is that of omitted variables and the classification of such. There may be differences in reporting of injuries based on omitted variables such as cultural changes within the institution, as suggested by the director of the security department. Over time there has been greater recognition of the problem of violence-related injuries in the

hospital setting, with an accompanying understanding that violence directed at the staff should not be tolerated. This may have increased staff reporting of injuries over time, and artificially raised the injury rates over time and also artificially increased or decreased the association between injuries and other key variables of interest. However, when the analyses were run without the last two years of data, the associations found in the full models remained. Access to the data in the electronic health records for the employee injuries was limited to one author and thus an inter-rater reliability examination as to the determination of whether an injury was violence-related per the established definition could not be accomplished.

Another limitation is that the present study is restricted to one institution and thus may not have the number of subjects needed to detect a difference in risk nor have an external comparison group. However, the advantage to investigating the topic at one institution is that the hours of work, and thus exposure, are available for each individual at a level not easily obtained in a larger multi-site study.

Comparing the time period pre-CEW against post-CEW implementation cannot identify whether any individual event is linked to CEW usage. If an injury is avoided because of a CEW being used, or because the CEW is simply available, there is no record of this non-event. Similarly, there is no data available as to which individual used the CEW and whether that person was injured in a CEW event. While CEW usage is available on an annual basis, no CEW event can be linked to any injury or non-injury event. CEW deployment is rare: there are only 3-5 CEW events at the hospital each year and conclusions could not be drawn from these low numbers.

Conclusion. This is the first study to examine whether carrying conducted electrical weapons, such as the TASER®, affects the violence-related injury rates among hospital staff. Comprehensive analysis of 11 years of data at an urban level 1 trauma center revealed no differences in the rates between the time period before CEW were carried by the hospital's security staff to the time after. However, the severity of injuries may have decreased in that same time period, based on workers' compensation claims.

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Appendix A: Sub-study 1

Examination of ED Nurse Staffing Levels and Their Effect on the Risk of Violence-related Injury to ED Nursing Staff

Background

Over the course of time, hospitals undergo varying levels of pressure to increase productivity and decrease costs. Personnel make up the largest cost to a hospital's budget and hospitals often look to decrease staffing levels to improve financial solvency. Staffing levels and hospital and patient outcomes have long been investigated by researchers, and many studies point to an association between decreasing staffing levels and an increase of adverse events for patients including increased mortality (Aiken, Clarke, Sloane, Sochalski, & Silber, 2002; Needleman et al., 2011), increased falls with injury (Patrician et al., 2011), and an increase in any nurse-sensitive patient adverse event (Martsolf et al., 2014), which includes postoperative respiratory failure, catheter-associated urinary tract infection, central line bloodstream infection, postoperative sepsis, etc. However, the evidence is not unequivocal. In a study of 256,000 hospitalizations at three hospitals in Australia, researchers found little evidence that increased staffing levels or skill mix resulted in decreased patient morbidity or mortality (Schreuders, Bremner, Geelhoed, & Finn, 2015). Likewise, researchers have found little evidence that California's minimum staffing laws and subsequent implementation have significantly decreased hospital-related patient complications (Cook, Gaynor, Stephens, & Taylor, 2012; Spetz, Harless, Herrera, & Mark, 2013).

The relationship between nurse outcomes and staffing ratios has also been examined. Investigators have found increased burnout among nurses working in environments with higher patient-to-staff ratios (Aiken et al., 2010; Gunnarsdottir, Clarke, Rafferty, & Nutbeam, 2009). Decreasing nurse staffing levels per patient may also increase the risk for injury to nursing staff. There have been higher reported incidents of needlestick injury among nursing staff when there are lower levels of staffing (Clarke, Rockett, Sloane, & Aiken, 2002; Patrician et al., 2011). The results of research investigating whether increases in patient to nurse ratios are associated with concomitant increases in violent injury are less clear.

For some, it makes intuitive sense that when there are decreased levels of nursing staff to care for patients there would be increased levels of violence and there is some research to agree with this. In a survey of 18,676 nurses in Canada with a response rate of 79.7%, the odds ratio of being assaulted was 2.3 for nurses who described working in conditions with the lowest levels of staffing as compared to the quartile of nurses working in the highest levels of staffing (Shields & Wilkins, 2009). If there is less staff to care for patients, the patients have to wait longer for care, may not receive the care they desire, and often become frustrated. According to a survey of health care practitioners, hospital staff who were injured in a violent attack reported long wait times as being the most common precipitate to violence (Ayranci, Yenilmez, Balci, & Kaptanoglu, 2006). In a review of violent incidents at a large hospital in the UK, James, Madeley, and Dove (James, Madeley, & Dove, 2006) found that there were increased wait times in 12% of the violent cases in a year, but there was no information on how frequent there were

extended wait times when no violence occurred. Though the authors did not precisely examine wait times, Medley et al. (Medley et al., 2012) found that a higher length of patient stay in the ED was significantly associated with a higher odds of violence among 220,004 ED admissions over the course of 3.5 years. Medley et al. also found a decreased odds for violence with an increased patient-to-nurse ratio on univariate logistic regression, though the odds ratio did not remain significant when entered into multivariate regression which included occupancy rate and patient-to-physician ratio. The authors found the highest odds for violence when the occupancy rates were also high.

However, the assumption that more staff makes for a safer environment in regards to violent injuries has not always held up to scrutiny. Increased staff levels were associated with increased numbers of violent incidents on the unit in a study of 136 acute psych wards in 67 hospitals over two years (Bowers et al., 2009). Consistent findings were also reported in a follow up study, (Papadopoulos, Bowers, Quirk, & Khanom, 2012) which demonstrated the association between violent incidents and increased staffing levels in the work shifts prior to shifts that had high conflict and containment events. Additional evidence was reported by Staggs who found an increased risk of assaults on 351 psychiatric units of hospitals that are part of the National Database of Nursing Quality Indicators (Staggs, 2013). Staggs found an approximately 12% increased risk of assault for every one hour of increased nursing hours per patient among these units. Bowers et al., suggest that the positive association of staffing levels with violent incidents may be a case where high levels of violence cause staff levels to be increased. However, contradictory results were found in a follow up study, (Bowers & Crowder,

2012) which examined staffing levels in successive shifts. Finally, some authors posit that increased nursing levels increases the likelihood of staff interventions with patients when rules are broken or patients become verbally aggressive which then triggers more conflict and subsequent violent incidents (Bowers et al., 2009). Similar findings have been found in the literature on assault injuries to law enforcement officers: a positive association between increased numbers of officers responding to a call and increased odds of an assault injury is well-documented (Covington, Huff-Corzine, & Corzine, 2014; Kaminski & Sorensen, 1995; Wilson & Brewer, 1992). Because of the differences between the patient populations in the ED and psychiatric units, these studies may not be directly comparable to this study.

Method

As with the investigations into the effectiveness of CEW to reduce staff injuries, the primary dependent variable is an injury rate of injuries per productive hours of each subject under study. In this case, the nursing staff comprise the subjects under study and the staffing level of each day is the primary independent variable under study. The productive hours worked, defined as paid time while carrying out the duties of patient care, were available on a daily basis from March of 2007 until the study ended December 31st, 2014. In addition, the hospital went live with an electronic health record of all patient care beginning in March of 2007, which includes each patient admission and discharge to and from the ED during that time period. This allowed for a very specific and exact investigation into the staffing in the ED on a daily basis. Staffing was computed as the total productive nursing hours in a twenty-four-hour period divided by

the total number of discharges from the ED in the same time period. Each day then has a number value of the average hours of nurse staffing for each patient discharge. For the analysis, Poisson-like regression will be used to investigate whether there are different rates of injuries at the different quartiles of staffing levels. The SAS code for the analysis of Sub-study 1 can be found in Appendix F.

Results

Table A.1 includes the results of the multivariate regression for the analysis of differences in injury rates to the ED nursing staff at different quartiles of nursing hours per patient discharge. Indeed, Table A.2 shows the highest rate of injury is associated with the quartile where there were the highest number of nursing hours staffed per patient discharge.

Table A.1 Multivariate results for ED nurse staffing and rate of violence-related injuries to nurse staff

	Comparisons	Mean Ratio Estimate	Mean Confidence Limits		Chi-Square	Pr > ChiSq
Quartiles Nursing Hours per Patient Discharge	<1.58 v. >=1.82	0.7974	0.3453	1.8416	0.28	0.5960
	>=1.58 to <1.69 v. >=1.82	0.9815	0.4568	2.1087	0.00	0.9618
	>=1.69 to <1.82 v. >=1.82	0.7319	0.3105	1.7256	0.51	0.4757
Experience Level	0-1 v. 11-34	1.5845	0.7073	3.5494	1.25	0.2634
	2-4 v. 11-34	0.9736	0.3903	2.4284	0.00	0.9542
	5-10 v. 11-34	0.8451	0.3780	1.8894	0.17	0.6818
Age	18-30 v. 49-69	0.8696	0.2977	2.5399	0.07	0.7983
	31-39 v. 49-69	1.3165	0.5955	2.9105	0.46	0.4970
	40-48 v. 49-69	0.8129	0.3456	1.9124	0.23	0.6351
Nursing Level	HCA v. RN	1.5016	0.7422	3.0380	1.28	0.2581
Race Group	Non-White v. White	0.6560	0.2704	1.5920	0.87	0.3514
Gender	M v. F	1.4074	0.7333	2.7009	1.06	0.3042

Table A.2 Rates of violence-related injuries to ED nursing staff by staffing levels

Nursing Hours per Discharged Patient	Rate of Injuries per 100 FTE
<1.58	4.8
>=1.58 to <1.69	6.2
>=1.69 to <1.82	4.6
v. >=1.82	6.4

Discussion

No risk difference was found for violence-related injuries to the ED nursing staff at different staffing levels over almost 8 years of investigation. Although there were no significant differences overall in any of the variables in the model, certain trends suggest a variation in risk of injury. Healthcare assistants (HCAs), males, and the lowest quartile of experience level were all estimated to be 1.4 times more at risk or greater, which similar to what is found in the literature (Arnetz, Aranyos, Ager, & Upfal, 2011; Estryn-Behar et al., 2008; Findorff, McGovern, Wall, Gerberich, & Alexander, 2004; Gacki-Smith et al., 2010; Kowalenko, Walters, Khare, Compton, & Michigan College of Emergency Physicians Workplace Violence Task Force, 2005; Moylan & Cullinan, 2011; Pompeii et al., 2013; Shields & Wilkins, 2009).

One reason the results did not achieve significance is likely due to the relatively low occurrence of the outcome under study. General acts of violence in the ED have not been documented in any measurable way during this time period, so unfortunately there is only data on the worst outcomes of violence in the ED- actual reports of injuries to the hospital staff. In the mixed-methods study of this population discussed in section A, the security officers reported facing on average at least one violent individual in the ED each day. If this outcome were measured over the entire 7.75 years of this study, an appreciable difference could be found for the rates of violent acts in the ED, rather than just for the rates of actual injuries to the staff. In one investigation in a different ED, the charts of 220,004 patients who visited ED over a 42-month period were examined for evidence that the patients were acting violently, yielding a rate of 1.3 violent incidents per 1,000 patient visits (Medley et al., 2012). A significant relationship was found

between the occupancy rates in the ED and violence perpetrated by patients, but not between violence and nurse/patient staffing.

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Appendix B: Sub-Study 2

Effect of De-escalation Training on ED Nursing Staff Risk of Violence-related Injury

Background

As the risk for violent injuries to hospital staff becomes more recognized in both the public health literature and the population at large, efforts to decrease the risk often include training staff to intervene and de-escalate situations earlier. In 2015, the state of Minnesota recognized the importance of decreasing the rates of violent injuries and the legislature passed a law requiring health care organizations in the state to implement actions to deter violent injuries (State of Minnesota, 2015). Among other items such as developing a response plan to violent actions, tracking violent behaviors, and designating a multidisciplinary committee, health care organizations in Minnesota are now required to have annual training for staff that includes at a minimum the identification of potentially violent situations, a review of the hospital's incident response plan, and the de-escalation of an act of violence.

From the mid-2000's, HCMC has had an annual self-paced learning activity on restraint reduction that included guidance on methods to de-escalate potentially violent situations and efforts to reduce restraint use. In 2010, the hospital's security trainers and psychiatric nursing staff and leaders developed a live training that was intended for all nursing and security staff to attend every other year, with continued use of the self-paced activity in years when a staff member did not go to the live training. The four-hour class included training on identifying one's own triggers in conflicted events, identification of

early escalation behaviors, guidance on de-escalating potentially violent situations, and how to physically protect oneself in the event of a violent event.

The literature demonstrates a wide variety of delivering de-escalation and violence-prevention training, with a concomitant variety of investigation outcomes. In a psychiatric facility in Georgia, a 32-hour training on empathic communication was implemented and investigators examined the differences in several outcomes between the experimental unit and the control unit (Smoot & Gonzales, 1995). The authors found no difference in number of assaults on staff, but a decrease in the number of incidences of both patient restraints and complaints was found. A contrary outcome was found in a study of this type of training delivered to psychiatric staff at facilities in the United Kingdom (Lee, Gray, & Gournay, 2012). These investigators examined the difference in outcomes between psychiatric facilities that used the 'traditional' methods of controlling potentially violent behavior, Control and Restraint, and a newer technique, Strategies in Crisis Intervention and Prevention, which focuses on early intervention and de-escalation. The authors found that patients were more likely to engage in disturbed behavior incidents and have longer lengths of stay in the locations where early intervention and de-escalation was taught via Strategies in Crisis Intervention and Prevention. The authors posit that the group that received training in early intervention were taught the theoretical aspects of crisis intervention, but had less practical training on employing either these methods or safely restraining patients.

Studies also demonstrate that there is potential for these types of interventions to have an effect on the number of violent incidents, but the impact is time-limited.

Fernandes et al. (Fernandes et al., 2002) investigated an intervention similar to one HCMC employed for its staff. The intervention consisted of a 4-hour class on assessment of escalating behaviors, de-escalation techniques, and personal safety practices via didactic lecture, videos of escalating behaviors, interactive role-play, and safety techniques; essentially the same format that HCMC has used. The authors found a decrease of violence experienced or witnessed by staff at 3 months post-intervention, but violent events increased back to baseline at the 6 month survey. Similarly, Gillam (Gillam, 2014) found a decrease in 'code purples,' hospital security team's alert of a violent situation, in the 90 days after higher percentages of staff were trained, but by 150 days no correlation was seen between months with higher number of staff trained and code purples.

Methods

To investigate whether there is a difference in the risk of injury for this population when staff have had de-escalation training, a Poisson-like model will again be employed with the primary dependent variable an injury rate of injuries per productive hours of each nurse under study. The primary independent variable is whether each individual staff member had received de-escalation training; only registered nurses had de-escalation training in the ED, so the health care assistants are excluded from this sub-study. Because there may be a temporal effect with the de-escalation training, a different value will be assessed depending on proximal relationship to the training: a '0' value will be for the time-period pre-training, '1' will be the time period up to 6 months after training, '2' will be 6-12 months after training, and '3' will be the time period beyond 12

months until re-training when the numbers 1-3 will again be used. The date of the de-escalation training comes from the hospital's staff education database. As with sub-study 1, the analysis includes the time period of March 2007, when the daily number of productive hours were available for each staff member, until December 31st, 2014. The SAS code for the analysis of Sub-study 2 can be found in Appendix G.

Results

The multivariate results of the examination into violence-related injuries and de-escalation training for the ED RNs are in Table B.1. There is no difference in risk between staff who have not, or have not yet, received training to de-escalate potentially violent situations and those who received training. The rates of injury among the RNs from March 2007 through December 2014 at the different time periods of training are in Table B.2: before training or no training, the 6 months following training, from 6 to 12 months after training, and the time period 12 months or more after training until retraining if it occurred.

Table B.1 Contrast estimate results of de-escalation training for RNs, full model

	Comparisons	Mean Estimate	Mean Confidence Limits		Chi-Square	Pr > ChiSq
Experience Level	0-1 v. 11-34	0.5576	0.1532	2.0297	0.79	0.3756
	2-4 v. 11-34	0.5431	0.1985	1.4865	1.41	0.2347
	5-10 v. 11-34	0.4819	0.1606	1.4458	1.70	0.1928
Age	23-35 v. 51-66	2.4518	0.7065	8.5090	2.00	0.1578
	36-43 v. 51-66	0.9773	0.2800	3.4102	0.00	0.9712
	44-50 v. 51-66	1.1952	0.3969	3.5989	0.10	0.7512
Level of Training	No Training v. 0-6 Months Post	1.3047	0.3094	5.5023	0.13	0.7172
	No Training v. 6-12 Months Post	0.6763	0.0870	5.2541	0.14	0.7084
	No Training v. >12 Months Post	1.2687	0.4559	3.5306	0.21	0.6486
Gender	M v. F	1.7914	0.7679	4.1790	1.82	0.1774

Table B.2 Rates of violence-related injuries to ED RNs by de-escalation training level

De-Escalation Training Level	Rate of Injuries per 100 FTE
No Training	4.4
0-6 Months Post	6.2
6-12 Months Post	3.2
>12 Months Post	5.6

Discussion

As with the investigation into staffing levels and violence-related injuries described

in Appendix A, the study is underpowered to demonstrate any meaningful differences in risk between staff. However, the results of Table B.2 do not hint at a trend that suggests training in de-escalation tactics assist with the prevention of violence-related injuries to this population of staff. A few factors may influence the association between training and violence-related injury with this particular population. After 2010, all new RNs received de-escalation training soon after being hired into their new positions. Thus, the staff who have been found to have the highest risk for violence-related injury both in the literature and in the full model study of CEW, the least experienced, are also the most likely to have recently received de-escalation training in this population. In addition, many of the RNs in this population never received the de-escalation training, so there may not be enough staff in each category to be able to find meaningful associations.

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Appendix C

Table of Studies as Cited in Chapter II

Author(s); **Title,** *Journal*; **Publication Date**	**Purpose of Study**	**Methods: Study Design;** *Analytic Plan*	**Population: Number of Subjects, Subject Characteristics if available**	**Relevant Variables: Dependent (outcome);** Independent (exposures of interest); *Potential Confounders*	**Results & Notes**
Risk Factors for Workplace Violence					
Sheridan, Henrion, Robinson, & Baxter; **Precipitants of violence in a psychiatric inpatient setting**, *Hospital and Community Psychiatry*; **1990**	To discover what causes aggressive behaviors among psychiatric inpatients-examine the events preceding aggressive times	**Interviews of aggressive patients w/in 72 hours of being 4-pointed, nursing staff were interviewed, & medical records were examined;** *Examine the interviews in a qualitative manner with counts*	**73 psychiatric inpatients' medical charts were reviewed; Nursing staff were interviewed (poorly described); 63 of the patients agreed to be interviewed**	**Patient being placed in 4 point restraints**; Behaviors or variables before restraint: anxious, delusional, hostile, etc. physical aggression precluded restraint (86% of patients), other internal & external variables leading up to restraint; *None noted by authors*	36% of restraint events was preceded by enforcement of rules, denials of patient requests. 20% by conflict with other patients. Delusions, hallucinations, & intoxications in about 40% of restraint events

Author(s); **Title,** *Journal*; **Publication Date**	**Purpose of Study**	**Methods: Study Design;** *Analytic Plan*	**Population: Number of Subjects, Subject Characteristics if available**	**Relevant Variables: Dependent (outcome);** Independent (exposures of interest); *Potential Confounders*	**Results & Notes**
Kaminski & Sorensen; **A multivariate analysis of individual, situational and environmental factors associated with police assault injuries**, *American Journal of Police*; **1995**	To analyze the factors that might be involved with patrol officer assault injuries	**Review of data from a previous study of police assaults in Baltimore over a 3-year period;** *Used multivariate logistic regression*	**Unit of analysis is 1187 police assaults in Baltimore over a 3-year period**	**Individual assault, defined as "any overt physical act that the officer perceives or has reason to believe was intended to cause him harm"**; Officer demographics, assailant demographics, situational factors; *Removed assaults on plain-clothed policemen, off duty, and special forces (e.g. SWAT). Also removed those assaults where there was no physical attack*	More education & experience for officers is associated with less risk for injury. Higher odds of injury when more officers are present

Author(s); **Title,** *Journal*; **Publication Date**	**Purpose of Study**	**Methods: Study Design;** *Analytic Plan*	**Population: Number of Subjects, Subject Characteristics if available**	**Relevant Variables: Dependent (outcome);** Independent (exposures of interest); *Potential Confounders*	**Results & Notes**
Findorff, McGovern, Wall, Gerberich, & Alexander; **Risk factors for work related violence in a health care organization**, *Injury Prevention*; **2004**	Discover whether job classes with more patient contact will have more injuries and whether increased supervisor support is predictive for decreases in both physical and nonphysical violence	**Groups of investigation were based on expected levels of violence and random sampling done within groups. Survey instrument sent out with some demographic data coming from respective human resources departments;** *Logistic regression- differences between those who had physical or non-physical violence and those who didn't*	**Clinical and non- in a large Midwest health group. 21000 employees, 4166 sampled, 1751 respondents**	**Survey responses: Physical- claimed hitting, slapping, etc. Non-physical, reported occasionally or more of 4 questions in regards to nonphysical violence**; Job family, supervisor support, patient contact; *Age, gender, race, marital status, income, education (but also by department, business unit, hours worked, patient contact)*	Violent events 9.1/100FTE. ORs for violence increased with more patient contact. Non-physical violence not associated with job family; physical violence associated with RNs & nursing assistants & also with working in ED, ICU, & psychiatric areas. Supervisor support not associated with risk for violent event. New policies created after the study addressing physical violence, sexual harassment, & respectful workplace

Author(s); **Title,** *Journal*; **Publication Date**	**Purpose of Study**	**Methods: Study Design;** *Analytic Plan*	**Population: Number of Subjects, Subject Characteristics if available**	**Relevant Variables: Dependent (outcome);** Independent (exposures of interest); *Potential Confounders*	**Results & Notes**
Nachreiner, Gerberich, Ryan, & McGovern; Minnesota nurses' study: perceptions of violence and the work environment, *Industrial Health*; **2007**	To identify the perceptions of violence and work environment among RNs	**Case-control study, mailed surveys sent to cases and controls;** *Descriptive analyses using SAS (bivariate)*	**6,300 nurses sampled. 475 cases (report of physical assault in 12 months) & 1,425 controls selected**	**Self-reported injury**; Supervisor support, quality of support & trust with coworkers, expectations of assault as part of work, preventive measures in workplace; *None noted*	Most participants expected violence as part of their jobs; especially in long-term care, and especially among those who have been previously assaulted. Of note, staff felt administration also expected violence as part of the job. The staff reporting less assaults reported more involvement by administration in preventing violence

Author(s)**; Title,** *Journal*; **Publication Date**	**Purpose of Study**	**Methods: Study Design;** *Analytic Plan*	**Population: Number of Subjects, Subject Characteristics if available**	**Relevant Variables: Dependent (outcome);** Independent (exposures of interest)**;** *Potential Confounders*	**Results & Notes**
Amore, Menchetti, Tonti, Scarlatti, Lundgren, Esposito, & Berardi; **Predictors of violent behavior among acute psychiatric patients: clinical study**, *Psychiatry and Clinical Neurosciences*; **2008**	To evaluate the prevalence of aggressive behaviors before and after the admission to an acute psychiatric inpatient unit, to identify clinical and sociodemographic factors associated with physically aggressive behavior in the month before admission to the psychiatric unit, and to identify clinical and sociodemographic factors of hospitalized psychiatric patients associated with physically aggressive behavior during hospitalization	**Patients admitted to inpatient psychiatric departments were evaluated (sociodemographic & clinical data), patients with various backgrounds and amounts of violence in recent or remote past were compared to one another;** *One way ANOVA was used for continuous variables, chi-square was used for categorical variables. Logistic regression used to find factors independently associated with physical aggression*	**303 patients admitted over the course of a year**	**Either physical aggression against others or "VOA," defined as verbal aggression, physical aggression against objects, or verbal threats of physical aggression**; Aggression within past month, aggression documented in medical history, psychiatric diagnosis, personality disorder, substance/alcohol abuse, medical co-morbidity, neuro symptoms (seizure disorder, traumatic brain injury, etc.), gender, age, where lived; *None noted*	75 of 303 patients responsible for physical aggression over 1 year. 173 events of physical aggression, with 101 against staff. Male gender, young age, & drug/alcohol abuse associated with physical aggression. Clinical depression inversely associated with aggression

Author(s); **Title,** *Journal*; **Publication Date**	**Purpose of Study**	**Methods: Study Design;** *Analytic Plan*	**Population: Number of Subjects, Subject Characteristics if available**	**Relevant Variables: Dependent (outcome);** Independent (exposures of interest); *Potential Confounders*	**Results & Notes**
Gates, Gillespie, Kowalenko, Succop, Sanker, & Farra; **Occupational and demographic factors associated with violence in the emergency department**, *Advanced Emergency Nursing Journal*; **2011**	To describe the frequency of violence against ED healthcare workers in a cohort of 6 hospitals, to identify whether demographic and occupational characteristics of ED health care workers are related to violence, and identify whether feelings of safety and level of confidence when dealing with workplace violence are related to demographic and occupational characteristics	**Asked ED staff in hospitals to respond to a survey with the following four areas of questions: demographic, violence expression, safety scale, & confidence scale;** *T-tests for differences between two groups, general linear modeling allowing for pairwise comparisons for comparing multiple groups*	**Direct care ED workers from 6 hospitals were invited to answer a survey, and there were 213 staff who were the first to volunteer to answer the survey**	**Survey responses: Physical- claimed hitting, slapping, etc. Non-physical: physical threats, verbal harassment, sexual harassment**; Feelings of safety, confidence dealing with pts, Age, gender, race, type of job, education level, previous training all not related to frequency of violence; *Acknowledgment that there could be selection bias- not random, first-come first-served*	48% of subjects reported physical assault. 98% reported verbal harassment. 9% said they had been injured by a patient in past 6 months. 74% reported seldom or never reported events. Level I Trauma had more physical threats than non-trauma, psychiatric-only areas also had more physical threats. Older employees and those with more experience in EDs felt less safe. Those experiencing more violence felt less safe. 54% of participants had no violence-prevention training

Author(s); **Title,** *Journal*; **Publication Date**	**Purpose of Study**	**Methods: Study Design;** *Analytic Plan*	**Population: Number of Subjects, Subject Characteristics if available**	**Relevant Variables: Dependent (outcome);** Independent (exposures of interest); *Potential Confounders*	**Results & Notes**
Blando, McGreevy, O'Hagan, Worthington, Valiante, Nocera, Casteel, & Peek-Asa; **Emergency department security programs, community crime, and employee assaults**, *The Journal of Emergency Medicine*; **2012**	To describe security characteristics and programs in hospital EDs in New Jersey and to describe the hospital budget for security and to then examine how these security features vary by the size of the hospital and by the crime rates in the hospitals' surrounding communities	**Interviews of ED nurse managers and security directors. Collection of data on revenue collected. Collection of data on crimes in city or town of hospital, with census data denominator to give rate;** *Divided 50 hospitals into 4 categories (big hosp, high crime; big hosp, low crime; sm hosp high crime; sm hosp low crime). Chi-squared tests to see how crime/size affected security budgets, etc. Wilcoxon tests to determine differences in rates of injury*	**84 hospitals in NJ; 70 randomly selected equally in 3 strata (Level I, 300+ beds, <300 beds), 50 EDs agreed to participate. The OSHA recordable injuries were used from these 50 hospitals to comprise the data**	**OSHA recordables only from 1992-2001- in order to calculate OSHA-recordable rates, they used the injury data from OSHA records, then used the number of hours worked in ED as the denominator.**; Crime in area, size of the hospital, investment in security departments; *Only OSHA recordables were used, don't know overall violent incident rates. Also, smaller hospitals may have less resources to track injuries*	Assault rates 2-5 times higher in small hospitals vs. large hospitals in this study. No difference in assault rates for large hospitals in high crime vs. low crime areas. The authors discussed revenue per bed and funding of security department. Interestingly, hospitals with highest assault rates (small hospitals in general) had less support from executive leadership than large hospitals

Pompeii, Dement, Schoenfisch, Lavery, Souder, Smith, & Lipscomb; **Perpetrator, worker and workplace characteristics associated with patient and visitor perpetrated violence (Type II) on hospital workers: a review of the literature and existing occupational injury data**, *Journal of Safety Research*; **2013**	To identify risk factors of Type II (patient on worker) violence experienced by hospital workers and to describe what is known about these events in regards to perpetrator characteristics, worker characteristics, circumstances surrounding violent events, potentially relevant work environment factors, warning sign, and consequences experienced by workers	**Review of injury records and violent events from 3 hospitals with a literature review;** *Crude rates, rate ratios and 95% CI were estimated using Poisson regression, with the natural log of full-time equivalents as the offset (denominator)*	**12,804 workers in 3 hospitals contributed a total of 27,681 full-time equivalents over the 6-year study period. Denominator is hours worked per week * months in study, then FTE (2000 hours worked per year)**	**Multiple sources of injury/violent incidents. OSHA, worker's comp, etc. violent events were all logged. OSHA recordables only from 1992-2001. Violent events were described in terms of the cause, nature, and body site of injury". Events categorized as needing time off work or medical Treatment ***most of the events were found in Worker's Comp, so particularly egregious violent events**; Perpetrator (i.e., patient, visitor) and their characteristics, patient/visitor actions toward staff, staff actions toward the patient,& characteristics of the patient gender, age, race, institutional tenure, occupational group and work location; C*ircumstances of the events, warning signs, whether the patient was in pain, if they were impaired, if situational factors triggered or escalated the event*	484 violent events found (1.7 per 100 FTE). Rates decreased with increased age and tenure. Men more likely to have violent event. Blacks much higher than whites. Rates much higher among public safety workers (5.4 per 100 FTE vs. nursing at 1.7). Psychiatric areas, ED, security, float pool, ICU were all places with high numbers of injury/FTE

Author(s); **Title,** *Journal*; **Publication Date**	**Purpose of Study**	**Methods: Study Design;** *Analytic Plan*	**Population: Number of Subjects, Subject Characteristics if available**	**Relevant Variables: Dependent (outcome);** Independent (exposures of interest); *Potential Confounders*	**Results & Notes**
Covington, Huff-Corzine, & Corzine; **Battered police: risk factors for violence against law enforcement officers**, *Violence and Victims*; **2014**	To examine situational variables, offender characteristics, and officer demographics that may correlate with violence directed at law enforcement officers	**3 years of use of force forms were examined to discover what those correlate characteristics may be to violence;** *Logistic regression-differences between situational factors, offender factors, & police demographics on assault injury*	**Over 700 officers employed by the Orlando police department, but the unit of analysis is any use-of-force event ("a chemical agent, a tire deflation device, an impact weapon, an ECD, a body strike, a K-9 bite occurred, or when any technique or weapon was employed that resulted in an actual or claimed injury")**	**Not well described. Only that the forms indicate which officers had been battered**; Situational characteristics (season, time of day, presence of alcohol establishments), offender characteristics (gender, race, age, BMI, use of alcohol), and officer characteristics (race, age, gender); *Missed cases due to a lack in reporting, especially of minor injuries. Differences between supervisors may lead to differences in reporting (and perhaps in policing?)*	Odds are almost twice higher that a battery will occur when multiple officers are present as when there is only one. Odds are also higher when the offender was perceived to have recently consumed alcohol. Officer demographics not significantly associated. Females more likely to have assaulted the officers than males

Author(s); **Title,** *Journal*; **Publication Date**	**Purpose of Study**	**Methods: Study Design;** *Analytic Plan*	**Population: Number of Subjects, Subject Characteristics if available**	**Relevant Variables: Dependent (outcome);** Independent (exposures of interest); *Potential Confounders*	**Results & Notes**
Prevention Evaluation					

Author(s); **Title,** *Journal*; **Publication Date**	**Purpose of Study**	**Methods: Study Design;** *Analytic Plan*	**Population: Number of Subjects, Subject Characteristics if available**	**Relevant Variables: Dependent (outcome);** Independent (exposures of interest); *Potential Confounders*	**Results & Notes**
Flannery, Hanson, Penk, Goldfinger, Pastva, & Navon; **Replicated declines in assault rates after implementation of the Assaulted Staff Action Program**, *Psychiatric Services*; **1998**	To examine the effects of the Assaulted Staff Action Program (ASAP) program on the number of assaults in three public-sector hospitals over a one-year period The ASAP program: when assault occurs, charge RN calls hotline & crisis intervention person meets with victim & works with the assaulted individual for 10 days	**Baseline assault rates were determined at each hospital over 3 months. ASAP implemented, then assault rates again determined;** *Repeated measure ANOVA*	**Unit of analysis was assault, but for direct care staff, there were 261 at hospital A, 295 at hospital B, & 384 at hospital C**	**Assaults were defined as unwanted physical contact with intent to harm, including punching, kicking, slapping, biting, spitting, and throwing objects at persons**; Exposed to ASAP Assaulted Staff Action Program- a team that helps staff after they've been assaulted; *Halo effects, staffing factors, and medication and management consultations*	Significant decreases in assault rate on the staff after implementation of the ASAP program. There were no differences between quarters after the intervention was implemented. The design appeared to be more applicable for long term psychiatric settings than for EDs

Author(s); **Title,** *Journal*; **Publication Date**	**Purpose of Study**	**Methods: Study Design;** *Analytic Plan*	**Population: Number of Subjects, Subject Characteristics if available**	**Relevant Variables: Dependent (outcome);** Independent (exposures of interest); *Potential Confounders*	**Results & Notes**
Rankins & Hendy; **Effect of a security system on violent incidents and hidden weapons in the emergency department**, *Annals of Emergency Medicine*; **1999**	The study's purpose was to determine the number and frequency of weapons confiscated and assaults in the ED before and after the implementation of a new security system	**Retrospective review of security records. Census for study period, counts of assaults, counts of weapons confiscated;** *Fisher's exact test to compare the proportions of weapons and assaults before and after the security system*	**Patients, weapons, employees at the study hospital. No denominator of the number of hospital employees was reported**	**Assault: physical attempt to inflict bodily injury on another. Assaults per 10,000 patients treated**; Security system in place, including metal detectors, security cameras, limited access, and a manned security booth; *Authors discussed inability to capture patients who slip through the metal detectors. There may be a bias with timing- may be more or less weapons in general during either study period*	No difference in assault rates after implementation of the security system, however there was a big difference in the number of weapons confiscated before and after implementation. No way to know if this prevented an assault with a deadly weapon, as these events are very rare. Study demonstrates that metal detectors can decrease deadly weapons from entering the hospital, but do not likely affect assault rates

Author(s); **Title,** *Journal*; **Publication Date**	**Purpose of Study**	**Methods: Study Design;** *Analytic Plan*	**Population: Number of Subjects, Subject Characteristics if available**	**Relevant Variables: Dependent (outcome);** Independent (exposures of interest); *Potential Confounders*	**Results & Notes**
Findorff, McGovern, & Sinclair; **Work-related violence policy: a process evaluation**, *American Association of Occupational Health Nurses Journal*; **2005**	To assess the incidence of violence at a health organization (Allina) & evaluate the process individuals follow when they are victims of violence	**Survey sent out to those sampled, which provided the data to be compared;** *Summary statistics with 95% confidence intervals*	**Current employees and those who left within one year & used proportionate sampling of different job codes. Of the 4,166 employees and former employees sampled and invited to participate, 1,751 employees responded to long survey (40%), 380 to short survey (51%). Over 21,000 employees in the health system**	**Self-report of both physical and non-physical violence experienced**; Occupation of the victim & variables around workplace violence policies; *None noted*	7.2% had been victims of work-related assault in past year & 60% had knowledge of the policy on workplace violence prevention. Intensive care & mental health had highest rates for physical injury, then ED. Guards had the highest rates, followed by paramedics, then nurses. Employer decided to have 3 different policies after this study- one for physical violence, one for non-physical, and one for sexual violence

Author(s); **Title,** *Journal*; **Publication Date**	**Purpose of Study**	**Methods: Study Design;** *Analytic Plan*	**Population: Number of Subjects, Subject Characteristics if available**	**Relevant Variables: Dependent (outcome);** Independent (exposures of interest); *Potential Confounders*	**Results & Notes**
Peek-Asa, Casteel, Allareddy, Nocera, Goldmacher, Ohagan, Blando, Valiante, Gillen, & Harrison; **Workplace violence prevention programs in psychiatric units and facilities**, *Archives of psychiatric nursing*; **2009**	This study was done to compare workplace violence prevention (WVP) measures in randomly selected psych units/facilities in NJ and CA (CA had new laws in place for WPV programs in the 2000's)	**Reviewed training materials, policies & procedures, interviewed nurse manager & 2 staff RNs, did a walkthrough of each facility. Additional information was received from security director;** *Mostly did Chi-square tests between CA & NJ to see if there were differences in implementation of violence deterrence per Cal/OSHA's new regulations*	**Random sample from 3 strata of hospitals: Trauma center, hospital with more than300 beds, and hospital with less than 300 beds. 83 hospitals, 53 from CA & 30 from NJ**	**Workplace violence measures: training, policies & procedures, environmental safeguards, & security**; Type of hospital, size of hospital, and location (CA vs. NJ); *None noted*	Hospitals in CA did not all adhere to CA's regulations on preventing Workplace violence; indeed, NJ seemed to score better in various areas. Enacting legislation is not nearly enough to improve workplace violence- it may only address policies within the institution, but not other ways workplace violence can be affected. Both states scored poorly on many environmental factors

Author(s); **Title,** *Journal*; **Publication Date**	**Purpose of Study**	**Methods: Study Design;** *Analytic Plan*	**Population: Number of Subjects, Subject Characteristics if available**	**Relevant Variables: Dependent (outcome);** Independent (exposures of interest); *Potential Confounders*	**Results & Notes**
Ho, Clinton, Lappe, Heegaard, Williams, & Miner; **Introduction of the conducted electrical weapon into a hospital setting**, *The Journal of Emergency Medicine*; **2010**	To examine the utility of using conducted electrical weapons within a healthcare organization	**Retrospective observational study. Events where conducted electrical weapons (CEW) was used over the course of a year were examined;** *Descriptive statistics*	**The hospital employed forty medical center protection officers over the course of the year of study**	**Injuries from hospital reports, which included differences in lost time injuries- days away from work**; Exposure variables not defined, though year prior implementation was compared against year after; *Not detailed for the most part, but the hospital leadership implemented more signs about it being violence-free and included info in patient bill of rights*	In the year before CEW, 31 injuries with 18 days lost time & 350 days of restricted or light-duty; in year post-implementation: 20 injuries with 0 days lost time & 16 days restricted or light-duty

Kim, Ideker, & Todicheeney-Mannes; **Usefulness of Aggressive Behaviour Risk Assessment Tool for prospectively identifying violent patients in medical and surgical units**, *Journal of Advanced Nursing*; **2011**	To answer the question: Does the tool, Aggressive Behaviour Risk Assessment Tool, reliably flag patients in medical-surgical units as being prone to have violent behaviors? Is there good sensitivity, specificity, & inter-rater reliability for the tool?	**17- item questionnaire was filled out on each patient by the nursing staff. A second one was filled out by another nurse (to assess inter-rater reliability), and a third section was filled out if there was a violent event. Descriptions of the violence were in a 4th section;** *Bivariate correlations using Kendall's tau test were generated among the dichotomous dependent variables and the dichotomous independent predictor variables from the 17-item checklist. Multivariate analyses were also performed with the variables (question items) that were statistically significant. Cohen's Kappa was estimated for inter-rater reliability*	**2063 adults admitted to the inpatient med/surg areas. There were originally over 2700 patients, but almost 700 did not have both questionnaires filled out by separate RNs, and were not included in the dataset**	**Code 55 called or a violent attack, threat of violence, sexual harassment, & verbal abuse; Positive items on the checklists**: physically aggressive/threatening, mumbling, history or signs/symptoms of mania, history of physical aggression, confusion/cognitive impairment, anxiety, shouting/demanding, staring, threatening to leave, and agitation; *None noted*	2.7% (n=56) of med/surg pts had at least one violent event. The items that correlated the strongest with a violent event were: confusion/cognitive impairment, anxiety, agitation, shouting/demanding and history of physical aggression. But, only 15% of those scored with the most prevalent item (confusion/cognitive impairment) had a violent event. However, if there were 2 items that were positive, there was a 41% likelihood that a person would be violent. 85% of those with a score of 4 or higher became violent

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Gates, Gillespie, Smith, Rode, Kowalenko, & Smith; **Using action research to plan a violence prevention program for emergency departments**, *Journal of Emergency Nursing*; **2011**	What strategies will be employed to reduce violence in this 4 part/4year study? This part of the study used focus groups to determine which strategies to use.	**60-75 minute focus groups took place over the course of several months, with each focus group having one manager, one patient, & 2 ED employees;** *Qualitative identification of themes*	**At the 3 hospitals in the study, authors did stratified random sampling of the various occupational groups (charge nurse, physicians, nurse manager, paramedics, security, etc), and invited 303 people to participate in the focus groups. 96 people agree to be part of the focus groups**	n/a- qualitative study	Make sure policies are very clear and that all know what they are. More education is required. Authors suggest that organizations should make sure the policy that violence is never acceptable is understood by all staff at the organization

Papadopoulos, Bowers, Quirk, & Khanom; **Events preceding changes in conflict and containment rates on acute psychiatric wards**, *Psychiatric Services*; **2012**	To discover what events on the unit significantly play a role in the uptick or downturn in the number of conflicts and containment activities that happen on the psychiatric wards in a "health trust" in London	**Mixed methods that combined longitudinal qualitative and matched quantitative data- which qualitative data preceded changes in conflict & containment rates;** *1st, graphed all conflicts and containments and decided on upturns and downturns in the data. 2nd get themes from the interviews. 3rd, matched the themes against the upturns and downturns, then used Pearson chi square tests to contrast each theme's level of association with upturns versus downturns in total conflict and containment scores*	**Hospital wards; 13 inpt psych wards and 3 psych ICUs over the course of two years. (The data came from the shift report checklist- on numbers of conflicts and numbers of containments, and semi-structured interviews with the ward managers and psych consultants)**	**Number of conflicts and containments per the nurses' shift reports**; This is essentially the qualitative data. There were 40 themes that emerged, 13 of which were significantly statistically tied to an upturn or downturn in conflict or containment reports; O*nly 27% of the transitions could be mapped to a qualitative theme, thus at least 73% of the transitions could not be explained by one of the themes.*	Most strongly associated was: "Positive staff practice," for instance an RN who learned relaxation strategies for pts came back and taught them; "Environment improvement"; "Increased staff activity," such as taking pts on day trips, being more assertive with pts, etc.; "Effective teamwork"; "Staff pressure/high workload/stressed". Negative staff morale significantly associated with upturns in conflict & containment; "Staff to Staff conflict" also associated. Things that improve staff morale, commitment, & practice and decrease conflict have the potential to decrease conflict and containment among patients. The overall environment impacts conflict as well

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Training					
Smoot & Gonzalez; **Cost-effective communication skills training for state hospital employees**, *British Journal of Psychiatry*; **1995**	Is Carkhuff training (a method of training staff to develop appropriate empathy by teaching cognitive & emotional aspects of interpersonal communication) a cost-effective way to reduce poor outcomes among staff & patients	**Quasi-experimental- before & after for each group;** *No statistical plan- plan to examine the cost-benefit of the two studies*	**2 inpatient psychiatric units- 35 staff in experimental unit, 37 staff in control unit**	**Number of assault injuries on staff by patients, turnover, patient complaints, patient restraint & seclusion, sick time**; Training was the primary exposure variable; None noted	Assaults on staff remained flat before and after the training, but patient complaints decreased, turnover decreased, patient complaints reduced, though no statistical evaluations were completed to assess the correlation the changes had to do with the education vs. any other variable. Intensive (and very expensive) education

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Fernandes, Raboud, Christenson, Bouthillette, Bullock, Ouellet, & Moore; **The effect of an education program on violence in the emergency department**, *Annals of Emergency Medicine*; **2002**	Examine the effect of a specific education effort to reduce violence in the ED (Standardized & developed by Crisis Prevention Institute & widely used in US & Canada)	**All ED workers had Crisis Intervention training in 4 hour blocks. All staff on alternate days of 7 of 14 days were asked to complete survey at end of shift. Survey asked about demographics, violent incidents, & reactions;** *Generalized estimating equation Poisson regression model to determine effect of intervention*	**All staff in the ED are monitored for violent incidents, and all offered to do a survey. 667 surveys returned with 798 surveys handed out to staff at the end of the shift. 25-30% male, 60% RN**	**The amount of verbal & physical violence experienced or witnessed**; Attending the Crisis Intervention program; *Adjusted for the number of days since social assistance payday, then job description, sex, age, years of experience, & height of employee.*	Reported experience (and witness) of physical injury decreased from baseline to 3 months, but increased from 3 months to 6 months. At 6 months still less violence than at baseline, but not by much; however staff reported feeling safer. Many staff don't feel safe in general. Authors suggest the results demonstrate that violence reduction programs may help, but there likely needs to be continued effort to engage & educate staff- e.g. refresher courses on ongoing basis

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Deans; **The effectiveness of a training program for emergency department nurses in managing violent situations**, *Australian Journal of Advanced Nursing*; **2004**	To determine if a training program in the prevention and management of violence had been experienced as improving knowledge, skills and attitudes of nurses employed in a regional ED with regard to their role of managing the aggressive behavior of patients	**Give training, assess attitudes & confidence 3 months pre- and 3 months post-training;** *Chi-Square tests of the different items on the questionnaires*	**40 RNs attended the program; 30RNs completed the pre- survey & 22 RNs completed post-survey**	**Measured attitudes & confidence. The authors stated that they measured number of incidents pre - & post-training, but data not in the manuscript**; Training taken; None noted	Many non-significant improvements in attitudes. Rated skills & knowledge higher after training course. Number of incidents reduced, though not statistically significant

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Lee, Gray & Gournay; **Comparing the outcomes of the application of C&R (general service) and SCIP in the management of disturbed behaviour in mental health care**, *Journal of Mental Health*; **2012**	To find whether training for workers in mental health environment that includes verbal de-escalation techniques and theoretical training, Strategies in Crisis Intervention and Prevention (SCIP), was superior to one that includes only safe physical restraint techniques, control and restraint (C&R)	**Cohort study of all psychiatric inpatients over the course of 6 months at 5 different psychiatric inpatient trusts;** *Used both Kaplan Meier survival analysis & Poisson regression, depending on the outcome measured*	**5 Psychiatric Inpatient ICUs in UK, with 315 patients admitted to the units over the course of the study. Of which, 135 were admitted to the 3 wards that used SCIP and 180 admitted to the 2 wards that used C&R**	**Measured disturbed behavior incidents & length of stay of the inpatients**; SCIP training (which includes de-escalation) versus traditional control and restraint training; *Staffing issues, environmental/ organizational factors and patient characteristics*	Patients on SCIP wards experienced longer length of stay and 48% increased risk for a behavioral incident

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Gillam; **Nonviolent crisis intervention training and the incidence of violent events in a large hospital emergency department: an observational quality improvement study**, Advanced Emergency Nursing Journal; **2014**	Does providing nonviolent crisis intervention training to ED personnel reduce violent events, manifested as code purples?	**Examined number of 'code purples,' emergency responses by the security team, that called during each month against number of trained staff;** *Correlation between the independent and dependent variables was calculated using Pearson's r*	**Though the total *n* was not specifically mentioned in the paper, there were 104 in the beginning of the study (42% trained), 109 at the end of the study (with 75% trained), and 37% of the 24 employees who left the organization were trained prior to leaving**	**Counts of 'code purples'**; Number of staff trained over the course of a time period; *Only that the number of psychiatric patients was taken into account*	Apparent short-term, but not long-term results. When higher percent of staff trained in a month prior, there was a decrease in the code purples in the 90 days after that. At 150 days, no correlation found

Wong, Wing, Weiss, & Gang; **Coordinating a Team Response to Behavioral Emergencies in the Emergency Department: A Simulation-Enhanced Interprofessional Curriculum**, *Western Journal of Emergency Medicine*; **2015**	The goal was to (1) develop an interprofessional curriculum focused on improving teamwork and staff attitudes toward patient violence using simulation-enhanced education for ED staff, and (2) to assess attitudes towards patient aggression both at pre- and post-curriculum implementation stages using a survey-based study design	**Employees were surveyed immediately before the course and after;** *Paired sample Student's t-test*	**162 employees participated in training, 106 paired surveys were completed**	**Measures of knowledge of constructs related to patient aggression**; Simulation training; *None noted*	Staff had more knowledge around factors contributing to patient aggression, but no change in confidence to manage aggression
Impact of violence					

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Croker & Cummings; **Nurses' reactions to physical assault by their patients**, *Canadian Journal of Nursing Research*; **1995**	To investigate the relationship between demographic variables and reactions to assaults in med/surg areas. Used qualitative surveys- causes, opinions of why assault occurred, coping strategies, & barriers to reporting	**Survey of all RNs at a hospital in medical/surgical areas;** *Pearson product moment correlations with defined variables*	**All staff in med/surg units at a rural hospital in Canada- 515 surveys sent, 30% response rate- 160, with 35 reporting injuries**	**Emotional reaction, biophysical reaction, social reaction, and whether or not the incident was reported**; Question: any patient knowingly touched you with intent to harm over past 5 years; *Age, height, weight, education, years of experience, patient's age & sex, number and severity of assaults, and coping behaviors of staff*	"Confusion, fear, & anger most prominent reasons patients attacked nurses per RN response. 91% of the assaults took place when the nurse had to touch patient's body- turning, bathing, assisting with returning to room, restraining. This is the first study to use this detailed questionnaire, it's not really validated at this point, though it does seem to elicit good material…

Findorff-Dennis, McGovern, Bull, & Hung; **Work related assaults. The impact on victims**, *American Association of Occupational Health Nurses Journal*; **1999**	The purpose of this pilot study was to describe the non-monetary cost of violence for individuals who had incurred a work-related assault	**Semi-structured, qualitative interviews were conducted with ten individuals who were randomly selected. Each person was interviewed once by the same clinical psychologist; interview instrument adapted from an earlier study looking into non-monetary costs;** *Content analysis & data display*	**10 sampled from the study below; randomized based on type of injury, though 5 of them were randomly selected based on a permanency rating of impairment, with the other 5 sampled to represent different injury types. 5M & 5F; 5 worked in HC; 4 in law enforcement (incl. security); 1 in education. The 10 were sampled from the 429 claimed workplace violence-related injuries in MN over course of a year**	n/a? Qualitative interviews. All 10 of the people were assaulted & 10 were considered permanently disabled; level of support & outcomes for the individual could be considered the dependent variables here	7 out of 10 staff changed jobs & 1 was terminated instead of given light duty. The 3 who did not change worked in law enforcement (not likely to leave though assaulted?), they also are only ones who reported good support from bosses. Changes in recreational activities & ADLs (6 could not do as much 2nd to chronic pain). 8/10 had trouble sleeping. 7/10 had symptoms of depression. Costs of treating psychological symptomss following an assault were covered by private insurance and not by worker's comp. The point that the 3 people who did not leave their jobs were in law enforcement could be interesting for my population. The bosses were described as supportive, whereas the bosses in education and HC were not described as such.

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McGovern, Kochevar, Lohman, Zaidman, Gerberich, Nyman, & Findorff-Dennis; **The cost of work-related physical assaults in Minnesota**, H*ealth Services Research*; **2000**	To describe the long-term productivity costs of occupational assaults	**Human capital method of estimating the costs of assault was used. Direct costs are those where resources could otherwise be used for the illness or injury- medical costs of the injury. Indirect costs are losses because a person cannot work;** *Descriptive statistics for rates*	**MN Workers over the course of 1 year- 1992- who suffered a work related assault that caused at least 4 days away from work. 229 women and 115 men.**	**Costs of assaults**; Characteristics of the insurer, worker, & worker's employer; *None noted*	73% of assaults were by clients (students, patients, or inmates, respectively) while only 4% were coworkers. Total is 18.4/100,00 workers covered by Worker's compensation in the state of MN, with 60/100,000 for police/safety & 40/100,000 for Services (health & education)

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Gerberich, Church, McGovern, Hansen, Nachreiner, Geisser, Ryan, Mongin, & Watt; **An epidemiological study of the magnitude and consequences of work related violence: the Minnesota Nurses' Study**, *Journal of Occupational and Environmental Medicine*; **2004**	To identify the magnitude of and potential risk factors for violence within a major occupational population (registered nurses)	**Survey of MN RNs.** *Investigate the frequency and consequences of workplace violence & identify potential risk factors; Descriptive stats and frequencies, then multiple regression to control covariates*	**6300 MN nurses sent survey 78% response rate. (57,388 RNs & 21,740 LPNs in 1998 in MN) 4,918 responded.**	**Physical assault- hit, slapped, kicked, pushed, choked, stabbed. Non-physical- threat, sexual harassment, & abuse. Then consequences of the assault (the outcome of assault becomes the exposure variable of interest)**; Type of unit/ facility, nurse demographics: age, gender, race, license type, marital status, facility, years in department, year graduated, department, years as a nurse, patient population, activity at work; *Recall bias*	Working in ED, psychiatric areas, & with geriatrics higher likelihood of violence. Many more problems after non-physical violence vs. physical including sleeplessness, frustration with self, loss of self-esteem, depression, difficulty concentrating; but also for outcomes such as quitting, job changes, & transferring. Younger age increased odds for assault. Many nurses report that they did not report injuries because the violence considered part of the job and don't really think there will be any outcome changes- non-supportive environment, minor, unnecessary to report.

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Findorff, McGovern, Wall, & Gerberich; **Reporting violence to a health care employer: a cross-sectional study**, *American Association of Occupational Health Nurses Journal*; **2005**	To identify the individual & employment characteristics associated with reporting workplace violence to an employer & to assess relationship between reporting and characteristics of the violent event	**Survey of staff- only those reporting violence were included in this study;** *ORs between each of the predictors and the outcomes using logistic regression. t-tests & Chi-square tests for non-physical violence ANOVA used for supervisor support by gender and perpetrator*	**Clinical and non-clinical staff in a large Midwest health group. 21000 employees, 4166 sampled, 1751 respondents; those w/both physical and non-physical violence were included in this study. 127 experienced physical violence & 833 experienced non-physical violence**	**Physical violence: asked if they've been assaulted or otherwise touched in an unwanted way. Non-physical violence measured by a set of 4 questions, then asked about each if they were reported to employer**; Employment characters (type of job, dept, etc.), work environment-supervisor support, history of violence, demographics, severity measures of assault, & perpetrator characteristics; *Modest response rate & misclassification bias (reporting events that did not occur in timeframe). Selection bias- those that responded may be more or less likely to experience violence*	57% of those who were victims of physical violence reported it & 40% of those victims of non-physical violence reported it. Those with more symptoms were more likely to report, & those with more occasions of non-physical violence were more likely to report. Men were less likely to report, & those in hospitals also less likely to report as compared to those working in other areas

Roche, Diers, Duffield, & Catling-Paull; **Violence toward nurses, the work environment, and patient outcomes**, *Journal of Nursing Scholarship*; **2010**	To relate nurses' self-rated perceptions of violence (emotional abuse, threat, or actual violence) on medical-surgical units to the nursing working environment and to patient outcomes	**Survey of staff-individual nurse data from the nurse survey; job satisfaction; nurses' intention to leave present position; and three questions about perception of violence over their five most recent shifts. Complexity of shift data captured using a survey as well & 11 questions on delayed nursing care. Comprehensive staffing & adverse event reports for the time involved;** *Regression and correlation between staffing levels, perception of violence, and independent variables assessed*	**RNs in 94 wards in 21 hospitals in Australia. All nursing staff on these wards were asked to respond to a survey with an 80% response rate 2,487 responded out of 3097 invited to participate**	**Perception of violence: "In the last 5 shifts you worked, have you experienced any of the following while carrying out your responsibilities as a nurse?" The response was "yes" or "no" to physical assault, threat of assault, or emotional abuse**; Many reviewed. Staffing, leadership, nurse/MD relations, skill mix ratios, etc.; *Exact mix of case types*	Overall, in the previous 5 shifts from the survey, 14% had physical violence, 21% had threat of assault, & 38% had emotional abuse. 90% of physical violence is from patients; 80% of threats from patients, with almost 20% from family & visitors; 40% of emotional abuse from patients, but also 30% from family & visitors & 15% from nursing co-worker, only 1% from physicians. More perceived violence= less tasks accomplished by the end of shift. Patient adverse events correlated with physical violence & threats. More BSN= less violence experienced. The analyses showed that as ward environments become less stable (fewer registered nurses, decreased staff levels, increased workload and unanticipated changes in patient needs, decreased perception of nurse leadership, lower nurse autonomy, poorer relations with doctors, more patients awaiting placement), perceived violence increases. Interestingly, there was huge variability between units at different hospitals. On some wards, up to 50% of staff reported some violent incident in the past 5 days, whereas 11 wards reported none. Up to 66%, threat of violence; and up to 65%, emotional abuse; 5 wards reported

					no threat, lowest for emotional abuse only 5%. Hospital size, rural vs. urban, ward size all not related to these results. Because of the high amount of variability between units, though not related to hospital size, etc, there is possibly evidence that violence can be controlled by something at the unit level

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Gates, Gillespie, & Succop; **Violence against nurses and its impact on stress and productivity**, *Nursing Economic$*; **2011**	The purpose of this study was to examine how the relationship of violence from patients and visitors is related to work performance and symptoms of PTSD in ED nurses	**Cross-sectional survey design- asked for a narrative for the last violent event and then a Likert-type rating of how it affected them (Impact of Events Scale), then a productivity questionnaire, finally demographics and whether they've had training for de-briefing after critically stressful events;** *Descriptive & bivariate statistics*	**Sample of 3000 nurses who belong to ED nurses' association (only 8.8% return rate)- 264 returned a completed survey**	**Outcomes from the violent events are the outcome variables- productivity, stress symptoms indicative of PTSD, demographics**; Self report- narrative of the last violent event; *Low response rate; assumption that all had injury. PTSD in 1st 7 days, but most often for diagnosis, it needs to last a long time. Severity of the event could affect the results*	Some evidence that there is decreased productivity when violence occurs, but extremely low response rate. Also, the authors offered no information as to how many actually reported having an injury, they pretty much assumed everyone did. They did show significant associations between stress symptoms and cognitive demands. Authors propose that RNs who have been assaulted will be less productive, though the evidence is lacking.

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Articles Describing the Scale, Magnitude, and Specific Locations of Workplace Violence in Healthcare					

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Pane, Winiarski, & Salness; **Aggression directed toward emergency department staff at a university teaching hospital**, *Annals of Emergency Medicine*; **1991**	Retrospective review of police records at a university teaching hospital to obtain specifics on the incidence & type of violence	**1 year retrospective review of police logs from 7/1986-7/1987;** *Incidents categorized exposure variables- no statistical analyses performed, only descriptive*	**UC Irvine Med Center, Level 1 Trauma, with 40,000 ED visits each year**	**Injuries are indicated by presence on police log**; Shift, type of incident, type of police response, perpetrator, & site; *None noted*	686 times the police had to come to respond to ED violence in one year. Only 7 violence-related incident reports were filled out by the staff

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Wyatt & Watt; **Violence towards junior doctors in accident and emergency departments**, *Journal of Accident and Emergency Medicine*; **1995**	Investigate the scale & management of patient aggression towards junior ED MDs	**Asked the Senior House officer a series of questions;** *Only descriptive counts at each facility were reported*	**All EDs (114) in 5 regions of England- Senior house officer was contacted and asked to participate. 100 were able to respond**	**Questions: Have you been assaulted, threatened, sworn at, attempts made to assault you**; Question of whether the institution had any training on managing aggression; *None noted*	23 of them had been assaulted at some time. 66 out of 100 sworn at on a weekly basis. Only 11 had training in managing aggressive patients

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Sullivan & Yuan; **Workplace assaults on minority health and mental health care workers in Los Angeles**, *American Journal of Public Health*; **1995**	To study and describe nonfatal workplace assaults upon minority health care workers	**Retrospective review of worker's comp cases and HR reports for LA county healthcare workers;** *95% CI's using Haenzel methods of Poisson*	**Health and mental health workers in LA county 1/1/86-12/31/90. 1025 assault-based claims; 628 verified assaults on 530 minority workers. The authors don't detail how many health workers there are at the county, but they determined rates by the total number of health workers at each respective facility**	**An intentional physical injury to a health care worker by another individual (as derived from worker's comp claims). Within this significance for lost time: back injury, emotional illness, cost, & struck against an object**; Type of facility. Type of assailant. Location within facility; *Misclassifications due to the employee health data not being collected for the use of research (not full information on the injuries)*	$4789 per claim. White HCW 12.1 assaults/1,000,000 employment days vs. approximately 17 for blacks & latinos and 22 for Filipinos. 10-fold higher rate in psychiatric hospitals vs. general hospitals. "Safety Police" had higher rates of injury than other occupational groups (102 vs. 49 for nursing assistants). In psychiatric facilities, less assault occurred at night vs. at general hospitals

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Bensley, Nelson, Kaufman, Silverstein, Kalat, & Walker Shields; **Injuries due to assaults on psychiatric hospital employees in Washington State**, *American Journal of Industrial Medicine*; **1997**	Provide evidence on the quantity & severity of assaults & risk or protective factors at a state psychiatric hospital in WA	**Used survey results, workers' compensation claims, & hospital incident reports;** *Rates of work comp/100FTE. Comparisons of other variables in the 3 sets of info. Set of 4 regressions with the outcomes being the scales of the most severe injuries in past year and total number of injuries*	**360 bed hospital with average daily census of 349 patients. 435 staff employed- 226 mental health technicians, 122 RNs, 193 other employees. 262 surveyed, with 147 completed questionnaires**	**Used work comp claims, incident reports on assaults by pts to staff, and survey**; Availability of help, isolation, training. Job class, unit, & how long worked at the hospital; *None noted*	13.8 work comp claims from assaults/100FTE. 237 formal reports on assaults- 35.3/100FTE. Incidence rate of 437/100FTE of at least mild injury. 197 moderate to severe injuries reported in the survey. More serious injuries for workers who worked ever as only employee on the ward. mental health techs, working in isolation, & geriatric ward all associated with increased number and severity of injuries. Assaults here are managed by ward staff. Compared to incident reports, there were 5 assaults reported in survey than reported in incident reports. Less than 1 work comp claim per 20 reported by survey

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Owen, Tarantello, Jones, & Tennant; **Repetitively violent patients in psychiatric units**, *Psychiatric Services*; **1998**	Aim of this study to examine recidivism of violence among psychiatric patients, and to determine patterns of serious violence & aggression with corresponding staff responses	**Looked at all violent events over course of 7 months and determined which events were done by recidivists, vs. non;** *Pearson chi tests for discrete data and Kruskal-Wallis test for continuous variables*	**5 psych units in Sydney, Au over 7-month period. 855 admissions (50% male, 50% on court hold)**	**Aggressive= threatening verbal or physical behavior to self or others. Violent- physical harm to self or others**; Recidivism, defined as 20 or more events of violent or aggressive behavior; D*emographics of patient, diagnosis, whether or not the patient is on a court hold*	20 of the patient admits were recidivists, and did 69% of the 752 serious violent and aggressive incidents; the other 31% of incidents were done by 154 others. Recidivist patients more likely to have organic brain damage & personality disorders. More likely to be older. Recidivists much more likely to be on court hold. Incidents done by recidivists less likely to be reported to occupational health staff. Somewhat more clear evidence that the more people are faced with violence, the less they report it. After violence by recidivists, there was less action as far as reporting it, calling in more staff, or calling police as compared to violence perpetrated by non-recidivists. "Perhaps the repetitively violent patient was less personally threatening than the patient who unexpectedly became violent."

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Lehmann, McCormick, & Kizer; **A survey of assaultive behavior in Veterans Health Administration facilities**, *Psychiatric Services*; **1999**	More clearly define the scope and impact of violence in healthcare facilities, specifically in the Veteran's Health Administration (VHA) facilities	**VHA facilities were asked for the number of incidents over the course of 1 year 1990-1991;** *Only descriptive statistics. Injury rates are per 1,000 employees over year. Rates on units were out of 100,000 days of care*	**Survey sent to all 'approximately' 950 VA medical centers & freestanding clinics, with 166 providing responses to the authors; total numbers not provided for the respective facilities, but the authors used human resources data to calculate rates**	**From "Loud and boisterous behavior that significantly disrupts the routine of the facility" to "Rape" to "Hostage taking"**; Locations in the facility, staff time lost, diagnosis of perpetrators, number of staff trained for assaultive behaviors, procedures in place. For patients, length of stay also examined; *None noted*	Most common places for assaults were in psych units, then admitting/triage. Security most injured at 73.7/1,000 security staff, then NAs at 71.8, LPNs at 34.6, then RNs at 22.5. Of those surveys that reported on patient/perpetrator information, most reported that substance abuse was primary or secondary diagnosis. Length of stay strongly related to number of assaultive incidents; also facilities that spent more per patient per day had less assaults

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Fernandes, Bouthillette, Raboud, Bullock, Moore, Christenson, Grafstein, Rae, Ouellet, Gillrie, & Way; **Violence in the emergency department: a survey of health care workers**, *Canadian Medical Association Journal*; **1999**	To examine perceived levels of violence in the ED, to obtain health care workers' definitions of violence, to determine the self-reported effect of violence on health care workers and to determine self-reported coping mechanisms, and potential preventive strategies	**Survey sent to all ED employees at the hospital;** *The data were summarized with medians for skewed continuous and ordinal data, means for normally distributed continuous data and proportions for categorical data-descriptive, no comparative statistics completed*	**ED workers in a Vancouver hospital- sent to all 163 staff. 106 responded, 47 RNs, 19 security, 13 MDs, 8 clerks, 7 social workers, 5 LPNs, 4 health unit coordinators, 2 aides. Mean age 37 yrs.**	**Job satisfaction, coping mechanisms, and capabilities on the job**; Asked respondents to say what type of violence. Physical, verbal, & witnessing physical or verbal in past year; *None noted*	55% reported experiencing physical violence against themselves in past year (89% of security workers, next highest was nurses at 57%). Most staff did not report the assault, even when there was injury. Most said violence interfered with both job satisfaction and capabilities. 90% say they are verbally abused once per week

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Kraus & Sheitman; **Characteristics of violent behavior in a large state psychiatric hospital**, *Psychiatric Services*; **2004**	To delineate quantitative & descriptive data on violent behavior at a large state psychiatric hospital	**Reviewed incident reports in the hospital over the 5-month time period that had to do with violence;** *Rate of violent behavior for each inpatient unit by: number of episodes per month/average census for month-descriptive, no comparative statistics completed*	**360 bed psychiatric hospital in Raleigh. 1,952 patients cared for over course of 5-month study period. The victims were not counted; perpetrators were the individuals of interest in this study**	**Physical assaults, property destruction, and instances of physical self-harm**; Identity of victim and aggressor, type of behavior, and hospital unit; *Could be differences in reporting bias between units*	419 violent episodes, 27 patients with 5 or more violent episodes accounted for 56% of all episodes, but represented only 1.4% of total patients served during study period. 10 of these had developmental, organic, or neurological disorder & 7 had personality disorder. More likely to have violence in female units. The most common person assaulted was another patient, then healthcare technicians

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Hodgson, Reed, Craig, Murphy, Lehmann, Belton, & Warren; **Violence in healthcare facilities: lessons from the Veterans Health Administration**, *Journal of Occupational and Environmental Medicine*; **2004**	The goal was to identify the prevalence, perpetrators, and causes of violent incidents, and facility-level characteristics at Veteran's Administration facilities that might guide intervention strategies	**Survey sent to all employees- only one was sent secondary to labor partners' concerns about coercion & possible reprisals for not completing the survey;** *Regression, plus worked on creating 'meta-factors' out of a bunch of factors that had co-linearity*	**All full & part-time staff of Veteran's Health Administration in US were eligible (not contracted labor, etc.). 72,349 usable responses at 139 facilities.**	**7 items on survey asking about # of incidents in past year. Perceptions of safety**; Indicators of satisfaction & organizational effectiveness. Hours & shifts. Mandatory OT, switching shifts, & floating + other items of work stress; *None noted*	13% of employees across 139 facilities reported 1 assault or more (1% to 26% between facilities). Floating, shift-switching, & mandatory overtime all increased risk of assaults. LPNs & RNs most likely to be assaulted by patients; nursing assistants (NA) & wage grade staff most likely to be assaulted by co-worker. NAs had highest assault rates, but felt safest. No relationship between proportion of individuals in each facility receiving training on managing & preventing disruptive behaviors & proportion of assaults. If you take out assaults by patients, clinical staff have much lower rates than other occupations. Highest proportion of staff assaulted in geriatrics, then extended care, then acute/specialty, then psychiatric areas

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Kowalenko, Walters, Khare, & Compton; **Workplace violence: a survey of emergency physicians in the state of Michigan**, *Annals of Emergency Medicine*; **2005**	To assess the experience of attending ED MDs within Michigan about violence in the workplace & to detail their reaction to such acts	**Surveys sent to MDs, asking for demographic information & other questions; Chi-square** *& binomial tests; 95% CIs reported, proportions for categorical variables*	**Out of 400 attending emergency medicine MDs in MI, 250 were sent questionnaires, 177 returned for 70% response, but 6 had missing responses and were excluded (68% total response)**	**Self-report. 4 types of violence: verbal threat-directly and specifically menacing, physical assault- physical contact of unwanted nature, confrontation outside of the immediate encounter-by patient or family or others, & stalking-unwanted or threatening contact persistent over time**; Type of facility, reason the patient attacked. Experience of MD. Security in ED; *Recall bias, subjective opinion whether a patient was intoxicated or had mental illness*	130 of 177 had at least 1 violent act. 128 had verbal threat, 48 (28.1%) had physical assault, 20 confrontation outside ED, & 6 had stalking. Those who were threatened and/or were assaulted had less experience than those who weren't. MDs described 45% of assaultive patients as intoxicated. 27% work where security staff are always in ED. 38% of respondents purchased a gun or knife because of the violence they experienced.

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Privitera, Weisman, Cerulli, Tu and Groman; **Violence toward mental health staff and safety in the work environment**, *Occupational Medicine*; **2005**	To study the prevalence of endangerment, threats, & assaults and determine sites of greatest incident frequency & perceived safety. Other key topics of inquiry included sources of violence and reporting to police/pressing of charges	**7-page survey to the employees of a department of psychiatry. Asked demographic data, violent events past 1 year, 1-5yr, 6-10yr, >10yr. Different questions to get at a sense of safety score;** *Used Generalized Estimating Equations in Poisson Regression*	**742 hospital employees working in psychiatric departments. Clinicians and non-clinicians were all given survey. 380 returned surveys- 80% responses were by women & 69% were clinicians**	**Assessed endangerment (though did not define for subjects), assaults & threats (defined)**; Experience, place of work, clinician vs. non-clinician; *Recall bias, with a potential of greater than 10 years of lag time between event and recall date*	55% of clinicians received threats, 14% of non-clinicians did. 34% of clinicians (8% non) experienced assaults. Authors stated that experienced staff had less violent acts, but the results do not reflect this position. Others are similar to other research: ED & inpatient psychiatric areas the most likely to have acts of violence.

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Flannery, Marks, Laudani, & Walker; **Psychiatric patient assault and staff victim gender: fifteen-year analysis of the Assaulted Staff Action Program (ASAP)**, *Psychiatric Quarterly*; **2007**	How much does gender play a role in risk for assault from patients in psychiatric areas (both inpatient and outpatient/ambulatory)	**Assaultive patients at Massachusetts Department of Mental Health who received care in 7 hospitals & 9 community programs-monitoring took place over 15 years. 1071 male & 1049 female staff: 64% mental health workers, 25% nurses, & 8% clinicians. ASAP is crisis intervention team to help with psychological sequelae following patient assaults;** *Chi-square tests of injuries in each period*	**1047 male (806 inpatient, 241 ambulatory) and 1056 female (766 inpatient, 290 ambulatory) assaultive patients**	**Assaults: unwanted contact with another person with intent to harm, including punching, kicking, slapping, biting, spitting, and throwing objects directly at staff. But also sexual assaults, nonverbal intimidation, verbal threats also part of investigation**; Gender and setting; *None noted*	Male patients almost twice as likely to harm male staff, same for female patients. Some evidence that men are becoming less violent and women more violent over the 15 year timespan.

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Kansagra, Rao, Sullivan, Gordon, Magid, Kaushal, Camargo, & Blumenthal; **A survey of workplace violence across 65 U.S. emergency departments**, *Academic Emergency Medicine*; **2008**	The purpose of this study was to examine more broadly workplace violence and perceptions of personal safety in EDs	**Survey- National ED Safety Study- surveys to the ED personnel. Random sample at EDs with more than 80 employees (sent to 80 employees at these institutions) & sent to all employees for those <81;** *Three multivariate analyses to determine which respondent and ED characteristics were associated with perception of safety and which ED characteristics were associated with increased frequency of attacks and weapons*	**Staff at the 65 emergency departments. 5695 surveys sent out, 66% overall response rate. At 4 hospitals, response rate was 45% or less and these were eliminated to control for non-response bias. 3518 surveys were included in the final analysis**	**Answer to the question 'total number of physical attacks by ED patients (or visitors) on ED personnel over the past 5 years'**; Screened with metal detectors, 24-hour security coverage, are ED MDs & RNs trained in techniques to manage violence, & how often patients & visitors found with weapons; *Age, gender, ethnicity, race, occupation, and number of years worked. The model also controlled for ED characteristics, including ED type, number of visits, and region*	73% felt safe most of time or always, 19% sometimes, & 8% never or rarely felt safe. 3461 attacks over 5-year period. Nurses were 5 times less likely to feel safe than MDs, physician's assistants, or nurse practitioners. Those with more experience felt less safe. Whites felt safer than other races. No decrease in violence at hospitals with violence prevention education.

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Estryn-Behar, van der Heijden, Camerino, Fry, Le Nezet, Conway, and Hasselhorn; **Violence risks in nursing--results from the European 'NEXT' Study**, *Occupational Medicine*; **2008**	To investigate the prevalence of violence from patients and their relatives/visitors in different clinical areas, to test the influence of teamwork characteristics upon violence, to examine the relationship between violence and burnout and intent to leave nursing, and to examine changes in levels of violence over time	**Survey, and then re-survey in 8 European countries;** *Chi-square tests of baseline measurements. Multivariate analyses for prediction of violence at baseline. ORs computed and all predictor variables with $p<0.05$ included in multivariate logistic regression model. Similar procedure to test association between exposure to violent events and intention to leave & burnout*	**In 10 European countries, a stratified sampling procedure was used in each country to reflect national distribution of nursing staff by workplace, geographical spread, & public or private funding. Survey was sent to 77,681 nurses. Approximately 40,000 responded, with 13,537 participating in both initial survey & follow up**	**Answer to the question, 'At your work place, are you subjected to violence from patients or their relatives?': never, very seldom, monthly, weekly to daily (dichotomized 'never or very seldom' vs. more). Second outcome with violence as exposure is intention to leave and burnout**; Many: teamwork, RN & MD relationship, hours worked, time pressure, qualifications of nurse, age, quality of information sharing, harassment by supervisors; *None noted*	22% had frequent exposure to physical violence (most common in France, UK, & Germany), psychiatric areas & ED most common for violence, shift work outside of daytime hours associated with physical violence. Younger, nursing assistants, and male gender all correlated with violence. Uncertainty regarding treatment, quality of teamwork, harassment by supervisors, time pressure score, frequency of interruptions, and shift work all highly correlated and significantly associated with burnout, intent to leave nursing (especially burnout)

Heick, Young, Peek-Asa; **Occupational injuries among emergency medical service providers in the United States**, *Journal of Occupational and Environmental Medicine*; **2009**	To describe the incidence and characteristics of nonfatal occupational injuries among emergency medical service providers in the US and examine the relationship between employee status and injury	**Survey. Demographics: age, gender, state of residence, certification level, length of service, number of calls per week, and average number of hours per week. Type of service, size of community, whether they transported patients, & then injury questions;** *Fisher exact test and Chi-square were used to compare employment type (volunteer vs. paid) against demographic variables and proportion willing to report injuries. Logistic regression used to determine ORs between volunteer vs. paid EMS providers*	**National Registration of EMT-certified providers (230,000), stratified sample of 3 levels (basic, intermediate, & paramedic). 1981 sampled, 675 completed the survey**	**Work-related motor vehicle crashes, assault, back injuries and back pain, slips or trips or falls and other injuries, that had occurred in the last 12 months**; Main one is type of service (volunteer vs. paid), then emergency medical service providers vs. firefighter, etc.; *More of the respondents were female and came from North Central vs. East Coast (all statistically significant). Impact of gender on injury & number of calls per week were confounders controlled for*	More volunteers came from smaller communities (<25,000 residents) vs. paid. 30% of EMS workers reported an injury, with 64% of those reporting multiple injuries over a year. 23% of total respondents reported an assault, with 12.9% of these assaults causing an injury. Paid providers were 2.7 times more likely to report assault.

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Casteel, Peek-Asa, Nocera, Smith, Blando, Goldmacher, O'Hagan, Valiante, & Harrison; **Hospital employee assault rates before and after enactment of the California hospital safety and security act**, *Annals of Epidemiology*; **2009**	To compare pre- & post-enactment employee assault rates in California ED & psychiatric units with those in New Jersey over the same time period (where there are no laws to address healthcare workers' safety in regards to violence)	**Looked at assault rates in ED & psychiatric units for the 3 years pre- & 6 years post-enactment of the CA hospital safety and security act;** *Pattern of assault behavior was graphed over time & then analyzed using Poisson regression for within hospital violence over time*	**New Jersey chosen as a comparative state, as distribution of urban hospital types is similar in both states. Population of interest is ED & psychiatric units in hospitals with counties of populations greater than 250,000. Random stratified sample by type & location (25 counties in CA & all counties in NJ). 95 hospitals in CA & 46 in NJ**	**OSHA-recorded violent injuries per 100,000 employee hours per year 1993-2001**; Hospital department (ED vs inpatient psychiatric), type of hospital, for profit vs. not for profit, location of hospitals within county; *None noted*	Assault rates decreased in pre- vs. post- for CA EDs from 0.68/100,000 hours per year to 0.60; NJ hospitals increased from 0.55 to 0.62 assaults post enactment time. It looks like rates remained stable in CA EDs, though they increased in NJ, giving a rate ratio of 0.52. in both states, assault rates in inpatient psychiatric units increased, though to a much greater degree in NJ. Perhaps laws help decrease violence, but the authors note there was a bigger decrease in the years just post-enactment, suggesting enforcement may be down as time progressed

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Gacki-Smith, Juarez, Boyett, Homeyer, Robinson, & MacLean; **Violence against nurses working in US emergency departments**, *The Journal of Nursing Administration*; **2009**	To investigate emergency nurses' experiences and perceptions of ED violence, the types and frequencies of assaults in the ED, and contributing factors to ED violence	**Surveys sent to all ED RNs part of the Emergency Nurses Association (ENA);** C*hi square tests & Fisher exact test for independent groups & percentages. Kruskal-Wallis & Mann-Whitney U tests for noncategorical variables*	**All 31,905 Members of ENA who worked in US EDs asked to answer to survey (convenience sample) 3,465 completed the survey (approximately 11% response rate)**	**Asked respondents to say what type of violence. Physical & verbal violence. Then reporting of the violence as an outcome variable**; Shift, type of population, demographic, experience; *Places that have security have more risk for violence (but security is probably warranted)*	Over 50% of respondents had physical violence over 3 years; over 70% had verbal abuse. More frequent violence is positively associated with male gender, working weekends & nights, working in organizations with fewer policies for reporting workplace violence, & participant reporting feeling that violence is part of practice. Barriers to reporting: worries of a negative effect on customer service scores, ambiguous reporting policies, reporting understood to be a sign of weakness, fear of retaliation from management, lack of actual injury, "comes with the job," & lack of support

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Shields & Wilkins; **Factors related to on-the-job abuse of nurses by patients**, *Health Reports/Statistics Canada*; **2009**	Examine the extent to which RNs in Canada are physically abused by pts, and how relates to characteristics of RNs, job variables, & workplace climate factors. Finally, how are workplace factors (staffing & resources, RN-MD relations, & support f/co-workers & supervisors) associated with abuse independent of personal & job factors	**30-minute telephone survey over the course of 3 months;** *Bivariate estimates for factors associated with assault & abuse. Logistic regression for workplace factors. Used bootstrap technique to estimate SEs, coefficients of variance & 95% CIs*	**2005 national study of nurses' work and health. Random sample of all RNs (from all Canadian territories' membership lists). 24403 RNs sampled, 21307 contacted, 18676 gave complete responses; restricted to 12,218 nurses working in hospitals or long-term care (218,300 nurses in Canada meet this restriction). Data weighted to give equal representation for RNs, LPNs, & psychiatric RNs**	**In past 12 months did you experience physical abuse from a patient? In past 12 months did you experience emotional abuse from a patient? (No further explanation or definition given to the participant)**; Characteristics of RN, job variables, & workplace climate factors; *Attitudinal factors- gloomy outlook (poor mental health & job dissatisfaction). More experience is presumed to be associated with less assaults*	34% reported being assaulted, 47% reported experiencing emotional abuse. Staffing/resource adequacy strongly correlated with risk for assault, same with RN-MD relations (most reported good relations), supervisor support (25% reported low support), & coworker support. With multivariate analysis, staffing/resources strongest influence on ORs for assault, though coworker support also played a significant role. Male nurses reported more violence. Strong evidence that the more experience, the less injuries. Fair or poor mental health associated with more assaults. Job satisfaction closely related to assaults. More evidence that more bachelor-prepared nurses at a facility is associated with less assaults. More assaults in long term care/geriatrics, palliative, psychiatric areas, critical care, ED. Lots of emotional abuse reported among ED staff.

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Roche, Diers, Duffield, & Catling-Paull; **Violence toward nurses, the work environment, and patient outcomes**, *Journal of Nursing Scholarship*; **2010**	Medical/Surgical nurses' perceptions of violence in 94 wards in 21 hospitals in Australia and to study the outcomes for patients	**Survey: 49 items on job satisfaction, intention to leave & 3 questions regarding perception of violence over past 5 shifts. Shift data captured & included information on nursing interventions left undone, staff levels & adverse events;** *For missing data, imputed ward mean. Explanatory variables were added to statistical models in sequence, and the properties of each newly expanded model were compared to those of the previous one (using the −2 log likelihood value). Regression*	**All staff from 94 randomly selected med/surg wards-staff and patient data were recorded over 7 days on wards. In addition, there was a survey to 3,099 potential respondents, with 80.3% response rate**	**"In past 5 days have you experienced physical assault, threat of assault, or verbal abuse?"**; Skill mix, RN/MD relations, patient factors (waiting for care), unit factors (busy-ness of unit), manager support; *No data on case mix of patients between the units*	14% experienced physical violence in previous 5 days. Better skill mix (more RNs & more BSNs associated with less violence). Physical violence associated with patient falls & med errors. Violence also associated with not finishing tasks. When proportion of patients waiting for care increased, the number of staff experiencing violence increased. Wide variability between units reporting physical violence in previous 5 days. Variations in the structure of the hospital, it's size, or rural/urban location were not significant in statistical models. Emotional abuse correlated with intent to leave, but not with other outcomes, such as adverse events.

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Behnam, Tillotson, Davis, & Hobbs; **Violence in the emergency department: a national survey of emergency medicine residents and attending physicians**, *The Journal of Emergency Medicine*; **2011**	Estimate the proportion of MDs who had experienced at least one type of violent act in past 12 months to within 5% of true proportion; also sought to get information on various prevention strategies	**Survey these sampled MDs-online. 34 multiple choice & 4 free response;** *Compare MDs who had experienced different types of violence vs. those who haven't, no real statistical analysis, more descriptive*	**All ED MDs in US with a residency program are the populations of interest, 134. 65 programs were randomly selected. Residency coordinator at each facility was contacted and invited residents and attending providers to participate in study. 263 MDs completed the survey from only 37 programs. Residents were 70% of respondents, but no information on overall response rate**	**Verbal threats, physical assaults, confrontations outside workplace, & stalking**; Demographics, ED volume, security in ED, availability of self-defense or other workshops, screening for weapons, perpetrator information, whether a report was filed, day/night shift; *None noted, though non-response rate may be an issue*	271 types of violence reported. Over 75% reported violent act in the past year. 27% had an assault. Violence more common in ED >60,000 visits. Felt most of the agitators were intoxicated. Most assaults happened at night. 1 in 10 reported a weapon being brandished. Most of the ED MDs surveyed did not have training available and did not screen for weapons.

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Arnetz, Aranyos, Ager, & Upfal; **Development and application of a population-based system for workplace violence surveillance in hospitals**, *American Journal of Industrial Medicine*; **2011**	Aim of the study is to (1) link data from a workplace violence (WPV) reporting database to human resources database to assess quality of data, (2) get rates of WPV in person-time, (3) examine nature and frequency of types of violence, & (4) examine trends in reporting incidents over time (a five-year period)	**Matched the report data of violent events with human resources data to get demographics on people who reported violence;** *Descriptive statistics (frequencies, incidence rates), then rate ratios with 95% CIs against the lowest rate employment category. Areas (cost centers) with an incidence < 0.19 were considered to be rare for WPV*	**7,687 employees at 6 hospital sites in a healthcare system**	**From violent incident reports Type I-IV perpetrator types (burglar [someone with no direct business with being at the facility], customer, fellow employee, personal relationship with another employee), then broken down to assault, combative patient, combative person, conflict, harassment, sexual harassment, threat & unprofessional behavior**; Type of facility, job class, type of unit; *Differing attitudes towards workplace violence. Differences in patient populations*	More Type III violence (employee-employee) than Type II (customer-employee). Almost 1/2 of incidents were non-physical conflict, 25% were assault, 21% combative patient. In terms of rates, mental health technicians had highest rate of reported violence by a large degree, then security, health unit coordinators, personal care assistants, & nurses. However, the highest numbers were among nurses (most Type II & Type III). Most (62%) incidents resulted in no injury.

Kelen, Catlett, Kubit, & Hsieh; **Hospital-based shootings in the United States: 2000 to 2011**, *Annals of Emergency Medicine*; **2012**	Comprehensively review hospital-related shootings from 2000-2011	**Search in LexisNexis, PubMed, Google, Netscape, & Bing, using "hospital shooting," "hospital violence," "assaults on HC providers," "shooting of healthcare workers," and "guns & hospitals";** S*hooting rates per 1,000 hospitals (based on US survey)*	**All US hospitals. 9,360 headlines were reviewed by 2 reviewers. Articles included only if shooting occurred at acute care hospital and at least one person was injured**	**Shootings with injury**; Hospital info, specific event locations, perpetrator & victim characteristics, outcome of injuries, & apparent motive. Categorized based on perpetrator's relation to workplace; *None noted*	154 shooting events (a bit more than 10 per year) in 148 hospitals with 235 victims (26.6 events per 1,000 hospitals 0.79 victims per 1,000,000 population). 44% of events in Southern states, northeast region had least. FL, CA, TX, OH, NC accounted for 1/3 of events. Large hospitals (>400) had highest incidence at 99.8 events per 1,000 hospitals). Almost 1/3 of events happened in EDs, some occurred in patient rooms, some outside. Grudge or revenge most frequent (27%) determined reason, followed by suicide (21%), escape attempt was 11% of events. MDs only 3% of victims, RN 5%, security 5%, perpetrator 45%, other patients 13%, visitors 8%. In 8% of cases the shooter grabbed security's gun. 29% of ED cases, the perpetrator was already in custody. Inner city location or dangerous neighborhood not associated with more hospital shootings. Few patterns overall to suggest ways to identify hospitals more at risk than others. Metal detectors probably don't work- most of the weapons would not have likely been confiscated by using them.

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Medley, Morris, Stone, Song, Delmas, & Thakrar; **An association between occupancy rates in the emergency department and rates of violence toward staff**, *The Journal of Emergency Medicine*; **2012**	To determine the relationship between increased ED occupancy rates & rate of violence toward ED staff	**Looked at all orders for Emergency Detainment, physical/chemical restraints, & incident reports for any violent incidents, looked at patients responsible, then occupancy rate for day & other similar factors;** *Exposures of interest summarized by study group (violent patient vs. non-), comparisons made using a 2-sample t-test. Logistic regression, odds ratios for presence of violent incidents*	**220,004 pts who visited ED over 42-month period**	**Reviewed charts for patients being violent "Unwelcome physical contact of any kind; Verbal threat of physical harm"**; Occupancy rate. Patient-MD ratio, Patient-RN ratio, number of patients left without being seen, & average length of stay (triage time until disposition); *None noted*	278 violent incidents with 1.3 incidents/1000patients served in ED. Occupancy rate on violent days 95% & 86% on non-violent days. Patient-MD ratio also significant. Authors state Patient-RN ratio not significant in this study.

Kowalenko, Gates, Gillespie, Succop, & Mentzel; **Prospective study of violence against ED workers**, *American Journal of Emergency Medicine*; **2013**	Describe the incidence of violence in ED healthcare workers over a 9-month period: Identify demographic, occupational, & perpetrator factors. examine acute stress, productivity, & feelings of safety & confidence among the staff. Secondary aim to identify predictors of acute stress response among victims of violence & predictors for loss of productivity	**Longitudinal repeat measure. Surveys given out once a month for 9 months. Violent event survey, Stanford Stress survey, & productivity survey;** *Descriptive statistics for violent events, subject, workplace, & perpetrator characteristics. Repeat measure linear regression for prediction of violent events, stress disorder, & productivity*	**6 hospitals in 2 states. 2 Level 1 traumas, 2 non-trauma center hospitals, & 2 suburban hospitals. Both trauma hospitals have separate psychiatric & adult only EDs. Staff were invited to participate, and participants had to work a minimum of 20 hours per week. 213 healthcare workers volunteered to be part of the study (& intervention study following): 117 RNs, 39 MDs, & 22 patient care assistants**	**Physical assaults& physical threats conveying threats of physical injury serious enough to unsettle your mind. Intent to inflict pain, injury, or punishment**; Feelings of safety & feelings of confidence. demographic, occupational, & perpetrator factors; *Convenience sample could have contributed to lower rate and biased results*	RNs with twice as many events as MDs. Mean of .46 violent events/person-month or ~5.5/person-year (1.5 assaults & 4 threats /person-year). Almost half of the assaults were perpetrated by women. RNs more likely to have stress after violent event. Violent events by male perpetrators resulted in statistically significant productivity losses. No differences in event rates between different types of hospitals (same at trauma as urban as suburban). <50% of events reported to hospital. Injury resulted in higher stress scores. No statistically significant differences in violent events based on sex or age of employee, time of day, hours worked per week, or hospital type. MD/physician's assistant more confident that they could handle violent patients than RNs (however, when sex is added to regression, loses significance). Those with graduate education less likely to be assaulted than those with 2 or 4 year degrees.
Restraints					

Author(s); **Title,** *Journal*; **Publication Date**	**Purpose of Study**	**Methods: Study Design;** *Analytic Plan*	**Population: Number of Subjects, Subject Characteristics if available**	**Relevant Variables: Dependent (outcome);** Independent (exposures of interest); *Potential Confounders*	**Results & Notes**
Lancaster, Whittington, Lane, Riley & Meehan; **Does the position of restraint of disturbed psychiatric patients have any association with staff and patient injuries?**, *Journal of Psychiatric and Mental Health Nursing*; **2008**	The aim of the research was to identify whether restraint position was associated with an increased risk of non-fatal injury to either staff or patients	**Data examined from incidence database in health trust in northwest England over 3 years of physical interventions and patient & staff outcomes (injuries);** *Mixed effects logistic regression was used to estimate the relative odds of injury to staff or patient*	**Unit of analysis is the incident of physical intervention used at the one health trust**	**Report in incidence reports**; Used blocks of variables: demographics, external factors, interpersonal factors, personal gain, aggravated behavior, aroused behavior; *None noted*	680 incidents of using physical intervention. Staff were injured in 17% of these cases & patients injured in 4% of them. The situations where patient was most likely injured are: attempt at self-harm, abusing a substance, & using a weapon. Interesting thing for my purposes is that staff are more likely to get injured in the application of restraint than the patient. But, this is all based on self- report, so staff might be more sensitive to their own injuries vs. the patients'

Moylan & Cullinan; **Frequency of assault and severity of injury of psychiatric nurses in relation to the nurses' decision to restrain**, *Journal of Psychiatric and Mental Health Nursing*; **2011**	1. Nurses with a history of being assaulted will make an earlier decision to restrain than nurses who do not. 2. Nurses with a history of violence-related injury will make an earlier decision to restrain than nurses who do not. 3. Comparing the data in current study with data from a prior study before more restrictive restraint policies were enacted	**Watch a video & say at which moment (second) he or she would need to restrain as only safe option. Then did a survey after. Field notes from interviews after video/survey provided qualitative data;** *"Used SPSS" and coded the qualitative notes into themes.*	**Convenience sample. 110 psychiatric nurses with at least 1 year of experience and had complete surveys. They came from 5 different hospitals in NY area**	**Self-reported assault (noxious physical contact by patient during time of aggression). Then info about most serious assaults (time off, medical treatment, etc.)**; Main ones- whether assault affects decisions to restrain, but also demographic factors; *Not random sampling at all with no discussion of differences between previous sample and current other than more male nurses, so only compared female nurses. Unknown whether the surveys were precisely the same? Else can't compare.*	80% of the nurses had been assaulted; 65% injured (82% of assaulted got injured). 13 of them lost more than a month of work days. No differences related to occupational position, shift, type of institution, or degree. Men had more assaults. Staff experiencing assaults was associated with a later decision to restrain; staff who experienced severe injury an even later decision to restrain. Probably most alarming is that many participants did not decide to restrain until the patient in the video was actively strangling the nurse (averaged a later decision to restrain than previous study in 1996, perhaps as a result of changing mores around restraint?) Nurses often felt blamed by management for injuries- were told to come back to work or else be disciplined. Need supportive management. "The 4th theme to emerge was that the psychological and emotional trauma of assault and injury is routinely ignored and is often more long lasting than the physical effects."
Staffing Ratios					

Author(s); **Title,** *Journal*; **Publication Date**	**Purpose of Study**	**Methods: Study Design;** *Analytic Plan*	**Population: Number of Subjects, Subject Characteristics if available**	**Relevant Variables: Dependent (outcome);** Independent (exposures of interest); *Potential Confounders*	**Results & Notes**
Clarke, Rockett, Sloane, & Aiken; **Organizational climate, staffing, and safety equipment as predictors of needlestick injuries and near-misses in hospital nurses**; *American Journal of Infection Control*; **2002**	How do nurse characteristics, specific protective equipment, and staffing & organizational climate contribute to the risk for needlestick injuries (NSI) and near-misses	**Surveys were analyzed to compare the various independent variables against the risk of NSI;** *To examine the relationship between the length of nursing experience and remaining NSI-free, the authors constructed a Kaplan-Meier curve, to examine the occurrence of NSI and near misses in the past year, logistic regression was used with the hospital as a clustering variable in GEE to estimate the odds of NSI and near-misses with various factors*	**22 hospitals agreed to be part of the study to have nurses surveyed. Questionnaires were sent to 4085 eligible nurses, with 2287 completed questionnaires**	**Self-reports of needlestick injury- nurses were asked if they ever had been stuck with a blood-contaminated needle or sharp object in past year & and asked if any near-misses with a needle or sharp in past month**; Organizational climate (support, encouragement, & average nurse experience), nurse staffing, protective equipment on the needles, and nature of work with perceived risk factors (venipuncture, handling blood samples, etc.), & compliance with universal precautions; *None noted*	Importantly here, there was a significant negative correlation between staffing levels and risk of needlestick injury & higher risk with lower staffing experience

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Spetz, Donaldson, Aydin, & Brown; **Using minimum nurse staffing regulations to measure the relationship between nursing and hospital quality of care**, *Health Services Research*; **2008**	To compare alternative measures of nurse staffing and assess the relative strengths and limitations of each measure	**Analyzed 4 different sources of staffing ratio data: 2 hospital-level sources of data: American Hospital Association's Annual Survey of Hospitals & CA's Hospital Planning statewide annual disclosure report. 2 unit-level data sources: CA Nurses Outcomes Coalition and CA Workforce Initiative;** *Compared the means and frequency distributions for these measures, using t-tests & Pearson correlations and Spearman (rank) correlations were computed for each comparison*	**All hospitals in CA were studied to determine accuracy of measurements**	**Most accurate way to use describe hours worked**; Can be measured by FTE/patient days to determine workload. Most common (and usefully compared across institutions) is hours per patient day HPPD; *None noted*	It appears that there are measurement errors with using AHA data that gives hospital-level data. They do not segregate non-productive hours to productive and thus overestimate how many nursing hours are allotted to each patient. To my thinking, it still works well for relative comparisons, but it's tough to translate what it means to the individual unit when comparing against one's own unit.

Bowers, Allan, Simpson, Jones, Van Der Merwe, & Jeffery; **Identifying key factors associated with aggression on acute inpatient psychiatric wards**, *Issues in Mental Health Nursing*; **2009**	To assess the relationship of patient aggression to other conflict behaviors, the use of containment methods, service environment, physical environment, patient routines, staff demographics, and staff group variables	**At the end of each shift, nurses document whether and how many conflict and containment events occurred over the course of the shift and the form also contains information on how many staff were on each unit and what type of staff (regular nursing staff, agency, student nurses, 'unqualified staff'), also surveys were given to the nursing staff on leadership factors, ward atmosphere, team climate, and burnout, and ward data was collected by a research on the physical environment and various ward security practices;** *Multilevel random effects modeling, using Poisson regression with number of beds on*	**136 acute psychiatric wards with attending patients and staff in 67 hospitals in the UK during 2004-2005 There is no mention of response rate or how many of the end of shift reports were completed that constituted the data of the study**	**Verbal violence, object violence, & physical violence, all per staff report**; Patient-staff conflict checklist, which occurs at the end of every shift report. "data on patients (age, gender, ethnicity, diagnosis, reason for admission, and postcode)", also measurements of "Ward atmosphere", attitudes to containment, team climate, leadership, burnout inventory. Objective factors: ward observability (ease to see all inpatients), physical environment & security practices, & restrictions placed on inpatients; Response bias is potential issue. S*taff deployment policies, asymmetry of power and rule imposition difficulties, the potential of any staff-patient interaction to result in an adverse outcome when the patient is acutely ill, and the general level of staff interpersonal skills*	More staff is associated with more aggressive behaviors (but this could be that because a ward is known to have more aggressive patients and the ward is staffed with more nurses). More restraint use is associated with more physically aggressive behaviors; again, there could be more restraint use in those areas because there are more aggressive patients. Positive relationship between aggressive incidents and restrictions on patients. Patient intoxication also associated with violent events (apparently psychiatric patients in the UK can get intoxicated?)

		wards as offset (verbal violence, object violence, & physical violence were the 3 dependent variables)			

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Patrician, Pryor, Fridman & Loan; **The association of shift-level nurse staffing with adverse patient events**, *American Journal of Infection Control*; **2011**	To investigate the association between shift-level staffing and needlestick injuries (NSI)	**These hospitals reported on staffing levels and various patient and nurse outcomes. NSI data were acquired from occupational health department or safety department. Had a research associate at each site collect the required info on staffing levels and injuries;** *The probability of needlestick injury was modeled using hierarchical logistic regression. Sounds like this hierarchy is a fancy way to talk about stratification according to several variables at once- unit, days, & shift in this case*	**Used the MilNOD- Military Nurses Outcomes Database. 57 units in 13 different hospitals. 108,000 shifts from 54 units were usable for this analysis**	**Self-reports of needlestick injury. This was collapsed so that only one event could happen per shift, but two events in one shift only happened once**; Three measures of staffing were used: skill mix, staff category mix (whether military or not), and total nursing care hours per patient per shift; *Regression covariates included hospital size, shift time (day, evening, or night), daily patient acuity, day of the week, year of data collection, and daily patient census*	There was an overall rate of 0.07% for nurses- 80 injuries in 108,000 shifts. 17.5 per 1,000 FTE over 4 years. More RNs staffed per patient significantly associated with decreases in NSI. A decrease in total staff hours per patient per shift associated with increased risk for NSI. More civilian RNs staffed in the unit also associated with less NSI, the civilian RNs had 9 years more experience on average than military RNs.

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Bowers & Crowder; **Nursing staff numbers and their relationship to conflict and containment rates on psychiatric wards—A cross sectional time series Poisson regression study,** *International Journal of Nursing Studies*; **2012**	To assess whether staffing levels change before or after violent events happen in inpatient psychiatric wards	**At the end of each shift, nurses document whether and how many conflict and containment events occurred over the course of the shift and the form also contains information on how many staff were on each unit and what type of staff (regular nursing staff, agency, student nurses, 'unqualified staff');** *"Cross sectional time series mixed effects Poisson regression" comparing the 9 shifts before and 9 shifts after conflict or containment events occurred*	**136 acute psychiatric wards with attending patients and staff in 67 hospitals in the UK during 2004-2005**	**Both major variables of interest were treated as independent and dependent in order to understand the nature of the relationship: Number of conflict and containment events and staffing levels for each shift (number and quality of staff per patient)**; Admissions over the shift, type of staff (agency, regular nursing staff, unqualified staff, student nurses), shift (night, evening, day), day of the week; *Variances in reporting between units/institutions may have caused bias, also variances in patients' symptoms*	The results show that there are increases in staffing levels before there are increases in conflict and containment events. In addition, the study found that when there are more qualified, regular staff there are more conflict and containment events. Interesting, as the results are the opposite of what would normally be assumed. Authors posited that more qualified staff are more likely to engage with the mentally ill and less likely to give in to requests.

Staggs; **Nurse staffing, RN mix, and assault rates on psychiatric units**, *Research in Nursing & Health*; **2013**	To investigate an association between nurse staffing and patient violence on psychiatric units and whether there is an association between nursing skill mix and violence on psychiatric units	**Assaults per patient day & Injury assaults per patient day compared between different staffing levels (total nursing care hours per patient day; RN mix was percent of total care hours during the unit-month provided by RNs);** *Used general linear modelling, assuming a Poisson-like distribution, but controlled for the overdispersion*	**Monthly data on staffing and assaults were collected from 351 adult psychiatric units in 255 U.S. hospitals; 3,397 unit-months (from NDNQI- a voluntary database that hospitals are members of)**	**Assault = any unwanted physical contact, including sexual, initiated by a patient toward another person. Unit staff classify each as an injury or non-injury. For each injury assault, injury level is reported (mild, moderate, severe, or death) and to classify the assault as a non-repeat assault (1st assault by patient in calendar month) or a repeat assault**; Total nursing care hours per patient day: RN mix was percent of total care hours during the unit-month provided by RNs. **Modeled the hours per patient day with RN hours as an interaction term**; *Controlled covariates: unit locked status (locked or unlocked), hospital type (psychiatric or general), and hospital teaching status (teaching or nonteaching)*	Very interesting- higher staffing levels strongly associated with higher assault and assault injury rates. But, at the same time a higher RN mix was associated with lower rates- "A random hospital intercept was included in each model to account for the nonindependence of units within the same hospital, and a random unit intercept was included to account for dependence among each unit's repeated measures. A complicated study, but with some important ramifications, potentially

Appendix D

SAS Code for Security Worker CEW Investigation

```
DATA hc4_7;
SET 'C:\Asus WebStorage\gram0066@umn.edu\MySyncFolder\SAS Data\New data
sets\hchrs.sas7bdat';
DROP  PP_YY End_MM DT_DD Dept Department_Title Unit_Title Jobcd
E001TTTL__Regular_Hours
   VAR17 VAR19;

yearfull = 1900+Birth_Year;

dob = mdy(6,30,yearfull);
format dob mmddyy10.;

/*To get sum hrs of ST, OT, code below*/
Hours = SUM(E001HRS_Reg_Hrs, VAR16, VAR18);


/*To create the beginning of the payperiod, the code is below*/
pp_start = Payperiod___End_Date - 13;
format pp_start mmddyy10.;
/*!!When I merge the total groups, I will need to make sure I only
include the
Payperiod___End_Date is less than 3/18/2007, otherwise there will be
overlapping data*/

ageobs = INT( (Payperiod___End_Date - dob)/365.25);
expobs = INT( (Payperiod___End_Date - Last_Start_Date)/365.25);

 IF Job_Title = 'HCMC HEALTH CARE ASSISTANT' then jobgrp = 3;
 IF Job_Title = 'HEALTH CARE ASSISTANT' then jobgrp = 3;
 IF Job_Title = 'HCMC NURSE, ROSTER' then jobgrp = 1;
 IF Job_Title = 'NURSE, ROSTER' then jobgrp = 1;
 IF Job_Title = 'HCMC NURSE STAFF' then jobgrp = 1;
 IF Job_Title = 'HCMC NURSE, STAFF' then jobgrp = 1;
 IF Job_Title = 'NURSE, STAFF' then jobgrp = 1;
 IF Job_Title = 'HCMC NURSE SENIOR STAFF' then jobgrp = 1;
 IF Job_Title = 'HCMC NURSE, SENIOR STAFF' then jobgrp = 1;
 IF Job_Title = 'NURSE, SENIOR STAFF' then jobgrp = 1;
 IF Job_Title = 'HCMC MEDICAL CENTER PROTECTION OFFICER' then jobgrp =
2;
 IF Job_Title = 'MEDICAL CENTER PROTECTION OFFICER' then jobgrp = 2;
 IF Job_Title = 'HCMC SECURITY SUPERVISOR' then jobgrp = 2;

 if Hours = 0 then delete;

RUN;
   /*At this point, the data looks like it will merge well with the
daily hours,
```

```
  now I need to work on transposing the violent injuries so they can be
captured
  in the payperiod*/
PROC SORT DATA= hc4_7 OUT= sort4_7;
 BY ID pp_start;
 RUN;

DATA inj4_7;
 SET 'C:\Asus WebStorage\gram0066@umn.edu\MySyncFolder\SAS Data\New
data sets\injcombine.sas7bdat';
 WHERE Date_of_Loss<'18mar2007'd;
 RUN;

DATA violinj4_7;
 SET inj4_7;
 WHERE violent="y";
 KEEP ID Date_of_Loss; /*At this point, there were 101 injuries, so an
equal # should be in the total later*/
 RUN;

PROC SORT DATA= violinj4_7 OUT= sortinj4_7;
 BY ID Date_of_Loss;
 RUN;

PROC TRANSPOSE  DATA= sortinj4_7
     OUT= transinj4_7
     NAME= ID
     PREFIX= violinj;

  BY ID;
 RUN;

DATA merge4_7;       /*by merging these two sets, I then got the
injuries to merge*/
  MERGE transinj4_7 sort4_7;  /*many (injuries) to one ID. Next step is
to say violent injury*/
  BY ID;        /*within that day makes the same named violent injury as
1*/

 If violinj1 >= pp_start and violinj1 <= Payperiod___End_Date then
vinj1 = 1; else vinj1 = 0;
 If violinj2 >= pp_start and violinj2 <= Payperiod___End_Date then
vinj2 = 1; else vinj2 = 0;
 If violinj3 >= pp_start and violinj3 <= Payperiod___End_Date then
vinj3 = 1; else vinj3 = 0;
 If violinj4 >= pp_start and violinj4 <= Payperiod___End_Date then
vinj4 = 1; else vinj4 = 0;
 If violinj5 >= pp_start and violinj5 <= Payperiod___End_Date then
vinj5 = 1; else vinj5 = 0;
 If violinj6 >= pp_start and violinj6 <= Payperiod___End_Date then
vinj6 = 1; else vinj6 = 0;
 If violinj7 >= pp_start and violinj7 <= Payperiod___End_Date then
vinj7 = 1; else vinj7 = 0;
```

```
 If violinj8 >= pp_start and violinj8 <= Payperiod___End_Date then
vinj8 = 1; else vinj8 = 0;

 vinj = SUM(vinj1, vinj2, vinj3, vinj4, vinj5, vinj6, vinj7, vinj8);
 If ID = 603281 and pp_start = MDY (02,06,2005) then vinj = 1;
 TASER = 1;

 loghours = LOG( Hours );
         /*!!the payperiods where there were no hours caused a problem,
need to delete!!
         I deleted the no hours ones & lost 2 injuries. Went back to
the original data and
         found the 2 injuries and put in 0.01 hrs in the pay period for
them to be
         included. Somehow on 4.26, I am still missing 3 injuries. So
what I did was
         examined the observations where violinj1-3 have dates present,
but vinj1-3 is
         missing. Have the date for injury, but doesn't correspond to a
date for EE. 4.30
         Andy gave me the code below to find the missing injuries. The
first injury I
         found was two years before the person started working in this
job, so shouldn't be
         included. Employee 255422 on 3/14/2004, and maybe he was
working a different job
         at the time. The second injury missing was from someone,
603281 on 1/29/2005, who
         had payable regularhours the week later. I excluded
orientation time, so that could
         be the reason it wasn't included. I included the injury in the
following week.*/

RUN;

proc means data = merge4_7 noprint;
    var vinj1 vinj2 vinj3 vinj4 vinj5 vinj6 vinj7 vinj8;
    by ID;
    output out = sumout sum(vinj1)=vinjsum1 sum(vinj2)=vinjsum2
sum(vinj3)=vinjsum3 sum(vinj4)=vinjsum4
sum(vinj5)=vinjsum5 sum(vinj6)=vinjsum6 sum(vinj7)=vinjsum7
sum(vinj8)=vinjsum8;
run;

data totmerge (keep = id vinj1prob vinj2prob vinj3prob vinj4prob
vinj5prob vinj6prob vinj7prob vinj8prob);
    merge merge4_7 sumout (drop = _type_ _freq_);
    by ID;
if first.id ne 1 then delete;
    if violinj1 ne . and vinjsum1 = 0 then do; vinj1prob=violinj1;
output; end;
    if violinj2 ne . and vinjsum2 = 0 then do; vinj2prob=violinj2;
output; end;
```

```
    if violinj3 ne . and vinjsum3 = 0 then do; vinj3prob=violinj3;
output; end;
    if violinj4 ne . and vinjsum4 = 0 then do; vinj4prob=violinj4;
output; end;
    if violinj5 ne . and vinjsum5 = 0 then do; vinj5prob=violinj5;
output; end;
    if violinj6 ne . and vinjsum6 = 0 then do; vinj6prob=violinj6;
output; end;
    if violinj7 ne . and vinjsum7 = 0 then do; vinj7prob=violinj7;
output; end;
    if violinj8 ne . and vinjsum8 = 0 then do; vinj8prob=violinj8;
output; end;

    format vinj1prob vinj2prob vinj3prob vinj4prob vinj5prob vinj6prob
vinj7prob vinj8prob mmddyy10.;

run;

/*4.20 It worked! The injuries & hours merged on many. It looks good.
Next step is to
create an injury variable out of the dates. 4.23- I did that, by
creating the new variable
vinj- which has the same name as the other merged data set. I wound up
with a count of
97, meaning I am missing 4 injuries in the end.*/

/*Next order of business will be to concatenate the data sets. I will
have to check all the
variable labels that they have the same names. I think I'll have to go
to the 7_14 data set and
change the Hours variable to sumhrs- nevermind, I fixed it onthe 4_7
data set.*/

DATA violentinj;
 SET 'C:\Asus WebStorage\gram0066@umn.edu\MySyncFolder\SAS Data\New
data sets\injcombine.sas7bdat';
 WHERE violent="y";
 RENAME Date_of_Loss = Report_Date;
 RUN;


PROC FREQ DATA= violentinj noprint;
 WHERE Report_Date>'17mar2007'd;
 TABLE ID*Report_Date / out=vinjcnt07_14;

 RUN;


DATA dailyhours1;
 SET 'C:\Asus WebStorage\gram0066@umn.edu\MySyncFolder\SAS Data\New
data sets\hrs7_14.sas7bdat'
   (KEEP = ID Hours TRC_Descr AGE Job_Title Last_Start_Date
Report_Date);
```

```
 WHERE TRC_Descr = 'Overtime Paid @ 1.5' or TRC_Descr = 'Regular' or
TRC_Descr = 'Overtime Paid @ 2X';
 if Hours = 0 then delete;

RUN;

PROC SORT DATA= dailyhours1; BY ID Report_Date AGE Job_Title
Last_Start_Date;
PROC SORT DATA= vinjcnt07_14; BY ID Report_Date;

proc means data = dailyhours1 noprint;
    var Hours;
    by ID Report_Date AGE Job_Title Last_Start_Date;
output out = sumhrs sum = ;
run;

DATA merge07_14;

 MERGE vinjcnt07_14 sumhrs;
 BY ID Report_Date;
 DROP PERCENT _TYPE_ _FREQ_;

 loghours = LOG( Hours );

 IF Job_Title = 'Health Care Asst' then jobgrp = 3;
 IF Job_Title = 'Nurse  Roster' then jobgrp = 1;
 IF Job_Title = 'Nurse Staff' then jobgrp = 1;
 IF Job_Title = 'Nurse Staff Sr' then jobgrp = 1;
 IF Job_Title = 'Protection Officer' then jobgrp = 2;
 IF Job_Title = 'Security Supervisor' then jobgrp = 2;

 If COUNT = . then vinj = 0;
 If COUNT = 1 then vinj = 1;

 yearofbirth = 2015-(AGE+1);
 dob = mdy(11,7,yearofbirth);
 format dob mmddyy10.;

 ageobs = INT( (Report_Date - dob)/365.25);
 expobs = INT( (Report_Date - Last_Start_Date)/365.25);

 If Report_Date < MDY(12,28,2007) then TASER = 1; else
 If Report_Date >= MDY(12,28,2007) then TASER = 2;
RUN;

PROC FORMAT;
 VALUE agegrpF  1 = '21-30'
      2 = '31-37'
      3 = '38-43'
      4 = '44-61' ;

 VALUE jobgrpF1 = 'Registered Nurse'
      2 = 'Security Officer'
```

```
      3 = 'Health Care Assist';

 VALUE racegrpF 1 = 'White'
      2 = 'Minority';

 VALUE $GenderF 'F' = 'Female'
      'M' = 'Male';

 VALUE deptF  1 = 'Nursing'
      2 = 'Security';

 VALUE expgrpF  1 = 'One year or less'
      2 = 'Two to six years'
      3 = 'Seven to thirteen years'
      4 = 'Fourteen years or more' ;

 VALUE TASERF 1 = 'Prior to TASER Implementation'
      2 = 'After TASER Implementation'

RUN;

DATA merge4_14;
 LENGTH Job_Title $40.;
 SET merge07_14 merge4_7;
 KEEP  ID pp_start Payperiod___End_Date dob Last_Start_Date Hours
ageobs expobs jobgrp vinj
   TASER loghours Report_Date;


RUN;

PROC SORT DATA= merge4_14; BY ID ageobs;

/*BELOW ARE THE STEPS I'LL NEED TO TAKE WHEN I WANT TO GET THE
DEMOGRAPHIC INFO INTO THE CONCATENATED SETS*/

DATA demog1;
 SET 'C:\Asus WebStorage\gram0066@umn.edu\MySyncFolder\SAS Data\New
data sets\demog.sas7bdat'
 (KEEP = ID Gender Race);
RUN;
PROC SORT DATA= demog1; BY ID;
DATA TASERmerge;

 MERGE demog1 merge4_14;
 BY ID;

 If ageobs < 31 then agegrp = 1; else
 If ageobs < 38 then agegrp = 2; else
 If ageobs < 44 then agegrp = 3; else
 If ageobs >=44 then agegrp = 4;
            /*At this point on 4/5/16, I no longer need these specific
```

```
              age groups. My next step is to get a DOB that I can use
that
              will correspond to the DOB I will get in the biweekly
data. The
              age groups could be different and anyway I won't use that
variable
              anyhow. On 5/1/16, I found the quartiles for the full set
to be
              the new ages in the groups above. But cannot use race.*/
 /*IF Race = 'W' then racegrp = 1; else
 IF Race ne 'W' then racegrp = 2;*/

 If expobs < 2 then expgrp = 1; else
 If expobs < 7 then expgrp = 2; else
 If expobs < 14 then expgrp = 3; else
 If expobs >=14 then expgrp = 4;

 IF ageobs = . then delete;

 IF jobgrp = 1 then dept = 1; else
 IF jobgrp = 2 then dept = 2; else
 IF jobgrp = 3 then dept = 1;

 Year1= Year(Report_Date);
 Year2= Year(Payperiod___End_Date);

 if (Year1 ne .) then Year = Year1;

 else if (Year2 ne .) then Year = Year2;

 LABEL TASER = 'TASER Implementation Period';
 LABEL expgrp = 'Experience Level';
 LABEL agegrp = 'Age Group';
/*Need to also create a year variable to investigate whether there were
any changes between specific years. Done on 5.28.*/

RUN;

PROC PRINT DATA = TASERmerge (OBS= 1000);
RUN;
/* The code below were my analyses that didn't have any covariates
added to the models, and demonstrated no difference.*/
DATA TASERsec;
 SET TASERmerge;
 WHERE dept = 2;
RUN;

DATA TASERnur;
 SET TASERmerge;
 WHERE dept = 1;
RUN;

proc genmod data=TASERsec;
```

```
 /*FORMAT Gender $GenderF.; Formatting messed with the results
 FORMAT TASER TASERF.;
 FORMAT expgrp expgrpF.;
 FORMAT agegrp agegrpF.;*/

 class ID TASER expgrp agegrp Gender /*Year*/;
    model vinj = Gender TASER expgrp agegrp /*Year*/ / d = poi link =
log offset = loghours noint;
 repeated subject = ID / type=ind;  /*choose ind, exch, or AR*/
 estimate '1' expgrp 1 0 0 -1 / exp;
 estimate '2' expgrp 0 1 0 -1 / exp;
 estimate '3' expgrp 0 0 1 -1 / exp;
 estimate '2' TASER -1 1 / exp;
 estimate '1' agegrp 1 0 0 -1 / exp;
 estimate '2' agegrp 0 1 0 -1 / exp;
 estimate '3' agegrp 0 0 1 -1 / exp;
 estimate 'M' Gender -1 1 / exp;


 lsmeans TASER / ilink cl;
 lsmeans expgrp / ilink cl;
 lsmeans agegrp / ilink cl;
 lsmeans Gender / ilink cl;
 /*lsmeans Year / ilink cl;*/

 LABEL TASER = 'TASER Implementation Period';
 LABEL expgrp = 'Experience Level';
 LABEL agegrp = 'Age Group';

 TITLE  'Effect of TASER Carriage on Violence-Related';
 TITLE2  'Injuries to Security Workers';
run;


proc genmod data=TASERsec;

 class ID expgrp ;
    model vinj = expgrp / d = poi link = log offset = loghours noint;
    repeated subject = ID / type=ind;  /*choose ind, exch, or AR*/
 estimate '1' expgrp 1 0 0 -1 / exp;
 estimate '2' expgrp 0 1 0 -1 / exp;
 estimate '3' expgrp 0 0 1 -1 / exp;

 lsmeans expgrp / ilink cl;

 /*FORMAT Gender $GenderF.; formats messed up the order
 FORMAT expgrp expgrpF.;
 /*FORMAT agegrp agegrpF.;*/

 LABEL expgrp = 'Experience Level';
 /*LABEL agegrp = 'Age Group';*/
```

```
 TITLE  'Effect of Experience Level on Violence-Related';
 TITLE2  'Injuries to Security Staff';

run;


proc genmod data=TASERsec;

 class ID TASER ;
    model vinj = TASER / d = poi link = log offset = loghours noint;
    repeated subject = ID / type=ind;  /*choose ind, exch, or AR*/
 estimate '2' TASER -1 1 / exp;

 lsmeans TASER / ilink cl;

 /*FORMAT Gender $GenderF.; formats messed up the order
 FORMAT expgrp expgrpF.;
 /*FORMAT agegrp agegrpF.;*/

 LABEL TASER = 'TASER Implementation Period';
 /*LABEL agegrp = 'Age Group';*/

 TITLE  'Effect of TASER Implementation on Violence-Related';
 TITLE2  'Injuries to Security Staff, Reduced Model';

run;


proc genmod data=TASERsec;

 class ID agegrp ;
    model vinj = agegrp / d = poi link = log offset = loghours noint;
    repeated subject = ID / type=ind;  /*choose ind, exch, or AR*/
 estimate '1' agegrp 1 0 0 -1 / exp;
 estimate '2' agegrp 0 1 0 -1 / exp;
 estimate '3' agegrp 0 0 1 -1 / exp;

 lsmeans agegrp / ilink cl;

 /*FORMAT Gender $GenderF.; formats messed up the order
 FORMAT expgrp expgrpF.;
 /*FORMAT agegrp agegrpF.;*/

 LABEL agegrp = 'Age Group';

 TITLE  'Effect of Age on Violence-Related';
 TITLE2  'Injuries to Security Staff';

run;

proc genmod data=TASERsec;

 class ID Gender ;
```

```
   model vinj = Gender / d = poi link = log offset = loghours noint;
   repeated subject = ID / type=ind;  /*choose ind, exch, or AR*/
 estimate 'M' Gender -1 1 / exp;

 lsmeans Gender / ilink cl;

 /*FORMAT Gender $GenderF.; formats messed up the order
 FORMAT expgrp expgrpF.;
 /*FORMAT agegrp agegrpF.;*/

 /*LABEL TASER = 'TASER Implementation Period';
 LABEL agegrp = 'Age Group';*/

 TITLE  'Effect of Gender on Violence-Related';
 TITLE2  'Injuries to Security Staff';

run;

proc genmod data=TASERsec;

 class ID Year ;
   model vinj = Year / d = poi link = log offset = loghours noint;
   repeated subject = ID / type=ind;  /*choose ind, exch, or AR*/

 lsmeans Year / ilink cl;

 /*FORMAT Gender $GenderF.; formats messed up the order
 FORMAT expgrp expgrpF.;
 /*FORMAT agegrp agegrpF.;*/

 /*LABEL TASER = 'TASER Implementation Period';
 LABEL agegrp = 'Age Group';*/

 TITLE  'Rates of Violence-Related';
 TITLE2  'Injuries to Security Staff by Year';

run;

PROC MEANS DATA = TASERsec MEAN MAXDEC=2 FW=8;
CLASS Year;
VAR expobs ageobs;
TITLE 'Average Experience by Year';
RUN;

PROC FREQ DATA=TASERsec;
TABLES vinj*Year ;
TITLE 'Cross Tabulation of Injuries and Year';
RUN;

DATA TASERsecto2012; /*Mike told me that 2013 was the year they started
to really stress the reporting, so ran analyses without 2013-2014*/
SET TASERsec;
WHERE Year < 2013;
```

```
RUN;

proc genmod data=TASERsecto2012;

 /*FORMAT Gender $GenderF.; Formatting messed with the results
 FORMAT TASER TASERF.;
 FORMAT expgrp expgrpF.;
 FORMAT agegrp agegrpF.;*/

 class ID TASER expgrp agegrp Gender /*Year*/;
    model vinj = Gender TASER expgrp agegrp /*Year*/ / d = poi link =
log offset = loghours noint;
 repeated subject = ID / type=ind;  /*choose ind, exch, or AR*/
 estimate '1' expgrp 1 0 0 -1 / exp;
 estimate '2' expgrp 0 1 0 -1 / exp;
 estimate '3' expgrp 0 0 1 -1 / exp;
 estimate '2' TASER -1 1 / exp;
 estimate '1' agegrp 1 0 0 -1 / exp;
 estimate '2' agegrp 0 1 0 -1 / exp;
 estimate '3' agegrp 0 0 1 -1 / exp;
 estimate 'M' Gender -1 1 / exp;


 lsmeans TASER / ilink cl;
 lsmeans expgrp / ilink cl;
 lsmeans agegrp / ilink cl;
 lsmeans Gender / ilink cl;
 /*lsmeans Year / ilink cl;*/

 LABEL TASER = 'TASER Implementation Period';
 LABEL expgrp = 'Experience Level';
 LABEL agegrp = 'Age Group';

 TITLE  'Effect of TASER Carriage on Violence-Related';
 TITLE2  'Injuries to Security Workers';
run;


proc genmod data=TASERsecto2012;

 class ID expgrp ;
    model vinj = expgrp / d = poi link = log offset = loghours noint;
    repeated subject = ID / type=ind;  /*choose ind, exch, or AR*/
 estimate '1' expgrp 1 0 0 -1 / exp;
 estimate '2' expgrp 0 1 0 -1 / exp;
 estimate '3' expgrp 0 0 1 -1 / exp;

 lsmeans expgrp / ilink cl;

 /*FORMAT Gender $GenderF.; formats messed up the order
 FORMAT expgrp expgrpF.;
 /*FORMAT agegrp agegrpF.;*/
```

```
 LABEL expgrp = 'Experience Level';
 /*LABEL agegrp = 'Age Group';*/

 TITLE  'Effect of Experience Level on Violence-Related';
 TITLE2  'Injuries to Security Staff';

run;


proc genmod data=TASERsecto2012;

 class ID TASER ;
    model vinj = TASER / d = poi link = log offset = loghours noint;
    repeated subject = ID / type=ind;  /*choose ind, exch, or AR*/
 estimate '2' TASER -1 1 / exp;

 lsmeans TASER / ilink cl;

 /*FORMAT Gender $GenderF.; formats messed up the order
 FORMAT expgrp expgrpF.;
 /*FORMAT agegrp agegrpF.;*/

 LABEL TASER = 'TASER Implementation Period';
 /*LABEL agegrp = 'Age Group';*/

 TITLE  'Effect of TASER Implementation on Violence-Related';
 TITLE2  'Injuries to Security Staff, Reduced Model';

run;


proc genmod data=TASERsecto2012;

 class ID agegrp ;
    model vinj = agegrp / d = poi link = log offset = loghours noint;
    repeated subject = ID / type=ind;  /*choose ind, exch, or AR*/
 estimate '1' agegrp 1 0 0 -1 / exp;
 estimate '2' agegrp 0 1 0 -1 / exp;
 estimate '3' agegrp 0 0 1 -1 / exp;

 lsmeans agegrp / ilink cl;

 /*FORMAT Gender $GenderF.; formats messed up the order
 FORMAT expgrp expgrpF.;
 /*FORMAT agegrp agegrpF.;*/

 LABEL agegrp = 'Age Group';

 TITLE  'Effect of Age on Violence-Related';
 TITLE2  'Injuries to Security Staff';

run;
```

```
proc genmod data=TASERsecto2012;

 class ID Gender ;
    model vinj = Gender / d = poi link = log offset = loghours noint;
    repeated subject = ID / type=ind;  /*choose ind, exch, or AR*/
 estimate 'M' Gender -1 1 / exp;

 lsmeans Gender / ilink cl;

 /*FORMAT Gender $GenderF.; formats messed up the order
 FORMAT expgrp expgrpF.;
 /*FORMAT agegrp agegrpF.;*/

 /*LABEL TASER = 'TASER Implementation Period';
 LABEL agegrp = 'Age Group';*/

 TITLE  'Effect of Gender on Violence-Related';
 TITLE2  'Injuries to Security Staff';

run;

proc genmod data=TASERsecto2012;

 class ID Year ;
    model vinj = Year / d = poi link = log offset = loghours noint;
    repeated subject = ID / type=ind;  /*choose ind, exch, or AR*/

 lsmeans Year / ilink cl;

 /*FORMAT Gender $GenderF.; formats messed up the order
 FORMAT expgrp expgrpF.;
 /*FORMAT agegrp agegrpF.;*/

 /*LABEL TASER = 'TASER Implementation Period';
 LABEL agegrp = 'Age Group';*/

 TITLE  'Rates of Violence-Related';
 TITLE2  'Injuries to Security Staff by Year';

run;

proc genmod data=TASERsec;

 /*FORMAT Gender $GenderF.; Formatting messed with the results
 FORMAT TASER TASERF.;
 FORMAT expgrp expgrpF.;
 FORMAT agegrp agegrpF.;*/

 class ID expgrp agegrp /*Year*/;
    model vinj = expgrp agegrp /*Year*/ / d = poi link = log offset =
loghours noint;
 repeated subject = ID / type=ind;  /*choose ind, exch, or AR*/
```

```
 estimate '1' agegrp 1 0 0 -1 / exp;
 estimate '2' agegrp 0 1 0 -1 / exp;
 estimate '3' agegrp 0 0 1 -1 / exp;


 TITLE  'Effect of Age on Violence-Related Injuries';
 TITLE2  'To Security Workers, Adjusted for Experience Level';
run;

PROC FREQ DATA=TASERsec;
TABLES ID*Gender ;
TITLE 'Gender of ID?';
RUN;
```

Appendix E

SAS Code for Nursing Staff CEW Investigation

```
DATA hc4_7;
SET 'C:\Asus WebStorage\gram0066@umn.edu\MySyncFolder\SAS Data\New data
sets\hchrs.sas7bdat';
DROP  PP_YY End_MM DT_DD Dept Department_Title Unit_Title Jobcd
E001TTTL__Regular_Hours
   VAR17 VAR19;

yearfull = 1900+Birth_Year;

dob = mdy(6,30,yearfull);
format dob mmddyy10.;

/*To get sum hrs of ST, OT, code below*/
Hours = SUM(E001HRS_Reg_Hrs, VAR16, VAR18);


/*To create the beginning of the payperiod, the code is below*/
pp_start = Payperiod___End_Date - 13;
format pp_start mmddyy10.;
/*!!When I merge the total groups, I will need to make sure I only
include the
Payperiod___End_Date is less than 3/18/2007, otherwise there will be
overlapping data*/

ageobs = INT( (Payperiod___End_Date - dob)/365.25);
expobs = INT( (Payperiod___End_Date - Last_Start_Date)/365.25);

 IF Job_Title = 'HCMC HEALTH CARE ASSISTANT' then jobgrp = 3;
 IF Job_Title = 'HEALTH CARE ASSISTANT' then jobgrp = 3;
 IF Job_Title = 'HCMC NURSE, ROSTER' then jobgrp = 1;
 IF Job_Title = 'NURSE, ROSTER' then jobgrp = 1;
 IF Job_Title = 'HCMC NURSE STAFF' then jobgrp = 1;
 IF Job_Title = 'HCMC NURSE, STAFF' then jobgrp = 1;
 IF Job_Title = 'NURSE, STAFF' then jobgrp = 1;
 IF Job_Title = 'HCMC NURSE SENIOR STAFF' then jobgrp = 1;
 IF Job_Title = 'HCMC NURSE, SENIOR STAFF' then jobgrp = 1;
 IF Job_Title = 'NURSE, SENIOR STAFF' then jobgrp = 1;
 IF Job_Title = 'HCMC MEDICAL CENTER PROTECTION OFFICER' then jobgrp =
2;
 IF Job_Title = 'MEDICAL CENTER PROTECTION OFFICER' then jobgrp = 2;
 IF Job_Title = 'HCMC SECURITY SUPERVISOR' then jobgrp = 2;

 if Hours = 0 then delete;

RUN;
   /*At this point, the data looks like it will merge well with the
daily hours,
```

```
  now I need to work on transposing the violent injuries so they can be
captured
  in the payperiod*/
PROC SORT DATA= hc4_7 OUT= sort4_7;
 BY ID pp_start;
 RUN;

DATA inj4_7;
 SET 'C:\Asus WebStorage\gram0066@umn.edu\MySyncFolder\SAS Data\New
data sets\injcombine.sas7bdat';
 WHERE Date_of_Loss<'18mar2007'd;
 RUN;

DATA violinj4_7;
 SET inj4_7;
 WHERE violent="y";
 KEEP ID Date_of_Loss; /*At this point, there were 101 injuries, so an
equal # should be in the total later*/
 RUN;

PROC SORT DATA= violinj4_7 OUT= sortinj4_7;
 BY ID Date_of_Loss;
 RUN;

PROC TRANSPOSE  DATA= sortinj4_7
     OUT= transinj4_7
     NAME= ID
     PREFIX= violinj;

  BY ID;
 RUN;

DATA merge4_7;       /*by merging these two sets, I then got the
injuries to merge*/
  MERGE transinj4_7 sort4_7;  /*many (injuries) to one ID. Next step is
to say violent injury*/
  BY ID;        /*within that day makes the same named violent injury as
1*/

 If violinj1 >= pp_start and violinj1 <= Payperiod___End_Date then
vinj1 = 1; else vinj1 = 0;
 If violinj2 >= pp_start and violinj2 <= Payperiod___End_Date then
vinj2 = 1; else vinj2 = 0;
 If violinj3 >= pp_start and violinj3 <= Payperiod___End_Date then
vinj3 = 1; else vinj3 = 0;
 If violinj4 >= pp_start and violinj4 <= Payperiod___End_Date then
vinj4 = 1; else vinj4 = 0;
 If violinj5 >= pp_start and violinj5 <= Payperiod___End_Date then
vinj5 = 1; else vinj5 = 0;
 If violinj6 >= pp_start and violinj6 <= Payperiod___End_Date then
vinj6 = 1; else vinj6 = 0;
 If violinj7 >= pp_start and violinj7 <= Payperiod___End_Date then
vinj7 = 1; else vinj7 = 0;
```

```
 If violinj8 >= pp_start and violinj8 <= Payperiod___End_Date then
vinj8 = 1; else vinj8 = 0;

 vinj = SUM(vinj1, vinj2, vinj3, vinj4, vinj5, vinj6, vinj7, vinj8);
 If ID = 603281 and pp_start = MDY (02,06,2005) then vinj = 1;
 TASER = 1;

 loghours = LOG( Hours );
         /*!!the payperiods where there were no hours caused a problem,
need to delete!!
         I deleted the no hours ones & lost 2 injuries. Went back to
the original data and
         found the 2 injuries and put in 0.01 hrs in the pay period for
them to be
         included. Somehow on 4.26, I am still missing 3 injuries. So
what I did was
         examined the observations where violinj1-3 have dates present,
but vinj1-3 is
         missing. Have the date for injury, but doesn't correspond to a
date for EE. 4.30
         Andy gave me the code below to find the missing injuries. The
first injury I
         found was two years before the person started working in this
job, so shouldn't be
         included. Employee 255422 on 3/14/2004, and maybe he was
working a different job
         at the time. The second injury missing was from someone,
603281 on 1/29/2005, who
         had payable regularhours the week later. I excluded
orientation time, so that could
         be the reason it wasn't included. I included the injury in the
following week.*/

RUN;

proc means data = merge4_7 noprint;
    var vinj1 vinj2 vinj3 vinj4 vinj5 vinj6 vinj7 vinj8;
    by ID;
    output out = sumout sum(vinj1)=vinjsum1 sum(vinj2)=vinjsum2
sum(vinj3)=vinjsum3 sum(vinj4)=vinjsum4
sum(vinj5)=vinjsum5 sum(vinj6)=vinjsum6 sum(vinj7)=vinjsum7
sum(vinj8)=vinjsum8;
run;

data totmerge (keep = id vinj1prob vinj2prob vinj3prob vinj4prob
vinj5prob vinj6prob vinj7prob vinj8prob);
    merge merge4_7 sumout (drop = _type_ _freq_);
    by ID;
if first.id ne 1 then delete;
    if violinj1 ne . and vinjsum1 = 0 then do; vinj1prob=violinj1;
output; end;
    if violinj2 ne . and vinjsum2 = 0 then do; vinj2prob=violinj2;
output; end;
```

```
    if violinj3 ne . and vinjsum3 = 0 then do; vinj3prob=violinj3;
output; end;
    if violinj4 ne . and vinjsum4 = 0 then do; vinj4prob=violinj4;
output; end;
    if violinj5 ne . and vinjsum5 = 0 then do; vinj5prob=violinj5;
output; end;
    if violinj6 ne . and vinjsum6 = 0 then do; vinj6prob=violinj6;
output; end;
    if violinj7 ne . and vinjsum7 = 0 then do; vinj7prob=violinj7;
output; end;
    if violinj8 ne . and vinjsum8 = 0 then do; vinj8prob=violinj8;
output; end;

    format vinj1prob vinj2prob vinj3prob vinj4prob vinj5prob vinj6prob
vinj7prob vinj8prob mmddyy10.;

run;

/*4.20 It worked! The injuries & hours merged on many. It looks good.
Next step is to
create an injury variable out of the dates. 4.23- I did that, by
creating the new variable
vinj- which has the same name as the other merged data set. I wound up
with a count of
97, meaning I am missing 4 injuries in the end.*/

/*Next order of business will be to concatenate the data sets. I will
have to check all the
variable labels that they have the same names. I think I'll have to go
to the 7_14 data set and
change the Hours variable to sumhrs- nevermind, I fixed it onthe 4_7
data set.*/

DATA violentinj;
 SET 'C:\Asus WebStorage\gram0066@umn.edu\MySyncFolder\SAS Data\New
data sets\injcombine.sas7bdat';
 WHERE violent="y";
 RENAME Date_of_Loss = Report_Date;
 RUN;


PROC FREQ DATA= violentinj noprint;
 WHERE Report_Date>'17mar2007'd;
 TABLE ID*Report_Date / out=vinjcnt07_14;

 RUN;


DATA dailyhours1;
 SET 'C:\Asus WebStorage\gram0066@umn.edu\MySyncFolder\SAS Data\New
data sets\hrs7_14.sas7bdat'
   (KEEP = ID Hours TRC_Descr AGE Job_Title Last_Start_Date
Report_Date);
```

```
 WHERE TRC_Descr = 'Overtime Paid @ 1.5' or TRC_Descr = 'Regular' or
TRC_Descr = 'Overtime Paid @ 2X';
 if Hours = 0 then delete;

RUN;

PROC SORT DATA= dailyhours1; BY ID Report_Date AGE Job_Title
Last_Start_Date;
PROC SORT DATA= vinjcnt07_14; BY ID Report_Date;

proc means data = dailyhours1 noprint;
    var Hours;
    by ID Report_Date AGE Job_Title Last_Start_Date;
output out = sumhrs sum = ;
run;

DATA merge07_14;

 MERGE vinjcnt07_14 sumhrs;
 BY ID Report_Date;
 DROP PERCENT _TYPE_ _FREQ_;

 loghours = LOG( Hours );

 IF Job_Title = 'Health Care Asst' then jobgrp = 3;
 IF Job_Title = 'Nurse  Roster' then jobgrp = 1;
 IF Job_Title = 'Nurse Staff' then jobgrp = 1;
 IF Job_Title = 'Nurse Staff Sr' then jobgrp = 1;
 IF Job_Title = 'Protection Officer' then jobgrp = 2;
 IF Job_Title = 'Security Supervisor' then jobgrp = 2;

 If COUNT = . then vinj = 0;
 If COUNT = 1 then vinj = 1;

 yearofbirth = 2015-(AGE+1);
 dob = mdy(11,7,yearofbirth);
 format dob mmddyy10.;

 ageobs = INT( (Report_Date - dob)/365.25);
 expobs = INT( (Report_Date - Last_Start_Date)/365.25);

 If Report_Date < MDY(12,28,2007) then TASER = 1; else
 If Report_Date >= MDY(12,28,2007) then TASER = 2;
RUN;

PROC FORMAT;
 VALUE agegrpF  1 = '18-30'
      2 = '31-39'
      3 = '40-48'
      4 = '49-69' ;

 VALUE jobgrpF1 = 'Registered Nurse'
      2 = 'Security Officer'
```

```
      3 = 'Health Care Assist';

 VALUE racegrpF 1 = 'White'
      2 = 'Minority';

 VALUE $GenderF 'F' = 'Female'
      'M' = 'Male';

 VALUE deptF  1 = 'Nursing'
      2 = 'Security';

 VALUE expgrpF  1 = 'One year or less'
      2 = 'Two to four years'
      3 = 'Five to ten years'
      4 = 'Eleven years or more' ;

 VALUE TASERF 1 = 'Prior to TASER Implementation'
      2 = 'After TASER Implementation'

RUN;

DATA merge4_14;
 LENGTH Job_Title $40.;
 SET merge07_14 merge4_7;
 KEEP  ID pp_start Payperiod___End_Date dob Last_Start_Date Hours
ageobs expobs jobgrp vinj
   TASER loghours Report_Date;


RUN;

PROC SORT DATA= merge4_14; BY ID ageobs;

/*BELOW ARE THE STEPS I'LL NEED TO TAKE WHEN I WANT TO GET THE
DEMOGRAPHIC INFO INTO THE CONCATENATED SETS*/

DATA demog1;
 SET 'C:\Asus WebStorage\gram0066@umn.edu\MySyncFolder\SAS Data\New
data sets\demog.sas7bdat'
 (KEEP = ID Gender Race);
RUN;
PROC SORT DATA= demog1; BY ID;
DATA TASERmerge;

 MERGE demog1 merge4_14;
 BY ID;

 If ageobs < 31 then agegrp = 1; else
 If ageobs < 40 then agegrp = 2; else
 If ageobs < 49 then agegrp = 3; else
 If ageobs >=49 then agegrp = 4;
            /*At this point on 4/5/16, I no longer need these specific
```

```
              age groups. My next step is to get a DOB that I can use
that
              will correspond to the DOB I will get in the biweekly
data. The
              age groups could be different and anyway I won't use that
variable
              anyhow. On 5/1/16, I found the quartiles for the full set
to be
              the new ages in the groups above. But cannot use race.*/
 /*IF Race = 'W' then racegrp = 1; else
 IF Race ne 'W' then racegrp = 2;*/

 If expobs < 2 then expgrp = 1; else
 If expobs < 5 then expgrp = 2; else
 If expobs < 11 then expgrp = 3; else
 If expobs >=11 then expgrp = 4;

 IF ageobs = . then delete;

 IF jobgrp = 1 then dept = 1; else
 IF jobgrp = 2 then dept = 2; else
 IF jobgrp = 3 then dept = 1;

 Year1= Year(Report_Date);
 Year2= Year(Payperiod___End_Date);

 if (Year1 ne .) then Year = Year1;

 else if (Year2 ne .) then Year = Year2;

 LABEL TASER = 'TASER Implementation Period';
 LABEL expgrp = 'Experience Level';
 LABEL agegrp = 'Age Group';
/*Need to also create a year variable to investigate whether there were
any changes between specific years. Done on 5.28.*/

RUN;

PROC PRINT DATA = TASERmerge (OBS= 1000);
RUN;
/* The code below were my analyses that didn't have any covariates
added to the models, and demonstrated no difference.*/
DATA TASERsec;
 SET TASERmerge;
 WHERE dept = 2;
RUN;

DATA TASERnur;
 SET TASERmerge;
 WHERE dept = 1;
RUN;
proc genmod data=TASERnur;
```

```
 /*FORMAT Gender $GenderF.; Formatting messed with the results
 FORMAT TASER TASERF.;
 FORMAT expgrp expgrpF.;
 FORMAT agegrp agegrpF.;*/

 class ID TASER expgrp agegrp Gender jobgrp /*Year*/;
    model vinj = Gender TASER expgrp agegrp jobgrp /*Year*/ / d = poi
link = log offset = loghours noint;
 repeated subject = ID / type=ind;  /*choose ind, exch, or AR*/
 estimate '1' expgrp 1 0 0 -1 / exp;
 estimate '2' expgrp 0 1 0 -1 / exp;
 estimate '3' expgrp 0 0 1 -1 / exp;
 estimate '2' TASER -1 1 / exp;
 estimate '1' agegrp 1 0 0 -1 / exp;
 estimate '2' agegrp 0 1 0 -1 / exp;
 estimate '3' agegrp 0 0 1 -1 / exp;
 estimate '3' jobgrp -1 1 / exp;
 estimate 'M' Gender -1 1 / exp;


 lsmeans TASER / ilink cl;
 lsmeans expgrp / ilink cl;
 lsmeans agegrp / ilink cl;
 lsmeans Gender / ilink cl;
 /*lsmeans Year / ilink cl;*/
 lsmeans jobgrp / ilink cl;

 LABEL TASER = 'TASER Implementation Period';
 LABEL expgrp = 'Experience Level';
 LABEL agegrp = 'Age Group';

 TITLE  'Effect of TASER Carriage on Violence-Related';
 TITLE2  'Injuries to ED Nursing Staff';
run;


proc genmod data=TASERnur;

 class ID expgrp ;
    model vinj = expgrp / d = poi link = log offset = loghours noint;
    repeated subject = ID / type=ind;  /*choose ind, exch, or AR*/
 estimate '1' expgrp 1 0 0 -1 / exp;
 estimate '2' expgrp 0 1 0 -1 / exp;
 estimate '3' expgrp 0 0 1 -1 / exp;

 lsmeans expgrp / ilink cl;

 /*FORMAT Gender $GenderF.; formats messed up the order
 FORMAT expgrp expgrpF.;
 /*FORMAT agegrp agegrpF.;*/

 LABEL expgrp = 'Experience Level';
 /*LABEL agegrp = 'Age Group';*/
```

```
 TITLE  'Effect of Experience Level on Violence-Related';
 TITLE2  'Injuries to ED Nursing Staff';

run;

proc genmod data=TASERnur;

 class ID TASER ;
    model vinj = TASER / d = poi link = log offset = loghours noint;
    repeated subject = ID / type=ind;  /*choose ind, exch, or AR*/
 estimate '2' TASER -1 1 / exp;

 lsmeans TASER / ilink cl;

 /*FORMAT Gender $GenderF.; formats messed up the order
 FORMAT expgrp expgrpF.;
 /*FORMAT agegrp agegrpF.;*/

 LABEL TASER = 'TASER Implementation Period';
 /*LABEL agegrp = 'Age Group';*/

 TITLE  'Effect of TASER Implementation on Violence-Related';
 TITLE2  'Injuries to ED Nursing Staff, Reduced Model';

run;

proc genmod data=TASERnur;

 class ID agegrp ;
    model vinj = agegrp / d = poi link = log offset = loghours noint;
    repeated subject = ID / type=ind;  /*choose ind, exch, or AR*/
 estimate '1' agegrp 1 0 0 -1 / exp;
 estimate '2' agegrp 0 1 0 -1 / exp;
 estimate '3' agegrp 0 0 1 -1 / exp;

 lsmeans agegrp / ilink cl;

 /*FORMAT Gender $GenderF.; formats messed up the order
 FORMAT expgrp expgrpF.;
 /*FORMAT agegrp agegrpF.;*/

 LABEL agegrp = 'Age Group';

 TITLE  'Effect of Age on Violence-Related';
 TITLE2  'Injuries to ED Nursing Staff';

run;

proc genmod data=TASERnur;

 class ID Gender ;
    model vinj = Gender / d = poi link = log offset = loghours noint;
```

```
   repeated subject = ID / type=ind;  /*choose ind, exch, or AR*/
 estimate 'M' Gender -1 1 / exp;

 lsmeans Gender / ilink cl;

 /*FORMAT Gender $GenderF.; formats messed up the order
 FORMAT expgrp expgrpF.;
 /*FORMAT agegrp agegrpF.;*/

 /*LABEL TASER = 'TASER Implementation Period';
 LABEL agegrp = 'Age Group';*/

 TITLE  'Effect of Gender on Violence-Related';
 TITLE2  'Injuries to ED Nursing Staff';

run;

proc genmod data=TASERnur;

 class ID jobgrp ;
   model vinj = jobgrp / d = poi link = log offset = loghours noint;
   repeated subject = ID / type=ind;  /*choose ind, exch, or AR*/
 estimate '3' jobgrp -1 1 / exp;

 lsmeans jobgrp / ilink cl;

 /*FORMAT Gender $GenderF.; formats messed up the order
 FORMAT expgrp expgrpF.;
 /*FORMAT agegrp agegrpF.;*/

 LABEL TASER = 'TASER Implementation Period';
 /*LABEL agegrp = 'Age Group';*/

 TITLE  'Effect of Nursing Job on Violence-Related';
 TITLE2  'Injuries to ED Nursing Staff';

run;

proc genmod data=TASERnur;

 class ID Year ;
   model vinj = Year / d = poi link = log offset = loghours noint;
   repeated subject = ID / type=ind;  /*choose ind, exch, or AR*/

 lsmeans Year / ilink cl;

 /*FORMAT Gender $GenderF.; formats messed up the order
 FORMAT expgrp expgrpF.;
 /*FORMAT agegrp agegrpF.;*/

 /*LABEL TASER = 'TASER Implementation Period';
 LABEL agegrp = 'Age Group';*/
```

```
 TITLE   'Rates of Violence-Related';
 TITLE2  'Injuries to ED Nursing Staff by Year';

run;

PROC FREQ DATA=TASERnur;
TABLES vinj*Year ;
TITLE 'Cross Tabulation of Injuries and Year';
RUN;

PROC FREQ DATA=TASERnur;
TABLES ID*Gender ;
TITLE 'Gender of ID full';
RUN;

DATA TASERrn;
 SET TASERnur;
 WHERE jobgrp = 1;
RUN;

DATA TASERhca;
 SET TASERnur;
 WHERE jobgrp = 3;
RUN;

PROC FREQ DATA=TASERrn;
TABLES ID*Gender ;
TITLE 'Gender of ID RN';
RUN;

PROC FREQ DATA=TASERhca;
TABLES ID*Gender ;
TITLE 'Gender of ID HCA';
RUN;
```

Appendix F

SAS Code for Staffing Level Investigation

```
/*To set up the data in the injury dataset to merge with the hours
data, I used Proc Freq to
create a count time for a violence-related injury.*/

/*Something happened to the names of the variables here when I brough
the injuries back together.*/
DATA violentinj;
 SET 'C:\Asus WebStorage\gram0066@umn.edu\MySyncFolder\SAS Data\New
data sets\injcombine.sas7bdat';
 WHERE violent="y";
 RENAME Date_of_Loss = Report_Date;
 RUN;


PROC FREQ DATA= violentinj noprint;
 WHERE Report_Date>'17mar2007'd;
 TABLE ID*Report_Date / out=vinjcnt07_14;

 RUN;/*Need to rename variable in order to merge on both.*/

/*When I merge the sets, I have to remove the hours that were non-
productive (there
were some on call hours mixed in with the productive). I will also have
to make sure to
only keep the injuries that were in the indicated year (this is for the
Oral prelim, to
limit the data to the daily view).*/


DATA dailyhours1;
 SET 'C:\Asus WebStorage\gram0066@umn.edu\MySyncFolder\SAS Data\New
data sets\hrs7_14.sas7bdat'
   (KEEP = ID Hours TRC_Descr AGE Job_Title Last_Start_Date
Report_Date);
 WHERE TRC_Descr = 'Overtime Paid @ 1.5' or TRC_Descr = 'Regular' or
TRC_Descr = 'Overtime Paid @ 2X';
 if Hours = 0 then delete;

RUN;

 /*After running this, I found that the injuries merged on the overtime
in a day as well as the regular time,
 and thus a lot of injuries were double counted. To control this I had
to make a sum of the hours for each
 day and then merge those files?*/

PROC SORT DATA= dailyhours1; BY ID Report_Date AGE Job_Title
Last_Start_Date;
```

```
PROC SORT DATA= vinjcnt07_14; BY ID Report_Date;

proc means data = dailyhours1 noprint;
    var Hours;
    by ID Report_Date AGE Job_Title Last_Start_Date;
output out = sumhrs sum = ;
run;
/*
PROC CONTENTS DATA = sumhrs;
RUN;*/

/*
DATA dailyhours;
 SET dailyhours1;
 KEEP ID AGE Job_Title Last_Start_Date Report_Date;

RUN;*/


/*PROC FREQ DATA=dailyhours;
        **There were many coded hours that should not be included and
were discarded using
         WHERE statement; these were hours such as On Call. I used this
PROC FREQ statement
         to figure out which observations to get rid of.**
 TABLES TRC_Descr;
 RUN;
DATA vinjcnt07_14;
 DROP PERCENT;
 RUN;*/



DATA merge07_14;

 MERGE vinjcnt07_14 sumhrs;
 BY ID Report_Date;
 DROP PERCENT _TYPE_ _FREQ_;
 loghours = LOG( Hours );
RUN;
/*
PROC CONTENTS DATA= merge07_14;
RUN;*/

/*Then I added the race and gender of the participants from the
demographic dataset.
WITH THIS MERGE I NOW HAVE MOSTLY BLANK ROWS WHERE IT INCLUDED
PARTICIPANTS FROM THE
HC DATA. When I do the full data set, I will have to merge the
demographics after
concatenating the other two sets. That way they will all get the
demographics together.*/
```

```
DATA demog1;
 SET 'C:\Asus WebStorage\gram0066@umn.edu\MySyncFolder\SAS Data\New
data sets\demog.sas7bdat'
 (KEEP = ID Gender Race);
RUN;
PROC SORT DATA= demog1; BY ID;

PROC FORMAT;
 VALUE agegrpF  1 = '20-30'
      2 = '31-39'
      3 = '40-48'
      4 = '49-66' ;

 VALUE expgrpF  1 = 'One year or less'
      2 = 'Two to four years'
      3 = 'Five to ten years'
      4 = 'Eleven years or more' ;

 VALUE jobgrpF1 = 'Registered Nurse'
      2 = 'Security Officer'
      3 = 'Health Care Assist';

 VALUE racegrpF 1 = 'White'
      2 = 'Minority';

 VALUE $GenderF 'F' = 'Female'
      'M' = 'Male';

 VALUE trainingF 1 = 'No Training'
      2 = '0-6 Months After Training'
      3 = '6-12 Months After Training'
      4 = 'Greater Than 12 Months After Training';

RUN;
/*
DATA missinginj;  THIS IS WHAT I USED TO FIND THE MISSING INJURIES AND
THEN ADJUSTED IN
SET merge07_14;   THE EXCEL SPREADSHEET.
 WHERE AGE = .;
RUN;

/*BELOW IS THE FINAL MERGED SET TO THIS POINT- NEED TO RUN THIS FOR THE
SET I CAN USE TO RUN
THE DAILY ANALYSES... THIS DATASET 'MERGE7_14' HAS MOST EVERYTHING I
NEED EXCEPT FOR THE
DE-ESCALATION DATES:*/

DATA merge7_14;

 MERGE demog1 merge07_14;
 BY ID;
 /*if AGE = . then delete;    At this point on 4/5/16, I no longer need
these specific
```

```
 If AGE < 36 then agegrp = 1; else  age groups. My next step is to get
a DOB that I can use
 If AGE < 45 then agegrp = 2; else  that will correspond to the DOB I
will get in the biweekly
 If AGE < 53 then agegrp = 3; else  data. The age groups could be
different and anyway I won't use
 If AGE >=53 then agegrp = 4;    that variable anyhow.*/
 IF Job_Title = 'Health Care Asst' then jobgrp = 3;
 IF Job_Title = 'Nurse  Roster' then jobgrp = 1;
 IF Job_Title = 'Nurse Staff' then jobgrp = 1;
 IF Job_Title = 'Nurse Staff Sr' then jobgrp = 1;
 IF Job_Title = 'Protection Officer' then jobgrp = 2;
 IF Job_Title = 'Security Supervisor' then jobgrp = 2;
 IF Race = 'W' then racegrp = 1; else
 IF Race ne 'W' then racegrp = 2;
 If COUNT = . then vinj = 0;
 If COUNT = 1 then vinj = 1;  /*Below this point is where I will make
the new DOB, based on 6 months
           prior to the date I got the age (1/2 participants could be
born before
           or after that date*/
 yearofbirth = 2015-(AGE+1);
 dob = mdy(11,7,yearofbirth);
 format dob mmddyy10.;

 ageobs = INT( (Report_Date - dob)/365.25);
 expobs = INT( (Report_Date - Last_Start_Date)/365.25);

RUN;
/*
PROC CONTENTS DATA= merge7_14;
RUN;



/*To check cut off points and to make sure I didn't lose any injuries
due to removing
the 0 hours and 0 age, I did this PROC FREQ to check both. I then also
added AGE in
to see where logical cut offs should be for running the analyses for
the different age
quartiles. I also did a table to figure out the job titles so I could
run the rates
of nursing v. security. Then I did a PROC FORMAT in order to name the
variables for age
and employee group.

PROC FREQ DATA=merge7_14;
 TABLE AGE;
 TABLE COUNT;
 TABLE Job_Title;
 TABLE Race;
RUN;*/
```

```
/*Then to get some rates I log transformed my hours and did a PROC
Genmod to get
stratified rates. [choose ind, exch, or AR for type] In doing this, I
found a bunch
of dates of injuries that didn't match up with dates that EEs worked.
So I need to
go back to the original data and modify when that injury occurred with
a date the
EE actually worked. I did this and went through all the injuries with
missing data
in the rows. There were a few injuries that did not match with a date,
even after
investigation, and I had to throw out those injuries. Unfortunately, on
a check, there
was still one more observation in the merged data than before I merged
the injuries,
indicating that there is still one injury that doesn't line up with the
rest and I
will have to find and fix. For today (2/29), I will just run the rates
to get the Oral
preliminary data out. For the final, I will have to find and fix. On
3/19, I found the
last missing injury, so will go back to the original data and figure
out that last injury.*/

/*Then I found out from Andy that I should be investigating each group
for its injury
rate and calculate by hand to make sure they match up with the genmod
of the rates. Ouch.
Not sure if it's the most efficient way, but I made sets of each group
to get sum totals
to calculate. When I did it for the agegrps, the rates I calculated by
hand matched precisely.
They also matched precisely with the other groups. Hand-calculated rate
ratios also matched.*/

/*
ODS OUTPUT GEEEmpPEst=myGEEEmpPEst;
proc genmod data = merge7_14;
    class ID agegrp;
    model vinj = agegrp / d = poi link = log offset = loghours noint;
    repeated subject = ID / type=ind;
 lsmeans agegrp / ilink cl;
 FORMAT agegrp agegrpF.;
   run;

DATA agerates1;
 SET merge7_14;
 WHERE agegrp=1;
RUN;

DATA agerates2;
```

```
 SET merge7_14;
 WHERE agegrp=2;
RUN;

DATA agerates3;
 SET merge7_14;
 WHERE agegrp=3;
RUN;

DATA agerates4;
 SET merge7_14;
 WHERE agegrp=4;
RUN;
*/
/*proc genmod data = merge7_14;
    class ID jobgrp ;
    model vinj = jobgrp / d = poi link = log offset = loghours;
    repeated subject = ID / type=ind;
 lsmeans jobgrp / ilink cl;
 FORMAT jobgrp jobgrpF.;
   run;
/*
DATA jobrates1;
 SET merge7_14;
 WHERE jobgrp=1;
RUN;

DATA jobrates2;
 SET merge7_14;
 WHERE jobgrp=2;
RUN;*/
/*
proc genmod data = merge7_14;
    class ID racegrp;
    model vinj = racegrp / d = poi link = log offset = loghours;
    repeated subject = ID / type=ind;
 lsmeans racegrp / ilink cl;
 FORMAT racegrp racegrpF.;
   run;

DATA racerates1;
 SET merge7_14;
 WHERE racegrp=1;
RUN;

DATA racerates2;
 SET merge7_14;
 WHERE racegrp=2;
RUN;*/
/*
proc genmod data = merge7_14;
    class ID Gender ;
    model vinj = Gender / d = poi link = log offset = loghours;
```

```
    repeated subject = ID / type=ind;
 lsmeans Gender / ilink cl;
 FORMAT Gender $GenderF.;
   run;


DATA genderratesF;
 SET merge7_14;
 WHERE Gender='F';
RUN;

DATA genderratesM;
 SET merge7_14;
 WHERE Gender='M';
RUN;*/

/*Next job is to bring in the patient discharges in here and then I'll
need to remember to also get a sum of
the nursing hours in each day [sum by report date where jobgrp = 1,3],
and then sum the discharges on each
day*/

DATA dailyd_c;
 SET 'C:\Asus WebStorage\gram0066@umn.edu\MySyncFolder\SAS Data\New
data sets\eddis7_14.sas7bdat';

 Report_Date = mdy(DEP_M,DEP_D,DEP_Y);
 format Report_Date mmddyy10.;

RUN;

PROC MEANS DATA= dailyd_c noprint;
    var PAT_COUNT;
    by Report_Date;
output out = sumd_c (drop = _TYPE_ _FREQ_) sum = sumdc;
WHERE Report_Date>'17mar2007'd;

RUN;

PROC SORT DATA=merge7_14;
BY Report_Date;
RUN;

PROC MEANS DATA= merge7_14 noprint;
 var Hours;
 by Report_Date;
 output out = sumd_hrs (drop = _TYPE_ _FREQ_) sum = sumHours;
 where jobgrp ne 2.;
RUN;

DATA HPPUday;
 MERGE sumd_c sumd_hrs;
 by Report_Date;
```

```
 WHERE Report_Date ne .;
 HPPU = sumHours/sumdc;
 RUN;

/*Everything looks good until these merge together and then the
sumHours get separated from the Report_Date and
go just with the same set of observations, rather than being tied to
either the Report_Date or ID. I'll have to
investigate creating the HPPU and merging afterwards. Then I did the
HPPU in a previous step, and... It worked!*/
DATA mergehrs_d_c;
 MERGE merge7_14 HPPUday ;
 by Report_Date;
 DROP sumHours sumdc;
 WHERE Report_Date ne .;
 RUN;

/*Next step is to bring in the de-escalation dates. I'll have to
transpose the dates, but first check out what they
 even look like.*/

DATA traindate;
 SET 'C:\Asus WebStorage\gram0066@umn.edu\MySyncFolder\SAS Data\New
data sets\demog.sas7bdat'
 (KEEP = ID Date_of_de_escalation_1 Date_of_de_escalation_2
Date_of_de_escalation_3);
/*
 Trndate = Date_of_de_escalation_1;
 OUTPUT;

 Trndate = Date_of_de_escalation_2;
 OUTPUT;

 Trndate = Date_of_de_escalation_3;
 OUTPUT;

 FORMAT Trndate mmddyy10.;

 KEEP ID Trndate;*/
RUN;

/*DATA traindate;
 SET date;

 IF Report_Date ne . then Training = 1; else
 IF Report_Date = . then Training = .;

RUN;*/

/*Sweet. Got it with the code above. The next step is to merge this
dataset with the merged sets and then create the
code for the time-dependent value of the training with diminishing
effects over time. And done 5.15.16.*/
```

```
/*PROC PRINT DATA = traindate;
RUN;*/

PROC SORT DATA= traindate; BY ID;
PROC SORT DATA= mergehrs_d_c; BY ID Report_Date;

DATA mergeall;
 MERGE traindate mergehrs_d_c;
 BY ID;
RUN;

DATA hrs_dc_trndt;
 SET mergeall;

if (Date_of_de_escalation_1 = .) or Date_of_de_escalation_1 gt
Report_Date then training1 = 1;

else if 0 le (Report_Date - Date_of_de_escalation_1) le 182 then
training1 = 2;

else if 182 le  (Report_Date - Date_of_de_escalation_1) le 365 then
training1 = 3;

else if (Report_Date - Date_of_de_escalation_1) gt 365 then training1 =
4;


if 0 le (Report_Date - Date_of_de_escalation_2) le 182 then training2 =
2;

else if 182 le  (Report_Date - Date_of_de_escalation_2) le 365 then
training2 = 3;

else if (Report_Date - Date_of_de_escalation_2) gt 365 then training2 =
4;


if (training2 = .) then training4 = training1;

else if training2 = 2 then training4 = 2;

else if training2 = 3 then training4 = 3;

else if training2 = 4 then training4 = 4;


if 0 le (Report_Date - Date_of_de_escalation_3) le 182 then training3 =
2;

else if 182 le  (Report_Date - Date_of_de_escalation_3) le 365 then
training3 = 3;
```

```
else if (Report_Date - Date_of_de_escalation_3) gt 365 then training3 =
4;


if (training3 = .) then training = training4;

else if training3 = 2 then training = 2;

else if training3 = 3 then training = 3;

else if training3 = 4 then training = 4;


 If ageobs < 31 then agegrp = 1; else
 If ageobs < 40 then agegrp = 2; else
 If ageobs < 49 then agegrp = 3; else
 If ageobs >=49 then agegrp = 4;

 If expobs < 2 then expgrp = 1; else
 If expobs < 5 then expgrp = 2; else
 If expobs < 11 then expgrp = 3; else
 If expobs >=11 then expgrp = 4;

 Year = Year(Report_Date);

 IF Age = . then delete;

 If HPPU < 1.58 then HPPUq = 1; else
 If HPPU < 1.69 then HPPUq = 2; else
 If HPPU < 1.82 then HPPUq = 3; else
 If HPPU >=1.82 then HPPUq = 4;

 /*To find the HPPU quarterly, ran another univariate on that variable
and got the quarters. 7.4.16
 If Report_Date le '31dec2007'd then Year = $2007 *Need to figure out
how to format a year here* Done 5.28. Next need
 to get rid of the observations that are before 2007 by removing folks
who don't have Age. Done 5.28*/
RUN;
/*
PROC PRINT DATA= hrs_dc_trndt (obs=1000);
RUN;

PROC CONTENTS DATA= hrs_dc_trndt;
RUN;*/
/*
And this worked. Diminishing effects over time are created. I will
format the training labels to designate how long after
the training the respective time periods are. I also want to get
quartiles of experience and age. Will do that using
Univariates on both. 5.15.16 And done 5.20.16.

PROC UNIVARIATE DATA = hrs_dc_trndt;
```

```
VAR expobs ageobs;
RUN;*/

/*proc genmod data=hrs_dc_trndt;

 FORMAT Gender $GenderF.;
 FORMAT training trainingF.;
 FORMAT expgrp expgrpF.;
 FORMAT agegrp agegrpF.;
 FORMAT jobgrp jobgrpF.;

 class ID training (ref="No Training") expgrp (ref="One year or less")
agegrp (ref="20-31") jobgrp (ref="Registered Nurse") Gender ;
    model vinj = HPPU Gender training expgrp agegrp jobgrp/ d = poi
link = log offset = loghours noint;
 repeated subject = ID / type=ind;
 lsmeans training / ilink cl;
 lsmeans expgrp / ilink cl;
 lsmeans agegrp / ilink cl;
 lsmeans Gender / ilink cl;
 lsmeans jobgrp / ilink cl;


 LABEL training = 'De-escalation Training Period';
 LABEL expgrp = 'Experience Level';
 LABEL agegrp = 'Age Group';
 LABEL HPPU = 'Hours of Nursing Staff per Patient Discharge';
 LABEL jobgrp= 'Occupation';

 TITLE  'Effect of De-escalation Training on Violence-Related';
 TITLE2  'Injuries to Security Workers and Nursing Staff';
run;*/

DATA hrs_dc_trndt_nurs;
 SET hrs_dc_trndt;
 WHERE jobgrp ne 2;
RUN;

/*PROC UNIVARIATE DATA = hrs_dc_trndt_rn; use this to find out the
quantiles for RNs
VAR expobs ageobs;
RUN;*/

proc genmod data=hrs_dc_trndt_nurs;

 class ID expgrp agegrp Gender jobgrp racegrp HPPUq;
    model vinj = HPPUq Gender expgrp agegrp jobgrp racegrp/ d = poi
link = log offset = loghours noint;
 repeated subject = ID / type=ind;  /*choose ind, exch, or AR*/
 estimate '1' HPPUq 1 0 0 -1  / exp;
 estimate '2' HPPUq 0 1 0 -1  / exp;
 estimate '3' HPPUq 0 0 1 -1  / exp;
 estimate '1' expgrp 1 0 0 -1  / exp;
```

```
 estimate '2' expgrp 0 1 0 -1  / exp;
 estimate '3' expgrp 0 0 1 -1  / exp;
 estimate '1' agegrp 1 0 0 -1 / exp;
 estimate '2' agegrp 0 1 0 -1 / exp;
 estimate '3' agegrp 0 0 1 -1 / exp;
 estimate '3' jobgrp -1 1 / exp;
 estimate '2' racegrp -1 1 / exp;
 estimate 'M' Gender -1 1 / exp;

 lsmeans HPPUq / ilink cl;
 lsmeans expgrp / ilink cl;
 lsmeans agegrp / ilink cl;
 lsmeans jobgrp / ilink cl;
 lsmeans racegrp / ilink cl;
 lsmeans Gender / ilink cl;


 LABEL racegrp = 'Race';
 LABEL expgrp = 'Experience Level';
 LABEL agegrp = 'Age Group';
 LABEL HPPU = 'Hours of Nursing Staff per Patient Discharge';
 LABEL jobgrp= 'Occupation';

 TITLE  'Effect of Staffing Levels on Violence-Related';
 TITLE2  'Injuries to Emergency Department Nursing Staff, full model';
run;

/*Need to do a PROC Means for each vinj by levels of covariate using a
Class statement

PROC MEANS DATA = hrs_dc_trndt_rn;
CLASS training;
VAR vinj;
RUN;

PROC MEANS DATA = hrs_dc_trndt_rn;
CLASS expgrp;
VAR vinj;
RUN;

PROC MEANS DATA = hrs_dc_trndt_rn;
CLASS agegrp;
VAR vinj;
RUN;  So, after doing this, I found that there were no injuries among
nurses in the 3-6 months following training
So, I will try changing the variable so it's the first 6 months
following training, following 6 months and time
period after that, then do my PROC MEANS again and see what I get*/


proc genmod data=hrs_dc_trndt_nurs;

 class ID expgrp ;
```

```
   model vinj = expgrp  / d = poi link = log offset = loghours noint;
 repeated subject = ID / type=ind;  /*choose ind, exch, or AR*/
 estimate '1' expgrp 1 0 0 -1  / exp;
 estimate '2' expgrp 0 1 0 -1  / exp;
 estimate '3' expgrp 0 0 1 -1  / exp;

 lsmeans expgrp / ilink cl;

 LABEL expgrp = 'Experience Level';

 TITLE  'Effect of Experience Level on Violence-Related';
 TITLE2  'Injuries to Emergency Department Nursing Staff';
run;

proc genmod data=hrs_dc_trndt_nurs;

 class ID Gender ;
   model vinj = Gender  / d = poi link = log offset = loghours noint;
 repeated subject = ID / type=ind;  /*choose ind, exch, or AR*/
 estimate 'M' Gender -1 1 / exp;

 lsmeans Gender / ilink cl;

 TITLE  'Relation of Gender on Violence-Related';
 TITLE2  'Injuries to Emergency Department Nursing Staff';
run;

proc genmod data=hrs_dc_trndt_nurs;

 class ID agegrp  ;
   model vinj = agegrp /*jobgrp*/ / d = poi link = log offset =
loghours noint;
 repeated subject = ID / type=ind;  /*choose ind, exch, or AR*/

 estimate '1' agegrp 1 0 0 -1 / exp;
 estimate '2' agegrp 0 1 0 -1 / exp;
 estimate '3' agegrp 0 0 1 -1 / exp;

 lsmeans agegrp / ilink cl;

 LABEL agegrp = 'Age Group';

 TITLE  'Effect of Age on Violence-Related';
 TITLE2  'Injuries to Emergency Department Nursing Staff';
run;

proc genmod data=hrs_dc_trndt_nurs;

 class ID  HPPUq;
   model vinj = HPPUq / d = poi link = log offset = loghours noint;
 repeated subject = ID / type=ind;  /*choose ind, exch, or AR*/
 estimate '1' HPPUq  1 0 0 -1 / exp;
 estimate '2' HPPUq  0 1 0 -1  / exp;
```

```
 estimate '3' HPPUq  0 0 1 -1  / exp;

 lsmeans HPPUq / ilink cl;

 LABEL HPPU = 'Hours of Nursing Staff per Patient Discharge';

 TITLE  'Effect of Staffing Level on Violence-Related';
 TITLE2  'Injuries to Emergency Department Nursing Staff';
run;

proc genmod data=hrs_dc_trndt_nurs;

 class ID racegrp  ;
    model vinj = racegrp / d = poi link = log offset = loghours noint;
 repeated subject = ID / type=ind;  /*choose ind, exch, or AR*/

 estimate '2' racegrp -1 1 / exp;

 lsmeans racegrp / ilink cl;

 LABEL racegrp = 'Race Group';

 TITLE  'Effect of Race on Violence-Related';
 TITLE2  'Injuries to Emergency Department Nursing Staff';
run;

proc genmod data=hrs_dc_trndt_nurs;

 class ID  Year;
    model vinj = Year / d = poi link = log offset = loghours noint;
 repeated subject = ID / type=ind;  /*choose ind, exch, or AR*/

 lsmeans Year / ilink cl;

 TITLE  'Rates of Violence-Related Injuries to';
 TITLE2  'Emergency Department Nursing Staff by Year';
run;
/*Need to add racegrp to this model*/
```

Appendix G

SAS Code for De-escalation Training Investigation

```
/*To set up the data in the injury dataset to merge with the hours
data, I used Proc Freq to
create a count time for a violence-related injury.*/

/*Something happened to the names of the variables here when I brough
the injuries back together.*/
DATA violentinj;
 SET 'C:\Asus WebStorage\gram0066@umn.edu\MySyncFolder\SAS Data\New
data sets\injcombine.sas7bdat';
 WHERE violent="y";
 RENAME Date_of_Loss = Report_Date;
 RUN;


PROC FREQ DATA= violentinj noprint;
 WHERE Report_Date>'17mar2007'd;
 TABLE ID*Report_Date / out=vinjcnt07_14;

 RUN;/*Need to rename variable in order to merge on both.*/

/*When I merge the sets, I have to remove the hours that were non-
productive (there
were some on call hours mixed in with the productive). I will also have
to make sure to
only keep the injuries that were in the indicated year (this is for the
Oral prelim, to
limit the data to the daily view).*/


DATA dailyhours1;
 SET 'C:\Asus WebStorage\gram0066@umn.edu\MySyncFolder\SAS Data\New
data sets\hrs7_14.sas7bdat'
   (KEEP = ID Hours TRC_Descr AGE Job_Title Last_Start_Date
Report_Date);
 WHERE TRC_Descr = 'Overtime Paid @ 1.5' or TRC_Descr = 'Regular' or
TRC_Descr = 'Overtime Paid @ 2X';
 if Hours = 0 then delete;

RUN;

 /*After running this, I found that the injuries merged on the overtime
in a day as well as the regular time,
 and thus a lot of injuries were double counted. To control this I had
to make a sum of the hours for each
 day and then merge those files?*/

PROC SORT DATA= dailyhours1; BY ID Report_Date AGE Job_Title
Last_Start_Date;
```

```
PROC SORT DATA= vinjcnt07_14; BY ID Report_Date;

proc means data = dailyhours1 noprint;
    var Hours;
    by ID Report_Date AGE Job_Title Last_Start_Date;
output out = sumhrs sum = ;
run;
/*
PROC CONTENTS DATA = sumhrs;
RUN;*/

/*
DATA dailyhours;
 SET dailyhours1;
 KEEP ID AGE Job_Title Last_Start_Date Report_Date;

RUN;*/


/*PROC FREQ DATA=dailyhours;
        **There were many coded hours that should not be included and
were discarded using
         WHERE statement; these were hours such as On Call. I used this
PROC FREQ statement
         to figure out which observations to get rid of.**
 TABLES TRC_Descr;
 RUN;
DATA vinjcnt07_14;
 DROP PERCENT;
 RUN;*/



DATA merge07_14;

 MERGE vinjcnt07_14 sumhrs;
 BY ID Report_Date;
 DROP PERCENT _TYPE_ _FREQ_;
 loghours = LOG( Hours );
RUN;
/*
PROC CONTENTS DATA= merge07_14;
RUN;*/

/*Then I added the race and gender of the participants from the
demographic dataset.
WITH THIS MERGE I NOW HAVE MOSTLY BLANK ROWS WHERE IT INCLUDED
PARTICIPANTS FROM THE
HC DATA. When I do the full data set, I will have to merge the
demographics after
concatenating the other two sets. That way they will all get the
demographics together.*/
```

```
DATA demog1;
 SET 'C:\Asus WebStorage\gram0066@umn.edu\MySyncFolder\SAS Data\New
data sets\demog.sas7bdat'
 (KEEP = ID Gender Race);
RUN;
PROC SORT DATA= demog1; BY ID;

PROC FORMAT;
 VALUE agegrpF  1 = '23-35'
      2 = '36-43'
      3 = '44-50'
      4 = '51-66' ;

 VALUE expgrpF  1 = 'Two years or less'
      2 = 'Three to six years'
      3 = 'Seven to twelve years'
      4 = 'Thirteen years or more' ;

 VALUE jobgrpF1 = 'Registered Nurse'
      2 = 'Security Officer'
      3 = 'Health Care Assist';

 VALUE racegrpF 1 = 'White'
      2 = 'Minority';

 VALUE $GenderF 'F' = 'Female'
      'M' = 'Male';

 VALUE trainingF 1 = 'No Training'
      2 = '0-6 Months After Training'
      3 = '6-12 Months After Training'
      4 = 'Greater Than 12 Months After Training';

RUN;
/*
DATA missinginj;  THIS IS WHAT I USED TO FIND THE MISSING INJURIES AND
THEN ADJUSTED IN
SET merge07_14;   THE EXCEL SPREADSHEET.
 WHERE AGE = .;
RUN;

/*BELOW IS THE FINAL MERGED SET TO THIS POINT- NEED TO RUN THIS FOR THE
SET I CAN USE TO RUN
THE DAILY ANALYSES... THIS DATASET 'MERGE7_14' HAS MOST EVERYTHING I
NEED EXCEPT FOR THE
DE-ESCALATION DATES:*/

DATA merge7_14;

 MERGE demog1 merge07_14;
 BY ID;
 /*if AGE = . then delete;    At this point on 4/5/16, I no longer need
these specific
```

```
 If AGE < 36 then agegrp = 1; else  age groups. My next step is to get
a DOB that I can use
 If AGE < 45 then agegrp = 2; else  that will correspond to the DOB I
will get in the biweekly
 If AGE < 53 then agegrp = 3; else  data. The age groups could be
different and anyway I won't use
 If AGE >=53 then agegrp = 4;    that variable anyhow.*/
 IF Job_Title = 'Health Care Asst' then jobgrp = 3;
 IF Job_Title = 'Nurse  Roster' then jobgrp = 1;
 IF Job_Title = 'Nurse Staff' then jobgrp = 1;
 IF Job_Title = 'Nurse Staff Sr' then jobgrp = 1;
 IF Job_Title = 'Protection Officer' then jobgrp = 2;
 IF Job_Title = 'Security Supervisor' then jobgrp = 2;
 IF Race = 'W' then racegrp = 1; else
 IF Race ne 'W' then racegrp = 2;
 If COUNT = . then vinj = 0;
 If COUNT = 1 then vinj = 1;  /*Below this point is where I will make
the new DOB, based on 6 months
           prior to the date I got the age (1/2 participants could be
born before
           or after that date*/
 yearofbirth = 2015-(AGE+1);
 dob = mdy(11,7,yearofbirth);
 format dob mmddyy10.;

 ageobs = INT( (Report_Date - dob)/365.25);
 expobs = INT( (Report_Date - Last_Start_Date)/365.25);

RUN;
/*
PROC CONTENTS DATA= merge7_14;
RUN;



/*To check cut off points and to make sure I didn't lose any injuries
due to removing
the 0 hours and 0 age, I did this PROC FREQ to check both. I then also
added AGE in
to see where logical cut offs should be for running the analyses for
the different age
quartiles. I also did a table to figure out the job titles so I could
run the rates
of nursing v. security. Then I did a PROC FORMAT in order to name the
variables for age
and employee group.

PROC FREQ DATA=merge7_14;
 TABLE AGE;
 TABLE COUNT;
 TABLE Job_Title;
 TABLE Race;
RUN;*/
```

```
/*Then to get some rates I log transformed my hours and did a PROC
Genmod to get
stratified rates. [choose ind, exch, or AR for type] In doing this, I
found a bunch
of dates of injuries that didn't match up with dates that EEs worked.
So I need to
go back to the original data and modify when that injury occurred with
a date the
EE actually worked. I did this and went through all the injuries with
missing data
in the rows. There were a few injuries that did not match with a date,
even after
investigation, and I had to throw out those injuries. Unfortunately, on
a check, there
was still one more observation in the merged data than before I merged
the injuries,
indicating that there is still one injury that doesn't line up with the
rest and I
will have to find and fix. For today (2/29), I will just run the rates
to get the Oral
preliminary data out. For the final, I will have to find and fix. On
3/19, I found the
last missing injury, so will go back to the original data and figure
out that last injury.*/

/*Then I found out from Andy that I should be investigating each group
for its injury
rate and calculate by hand to make sure they match up with the genmod
of the rates. Ouch.
Not sure if it's the most efficient way, but I made sets of each group
to get sum totals
to calculate. When I did it for the agegrps, the rates I calculated by
hand matched precisely.
They also matched precisely with the other groups. Hand-calculated rate
ratios also matched.*/

/*
ODS OUTPUT GEEEmpPEst=myGEEEmpPEst;
proc genmod data = merge7_14;
    class ID agegrp;
    model vinj = agegrp / d = poi link = log offset = loghours noint;
    repeated subject = ID / type=ind;
 lsmeans agegrp / ilink cl;
 FORMAT agegrp agegrpF.;
   run;

DATA agerates1;
 SET merge7_14;
 WHERE agegrp=1;
RUN;

DATA agerates2;
```

```
 SET merge7_14;
 WHERE agegrp=2;
RUN;

DATA agerates3;
 SET merge7_14;
 WHERE agegrp=3;
RUN;

DATA agerates4;
 SET merge7_14;
 WHERE agegrp=4;
RUN;
*/
/*proc genmod data = merge7_14;
    class ID jobgrp ;
    model vinj = jobgrp / d = poi link = log offset = loghours;
    repeated subject = ID / type=ind;
 lsmeans jobgrp / ilink cl;
 FORMAT jobgrp jobgrpF.;
   run;
/*
DATA jobrates1;
 SET merge7_14;
 WHERE jobgrp=1;
RUN;

DATA jobrates2;
 SET merge7_14;
 WHERE jobgrp=2;
RUN;*/
/*
proc genmod data = merge7_14;
    class ID racegrp;
    model vinj = racegrp / d = poi link = log offset = loghours;
    repeated subject = ID / type=ind;
 lsmeans racegrp / ilink cl;
 FORMAT racegrp racegrpF.;
   run;

DATA racerates1;
 SET merge7_14;
 WHERE racegrp=1;
RUN;

DATA racerates2;
 SET merge7_14;
 WHERE racegrp=2;
RUN;*/
/*
proc genmod data = merge7_14;
    class ID Gender ;
    model vinj = Gender / d = poi link = log offset = loghours;
```

```
    repeated subject = ID / type=ind;
 lsmeans Gender / ilink cl;
 FORMAT Gender $GenderF.;
   run;


DATA genderratesF;
 SET merge7_14;
 WHERE Gender='F';
RUN;

DATA genderratesM;
 SET merge7_14;
 WHERE Gender='M';
RUN;*/

/*Next job is to bring in the patient discharges in here and then I'll
need to remember to also get a sum of
the nursing hours in each day [sum by report date where jobgrp = 1,3],
and then sum the discharges on each
day*/

DATA dailyd_c;
 SET 'C:\Asus WebStorage\gram0066@umn.edu\MySyncFolder\SAS Data\New
data sets\eddis7_14.sas7bdat';

 Report_Date = mdy(DEP_M,DEP_D,DEP_Y);
 format Report_Date mmddyy10.;

RUN;

PROC MEANS DATA= dailyd_c noprint;
    var PAT_COUNT;
    by Report_Date;
output out = sumd_c (drop = _TYPE_ _FREQ_) sum = sumdc;
WHERE Report_Date>'17mar2007'd;

RUN;

PROC SORT DATA=merge7_14;
BY Report_Date;
RUN;

PROC MEANS DATA= merge7_14 noprint;
 var Hours;
 by Report_Date;
 output out = sumd_hrs (drop = _TYPE_ _FREQ_) sum = sumHours;
 where jobgrp ne 2.;
RUN;

DATA HPPUday;
 MERGE sumd_c sumd_hrs;
 by Report_Date;
```

```
 WHERE Report_Date ne .;
 HPPU = sumHours/sumdc;
 RUN;

/*Everything looks good until these merge together and then the
sumHours get separated from the Report_Date and
go just with the same set of observations, rather than being tied to
either the Report_Date or ID. I'll have to
investigate creating the HPPU and merging afterwards. Then I did the
HPPU in a previous step, and... It worked!*/
DATA mergehrs_d_c;
 MERGE merge7_14 HPPUday ;
 by Report_Date;
 DROP sumHours sumdc;
 WHERE Report_Date ne .;
 RUN;

/*Next step is to bring in the de-escalation dates. I'll have to
transpose the dates, but first check out what they
 even look like.*/

DATA traindate;
 SET 'C:\Asus WebStorage\gram0066@umn.edu\MySyncFolder\SAS Data\New
data sets\demog.sas7bdat'
 (KEEP = ID Date_of_de_escalation_1 Date_of_de_escalation_2
Date_of_de_escalation_3);
/*
 Trndate = Date_of_de_escalation_1;
 OUTPUT;

 Trndate = Date_of_de_escalation_2;
 OUTPUT;

 Trndate = Date_of_de_escalation_3;
 OUTPUT;

 FORMAT Trndate mmddyy10.;

 KEEP ID Trndate;*/
RUN;

/*DATA traindate;
 SET date;

 IF Report_Date ne . then Training = 1; else
 IF Report_Date = . then Training = .;

RUN;*/

/*Sweet. Got it with the code above. The next step is to merge this
dataset with the merged sets and then create the
code for the time-dependent value of the training with diminishing
effects over time. And done 5.15.16.*/
```

```
/*PROC PRINT DATA = traindate;
RUN;*/

PROC SORT DATA= traindate; BY ID;
PROC SORT DATA= mergehrs_d_c; BY ID Report_Date;

DATA mergeall;
 MERGE traindate mergehrs_d_c;
 BY ID;
RUN;

DATA hrs_dc_trndt;
 SET mergeall;

if (Date_of_de_escalation_1 = .) or Date_of_de_escalation_1 gt
Report_Date then training1 = 1;

else if 0 le (Report_Date - Date_of_de_escalation_1) le 182 then
training1 = 2;

else if 182 le  (Report_Date - Date_of_de_escalation_1) le 365 then
training1 = 3;

else if (Report_Date - Date_of_de_escalation_1) gt 365 then training1 =
4;


if 0 le (Report_Date - Date_of_de_escalation_2) le 182 then training2 =
2;

else if 182 le  (Report_Date - Date_of_de_escalation_2) le 365 then
training2 = 3;

else if (Report_Date - Date_of_de_escalation_2) gt 365 then training2 =
4;


if (training2 = .) then training4 = training1;

else if training2 = 2 then training4 = 2;

else if training2 = 3 then training4 = 3;

else if training2 = 4 then training4 = 4;


if 0 le (Report_Date - Date_of_de_escalation_3) le 182 then training3 =
2;

else if 182 le  (Report_Date - Date_of_de_escalation_3) le 365 then
training3 = 3;
```

```
else if (Report_Date - Date_of_de_escalation_3) gt 365 then training3 =
4;


if (training3 = .) then training = training4;

else if training3 = 2 then training = 2;

else if training3 = 3 then training = 3;

else if training3 = 4 then training = 4;


 If ageobs < 36 then agegrp = 1; else
 If ageobs < 44 then agegrp = 2; else
 If ageobs < 51 then agegrp = 3; else
 If ageobs >=51 then agegrp = 4;

 If expobs < 3 then expgrp = 1; else
 If expobs < 7 then expgrp = 2; else
 If expobs < 13 then expgrp = 3; else
 If expobs >=13 then expgrp = 4;

 Year = Year(Report_Date);

 IF Age = . then delete;

 /*If Report_Date le '31dec2007'd then Year = $2007 *Need to figure out
how to format a year here* Done 5.28. Next need
 to get rid of the observations that are before 2007 by removing folks
who don't have Age. Done 5.28*/
RUN;
/*
PROC PRINT DATA= hrs_dc_trndt (obs=1000);
RUN;

PROC CONTENTS DATA= hrs_dc_trndt;
RUN;*/
/*
And this worked. Diminishing effects over time are created. I will
format the training labels to designate how long after
the training the respective time periods are. I also want to get
quartiles of experience and age. Will do that using
Univariates on both. 5.15.16 And done 5.20.16.

PROC UNIVARIATE DATA = hrs_dc_trndt;
VAR expobs ageobs;
RUN;*/

/*proc genmod data=hrs_dc_trndt;

 FORMAT Gender $GenderF.;
 FORMAT training trainingF.;
```

```
 FORMAT expgrp expgrpF.;
 FORMAT agegrp agegrpF.;
 FORMAT jobgrp jobgrpF.;

 class ID training (ref="No Training") expgrp (ref="One year or less")
agegrp (ref="20-31") jobgrp (ref="Registered Nurse") Gender ;
    model vinj = HPPU Gender training expgrp agegrp jobgrp/ d = poi
link = log offset = loghours noint;
 repeated subject = ID / type=ind;
 lsmeans training / ilink cl;
 lsmeans expgrp / ilink cl;
 lsmeans agegrp / ilink cl;
 lsmeans Gender / ilink cl;
 lsmeans jobgrp / ilink cl;


 LABEL training = 'De-escalation Training Period';
 LABEL expgrp = 'Experience Level';
 LABEL agegrp = 'Age Group';
 LABEL HPPU = 'Hours of Nursing Staff per Patient Discharge';
 LABEL jobgrp= 'Occupation';

 TITLE  'Effect of De-escalation Training on Violence-Related';
 TITLE2  'Injuries to Security Workers and Nursing Staff';
run;*/

DATA hrs_dc_trndt_rn;
 SET hrs_dc_trndt;
 WHERE jobgrp= 1;
RUN;

/*PROC UNIVARIATE DATA = hrs_dc_trndt_rn; use this to find out the
quantiles for RNs
VAR expobs ageobs;
RUN;*/

proc genmod data=hrs_dc_trndt_rn;

 /*FORMAT Gender $GenderF.;
 FORMAT training trainingF.;
 FORMAT expgrp expgrpF.;
 FORMAT agegrp agegrpF.;
 FORMAT jobgrp jobgrpF.;*/

 class ID training expgrp agegrp Gender ;
    model vinj = Gender training expgrp agegrp / d = poi link = log
offset = loghours noint;
 repeated subject = ID / type=ind;  /*choose ind, exch, or AR*/
 estimate '1' expgrp 1 0 0 -1 / exp;
 estimate '2' expgrp 0 1 0 -1 / exp;
 estimate '3' expgrp 0 0 1 -1 / exp;
 estimate '1' agegrp 1 0 0 -1 / exp;
 estimate '2' agegrp 0 1 0 -1 / exp;
```

```
 estimate '3' agegrp 0 0 1 -1 / exp;
 estimate '2' training -1 1 0 0 / exp;
 estimate '3' training -1 0 1 0 / exp;
 estimate '4' training -1 0 0 1 / exp;
 estimate 'M' Gender -1 1 / exp;

 lsmeans training / ilink cl;
 lsmeans expgrp / ilink cl;
 lsmeans agegrp / ilink cl;
 lsmeans Gender / ilink cl;

 LABEL training = 'De-escalation Training Period';
 LABEL expgrp = 'Experience Level';
 LABEL agegrp = 'Age Group';
 LABEL HPPU = 'Hours of Nursing Staff per Patient Discharge';

 TITLE  'Effect of De-escalation Training on Violence-Related';
 TITLE2  'Injuries to Emergency Department Nurses, full model';
run;

/*Need to do a PROC Means for each vinj by levels of covariate using a
Class statement

PROC MEANS DATA = hrs_dc_trndt_rn;
CLASS training;
VAR vinj;
RUN;

PROC MEANS DATA = hrs_dc_trndt_rn;
CLASS expgrp;
VAR vinj;
RUN;

PROC MEANS DATA = hrs_dc_trndt_rn;
CLASS agegrp;
VAR vinj;
RUN;  So, after doing this, I found that there were no injuries among
nurses in the 3-6 months following training
So, I will try changing the variable so it's the first 6 months
following training, following 6 months and time
period after that, then do my PROC MEANS again and see what I get*/

proc genmod data=hrs_dc_trndt_rn;

 class ID training ;
    model vinj = training / d = poi link = log offset = loghours noint;
 repeated subject = ID / type=ind;  /*choose ind, exch, or AR*/

 estimate '2' training -1 1 0 0 / exp;
 estimate '3' training -1 0 1 0 / exp;
 estimate '4' training -1 0 0 1 / exp;

 lsmeans training / ilink cl;
```

```
 LABEL training = 'De-escalation Training Period';

 TITLE  'Effect of De-escalation Training on Violence-Related';
 TITLE2  'Injuries to Emergency Department Nurses, training alone';
run;

proc genmod data=hrs_dc_trndt_rn;

 class ID expgrp ;
    model vinj = expgrp  / d = poi link = log offset = loghours noint;
 repeated subject = ID / type=ind;  /*choose ind, exch, or AR*/
 estimate '1' expgrp 1 0 0 -1 / exp;
 estimate '2' expgrp 0 1 0 -1 / exp;
 estimate '3' expgrp 0 0 1 -1 / exp;

 lsmeans expgrp / ilink cl;

 LABEL expgrp = 'Experience Level';

 TITLE  'Effect of Experience Level on Violence-Related';
 TITLE2  'Injuries to Emergency Department Nurses';
run;

proc genmod data=hrs_dc_trndt_rn;

 class ID Gender ;
    model vinj = Gender  / d = poi link = log offset = loghours noint;
 repeated subject = ID / type=ind;  /*choose ind, exch, or AR*/
 estimate 'M' Gender -1 1 / exp;

 lsmeans Gender / ilink cl;

 TITLE  'Relation of Gender on Violence-Related';
 TITLE2  'Injuries to Emergency Department Nurses';
run;

proc genmod data=hrs_dc_trndt_rn;

 class ID agegrp  ;
    model vinj = agegrp / d = poi link = log offset = loghours noint;
 repeated subject = ID / type=ind;  /*choose ind, exch, or AR*/

 estimate '1' agegrp 1 0 0 -1 / exp;
 estimate '2' agegrp 0 1 0 -1 / exp;
 estimate '3' agegrp 0 0 1 -1 / exp;

 lsmeans agegrp / ilink cl;

 LABEL agegrp = 'Age Group';

 TITLE  'Effect of Age on Violence-Related';
 TITLE2  'Injuries to Emergency Department Nurses';
```

```
run;

/*proc genmod data=hrs_dc_trndt_rn;

 class ID  ;
    model vinj = HPPU / d = poi link = log offset = loghours noint;
 repeated subject = ID / type=ind;  choose ind, exch, or AR

 LABEL HPPU = 'Hours of Nursing Staff per Patient Discharge';

 TITLE  'Effect of Staffing Level on Violence-Related';
 TITLE2  'Injuries to Emergency Department Nurses';
run;*/


/*proc genmod data=hrs_dc_trndt_rn; **Had to take RG out- not enough
injuries**

 class ID racegrp  ;
    model vinj = racegrp / d = poi link = log offset = loghours noint;
 repeated subject = ID / type=ind;  choose ind, exch, or AR

 estimate '2' racegrp -1 1 / exp;

 lsmeans racegrp / ilink cl;

 LABEL racegrp = 'Race Group';

 TITLE  'Effect of Race on Violence-Related';
 TITLE2  'Injuries to Emergency Department Nurses';*/
run;

proc genmod data=hrs_dc_trndt_rn;

 class ID  Year;
    model vinj = Year / d = poi link = log offset = loghours noint;
 repeated subject = ID / type=ind;  /*choose ind, exch, or AR*/

 lsmeans Year / ilink cl;

 TITLE  'Rates of Violence-Related Injuries to';
 TITLE2  'Emergency Department Nurses by Year';
run;
```

Appendix H

IRB Statements of Approval

HUMAN SUBJECTS RESEARCH COMMITTEE

Hennepin County Medical Center
April 7, 2015 Hennepin Healthcare System, Inc.

Joshua Gramling
SURG-TRAUMA-NEURO INPATIENT
Hennepin County Medical Center

Dear Joshua Gramling

The Office for Human Subjects Research is in receipt of your proposed study entitled: **"The Effectiveness of Conducted Electrical Weapon Carriage in Reducing Hospital Staff Injuries"**. This is a retrospective cohort study of security and ED nursing personnel at HCMC from 1/1/04 to 12/31/14 using a pre- and post-test evaluation of the introduction of an intervention of arming security guards in the ED with TASERS. This project involves no more than minimal risk and it has been confirmed that risks related to invasion of privacy and breach of confidentiality are no greater than minimal, and the research is not classified. This project was approved under 45 CFR 46 expedited review category 5. This project is retrospective and does not adversely affect the rights and welfare of subjects; all criteria for waiver of consent were met in accordance with 45 CFR 46.116 and waiver of consent was approved. **You may proceed with this project**.

This project has been assigned **HSR #15-3965**. Please use this number in all future correspondence.

Approval of this project will expire on 4/7/2016.

Continuing review for this project will require reporting **annually**. Reporting forms will be sent to you before the reports are due. It is mandatory that you complete and return these forms by the indicated date. Failure to complete and return forms will be cause for approval expiration of this project. Annual re-approval will be required for continuation of this project.

Please note the following:

- This project may be audited at any time.
- Any proposed changes in this project and notification of project completion must be submitted to the Office for Human Subjects Research. Changes should not be initiated until written approval is received.
- All serious adverse events (on-site), unanticipated problems involving risks to subjects or others, external new information that may alter risk to subjects or others, and reportable non-compliance must be reported to the Office for Human Subjects Research. Please see the attached guide for information that requires prompt reporting to the Office for Human Subjects Research.
- For your review, Research Investigator Responsibilities and the Prompt Reporting Guide and forms are available at: http://mmrf.org/resources/hrsc.html
- The Human Subjects Research Committee is in compliance with applicable federal regulations.

Sincerely,

Karen Heim-Duthoy, PharmD
Vice Chair
Human Subjects Research Committee

Association for the Accreditation of Human Research Protection Programs, Inc. — Full Accreditation

Mailing Address: 701 Park Avenue, S9.115, Minneapolis, MN 55415
Physical Location: 914 South 8th Street, Shapiro Building S9.115, Minneapolis, MN 55404
Phone: 612-873-6882 Fax: 612-873-1646

HUMAN SUBJECTS RESEARCH COMMITTEE

Frederick Langendorf, M.D.
Chair
Karen Heim-Duthoy, PharmD
Vice Chair

Hennepin County Medical Center
Hennepin Healthcare System, Inc.

May 1, 2012

Joshua Gramling
School of Public Health
Hennepin County Medical Center

Dear Joshua Gramling

The Office for Human Subjects Research is in receipt of your proposed study entitled: **"A Qualitative Inquiry into the Injuries Sustained by Security Guards at HCMC"**. This is a secondary data analysis of three sets of records. The first record group is the injury log kept by the hospitals occupational health department to first identify the number and severity of injuries by obtaining injury data for the past 4 years and analyzing the numbers of injuries against the number of security guards. The second record group, "Report Exec" is the event log that is filled out by the security guards themselves after an incident with a patient has occurred that will include possible records of violent situations with patients where a security worker was not injured. The third record group is the patient record itself, EPIC, to review what happens to patients after an incident involving the injury of a security worker with the goal of having a better understanding the escalating situations to determine if there could have been something done to prevent one of the subjects from getting injured in the process.. The project has been reviewed and found to be adequate. Since the project involves no more than minimal risk and it has been confirmed that confidentiality will be maintained, it was approved under the Title 45 CFR 46 expedited review procedure number 5. Waiver of consent was approved under 45 CFR 46.116. **You may proceed with this project**.

This project has been assigned **HSR #12-3449**. Please use this number in all future correspondence.

Approval of this project will expire on 5/1/2013.

Continuing review for this project will require reporting **annually**. Reporting forms will be sent to you before the reports are due. It is mandatory that you complete and return these forms by the indicated date. Failure to complete and return forms will be cause for administrative hold and/or closure of this project. Annual re-approval will be required for continuation of this project.

Please note the following:

- This project may be audited at any time.
- Any proposed changes in this project, any new information that may alter risk or confidentiality to the subjects, and notification of project completion must be submitted to the Office for Human Subjects Research. Changes should not be initiated until written approval is received.
- All serious and/or unanticipated adverse events must be promptly reported to the Office for Human Subjects Research as they occur.
- For your review, a list of research investigator responsibilities is available at: www.mmrf.org/MMRF/research/hrsc.html

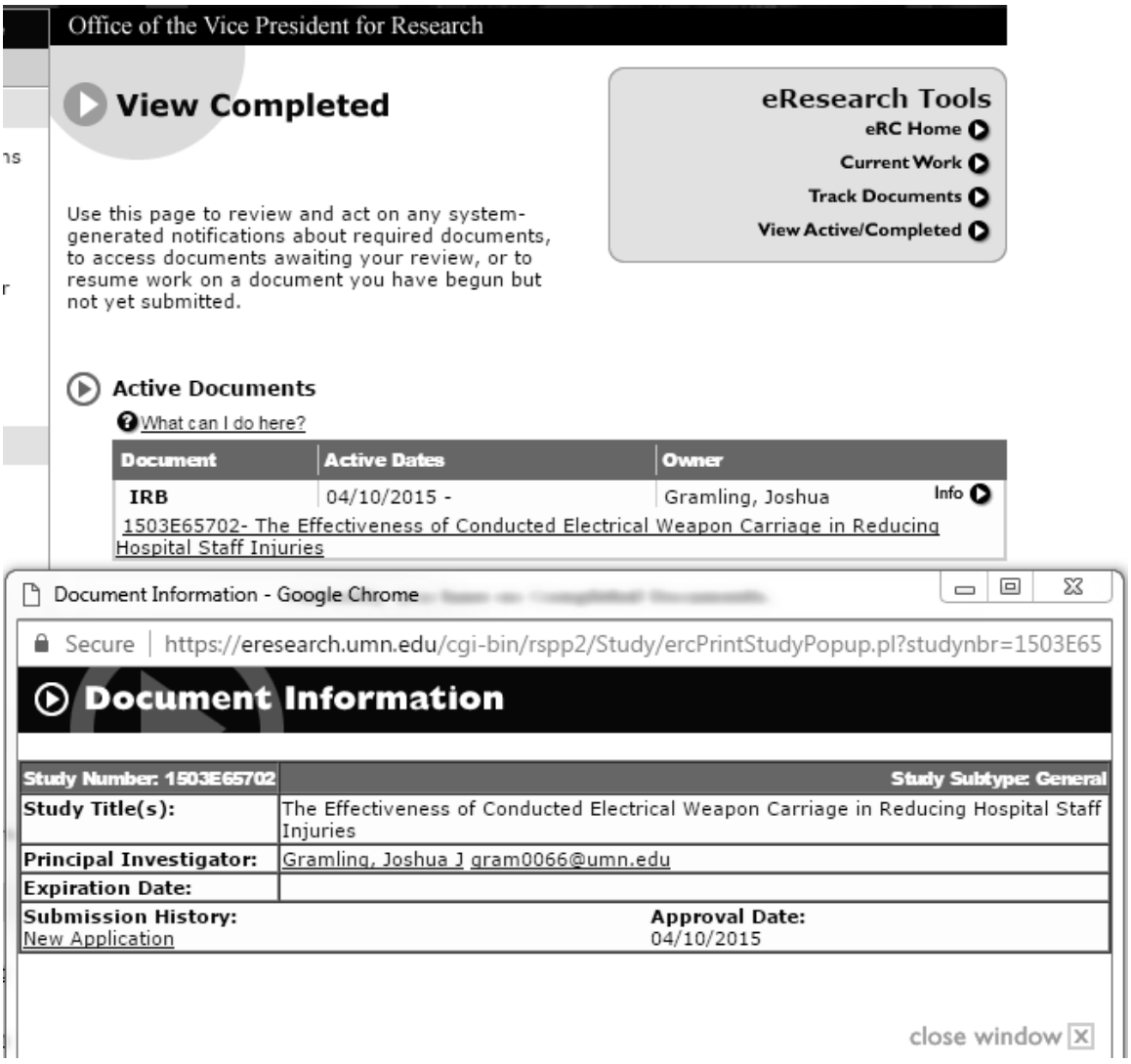
Please be informed that the Human Subjects Research Committee is in compliance with applicable federal regulations.

Sincerely,

Karen Heim-Duthoy, PharmD
Vice Chair
Human Subjects Research Committee

Full Accreditation

Mailing Address: 701 Park Avenue, Shapiro 9.904, Minneapolis, MN 55415
Physical Location: 914 South 8th Street, 904 Shapiro Building, Minneapolis, MN 55404
Phone: 612-347-8528 Fax: 612-347-7627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04/10/2015 -
Gramling, Joshua
Info
1503E65702- The Effectiveness of Conducted Electrical Weapon Carriage in Reducing Hospital Staff Injuries
Document Information - Google Chrome
Secure | https://eresearch.umn.edu/cgi-bin/rspp2/Study/ercPrintStudyPopup.pl?studynbr=1503E65
Document Information
Study Number: 1503E65702
Study Subtype: General
Study Title(s):
The Effectiveness of Conducted Electrical Weapon Carriage in Reducing Hospital Staff Injuries
Principal Investigator:
Gramling, Joshua J gram0066@umn.edu
Expiration Date:
Submission History:
New Application
Approval Date:
04/10/2015
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Appendix I

Tables for Experience Level Association Stratified by Age and Age Level Association Stratified by Experience Level

Table I.1 Effect of Experience on Violence-Related Injuries To Security Workers by Age Group						
Effect of Experience on Violence-Related Injuries To Security Workers, **Age 21-30 Years**						
Years of experience	**Rate of injuries per 100,000 hours worked**	**Rate ratio as compared to 14-33**	**Mean 95% confidence limits**		**Chi-Square**	**Pr > ChiSq**
0-1	63.1	n/a	n/a	n/a	n/a	n/a
2-6	77.1	n/a	n/a	n/a	n/a	n/a
7-13	n/a (no observations)	n/a	n/a	n/a	n/a	n/a
14-33	n/a (no observations)	n/a	n/a	n/a	n/a	n/a
Effect of Experience on Violence-Related Injuries To Security Workers, **Age 31-37 Years**						
Years of experience	**Rate of injuries per 100,000 hours worked**	**Rate ratio as compared to 14-33**	**Mean 95% confidence limits**		**Chi-Square**	**Pr > ChiSq**
0-1	43.4	1.02	0.28	3.72	0.00	0.98
2-6	31.9	0.74	0.23	2.41	0.24	0.62
7-13	45.9	1.07	0.34	3.36	0.01	0.90
14-33	42.8	n/a	n/a	n/a	n/a	n/a
Effect of Experience on Violence-Related Injuries To Security Workers, **Age 38-43 Years**						
Years of experience	**Rate of injuries per 100,000 hours worked**	**Rate ratio as compared to 14-33**	**Mean 95% confidence limits**		**Chi-Square**	**Pr > ChiSq**
0-1	44.6	2.26	0.73	6.98	1.99	0.16
2-6	38.5	1.95	0.73	5.17	1.79	0.18
7-13	13.7	0.69	0.15	3.25	0.22	0.64
14-33	19.8	n/a	n/a	n/a	n/a	n/a

Table I.1 Effect of Experience on Violence-Related Injuries To Security Workers, **Age 44-61 Years**

Years of experience	**Rate of injuries per 100,000 hours worked**	**Rate ratio as compared to 14-33**	**Mean 95% confidence limits**		**Chi-Square**	**Pr > ChiSq**
0-1	45.1	1.79	0.58	5.47	1.03	0.31
2-6	56.0	2.22	0.93	5.31	3.22	0.07
7-13	16.3	0.65	0.18	2.31	0.45	0.50
14-33	25.2	n/a	n/a	n/a	n/a	n/a

Table I.2 Effect of Age on Violence-Related Injuries To Security Workers by Experience Level						
Effect of Age on Violence-Related Injuries To Security Workers, **0-1 Years' Experience**						
Age	**Rate of injuries per 100,000 hours worked**	**Rate ratio as compared to 44-61**	**Mean 95% confidence limits**		**Chi-Square**	**Pr > ChiSq**
21-30	63.1	1.40	0.46	4.26	0.35	0.55
31-37	43.4	0.96	0.28	3.30	0.00	0.95
38-43	44.6	0.99	0.27	3.64	0.00	0.99
44-61	45.1	n/a	n/a	n/a	n/a	n/a
Effect of Age on Violence-Related Injuries To Security Workers, **2-6 Years' Experience**						
Age	**Rate of injuries per 100,000 hours worked**	**Rate ratio as compared to 44-61**	**Mean 95% confidence limits**		**Chi-Square**	**Pr > ChiSq**
21-30	77.1	1.38	0.58	3.27	0.53	0.53
31-37	31.9	0.57	0.25	1.32	1.71	0.19
38-43	38.5	0.69	0.26	1.84	0.56	0.46
44-61	56.0	n/a	n/a	n/a	n/a	n/a
Effect of Age on Violence-Related Injuries To Security Workers, **7-13 Years' Experience**						
Age	**Rate of injuries per 100,000 hours worked**	**Rate ratio as compared to 44-61**	**Mean 95% confidence limits**		**Chi-Square**	**Pr > ChiSq**
21-30	n/a (no observations)	n/a	n/a	n/a	n/a	n/a
31-37	45.9	n/a	n/a	n/a	n/a	n/a
38-43	13.7	n/a	n/a	n/a	n/a	n/a
44-61	16.3	n/a	n/a	n/a	n/a	n/a

Effect of Age on Violence-Related Injuries To Security Workers, **14-33 Years' Experience**						
Age	**Rate of injuries per 100,000 hours worked**	**Rate ratio as compared to 44-61**	**Mean 95% confidence limits**		**Chi-Square**	**Pr > ChiSq**
21-30	n/a (no observations)	n/a	n/a	n/a	n/a	n/a
31-37	42.8	n/a	n/a	n/a	n/a	n/a
38-43	19.8	n/a	n/a	n/a	n/a	n/a
44-61	25.2	n/a	n/a	n/a	n/a	n/a