NON-FATAL STRANGULATION: CLIENT PRESENTATION WITHOUT PHYSICAL INJURY

Jennifer Johnson

Maryville University

Capstone Chair:	Dr. Elizabeth Buck
Capstone Committee Member:	Dr. Jeanne Catanzaro
Date of Submission:	April 24, 2017

Abstract

Background: Strangulation patients present a vast variety of symptoms and physical presentations, including no visible injuries, neck pain, and the absence of petechial hemorrhage. However, it is important to note that in 50% of reported cases of strangulation, there can be significant injury without leaving noticeable bruises on the neck (Funk & Schuppel, 2003; Utely, 2014).

Purpose: The purpose of this project is to examine the occurrence of injury identification in NSF patients by comparing subjective symptoms disclosed by the NFS patient and the physical injury identified to the neck region, the occurrence of injury presentation without subsequent radiological studies completed, and the percentage of NSF patients that present with no injury presentation to the neck region, but had abnormal radiological findings.

Design: A nonexperimental, retrospective quantitative descriptive study.

Methods: The initial statistical test completed was a frequency statistical test in identifying those individuals that disclosed a strangulation (N = 295); however, 113 did not present with any physical findings.

Results: The initial statistical test completed was a frequency statistical test in identifying those individuals that disclosed a strangulation (N = 295); however, 113 did not present with any physical findings. The physical findings initially identified included the presence of ligature marks 6% (n = 11), bruising to the neck region 54% (n = 99), presence of petechiae 25% (n = 45), circumferential marks 27% (n = 27), neck swelling 13% (n = 24), or scratch marks to the neck 54% (n = 98). Frequency statistical analysis provided additional information for the demographics of the total number of non-fatal strangulation (NFS) patients with regards to sex and race. Of the 295 patients, there were 113 patients that presented without the outward

physical presentation that a strangulation event had taken place. Without visible injury and with disclosure alone, the question to provide radiological testing may exist. There were two patients identified in the scholarly project who experienced a fracture, one had thyroid cartilage fracture and one had a cervical fracture, neither without physical findings to the neck region. The African-American female patient who sustained a thyroid cartilage fracture disclosed only neck pain, being light-headed, and the presence of a cough. In contrast, the African-American female who sustained a cervical fracture only disclosed a sore throat.

Conclusion: This information provides evidence of the need for individualized, consistent, evidence-based medical care specifically tailored to the needs of each strangulation patient and not determinate on the visible injury.

Implications for Practice: Development of an assessment algorithm to aid in a pathway for determining radiological studies to be completed, whether admission is appropriate, and referral to an ear, nose and throat specialist as well as to provide valuable information to the legal community to ensure that individuals who have survived a strangulation will be encouraged to seek medical intervention to ensure physical safety.

Acknowledgments

I would like to extend my appreciation and gratitude to Dr. Elizabeth Buck, my chair of this scholarly project. Her expertise, mentoring, and guidance throughout this project assisted in its completion. Further appreciation is to Dr. Jeanne Catanzaro, my nursing profession mentor, without her guidance and prodding I would not have embarked on this adventure, and to Dr. Crocker for assisting getting all the ideas and words in my brain to flow eloquently.

Table of Contents

List of Tables

CHAPTER I: INTRODUCTION

Intimate partner violence (IPV) is a serious public health issue throughout the United States (Smith, Fowler, & Niolon, 2014), with strangulation accounting for 10% of all intimate partner deaths (Funk & Schuppel, 2003; Lambe, Pushel, & Anders, 2008; Shields, Corey, Weakley-Jones, & Stewart, 2010; Volochinsky, 2012). Furthermore, it has been estimated that 25% of intimate partner victims have sustained a strangulation (Alliance, 2014; Banwari, 2015; Carlson, 2014). With IPV, there is a concern regarding the differing types of injuries that could potentially be sustained at the hand of a significant other, which is furthered by the knowledge that strangulation is one of the best predictors for homicide for intimate partner victims (Faugno, Waszak, Strack, Brooks, & Gwinn, 2013). This author resides and practices in the state of Kansas where this issue of strangulation has been growing in the past years. In 2014, the Kansas Bureau of Investigations reported 16 homicides related to IPV. Of the 97 homicides reported for the state of Kansas, intimate partner death accounts for 16.5% of all homicides in Kansas (Kansas Bureau of Investigations, 2014). Unfortunately, strangulation rates are not specifically monitored by the Kansas Bureau of Investigation.

The act of strangulation is a form of power and control used to silence the victim while causing devastating effects on health, safety, and wellbeing. The batterer does not use the act as a means to kill the victim, but to make it known they could (Strack & Gwinn, 2011). As a form of asphyxia, the victim experiences lethal pressure on the structures of the neck, including the airway, circulatory system, and nervous structures of the neck, which can lead to anoxia, irreversible brain damage, and death (Di Paolo et al., 2009; Green, 2013; Lambe et al., 2008). The lack of circulation of blood to the brain will result in unconsciousness in approximately 10

seconds and sustaining brain death in 4 minutes (Faugno et al., 2013). Strangulation is believed to leave evidence that it has occurred, such as physical signs of ligature marks, red marks, scratches, bruises, and petechiae. Furthermore, it is estimated that jugular vein compression for approximately 10 to 30 seconds with 4 to 4.5 pounds of pressure will result in petechial hemorrhage (Lambe et al., 2008; Stapczynski, 2010). If the jugular veins are not compressed, the presentation of petechiae and scleral hemorrhage will not be evident. Compression of the carotid arteries for a duration of 10 seconds with 11 pounds of pressure will result in a loss of consciousness without petechial hemorrhage formation (Lambe et al., 2008). Loss of consciousness may produce a generalized seizure with subsequent loss of bowel or bladder function.

Strangulation patients present a vast variety of symptoms and physical presentations, including no visible injuries, neck pain, and the absence of petechial hemorrhage. However, it is important to note that in 50% of reported cases of strangulation, there can be significant injury without leaving noticeable bruises on the neck (Funk & Schuppel, 2003; Utely, 2014). In some cases, there may be the presence of defensive injuries, such as lacerations and scratch marks, that may have been sustained by the victim in an attempt to remove the pressure from the neck to improve breathing (Carlson, 2014). The lack of knowledge of the absence of physical presentation of injuries may result in limited or no diagnostic evaluation being completed if the patient does not exhibit any physical presentation of manual or ligature marks that may be consistent with strangulation. Nevertheless, patients may have sustained life-threatening injuries when discharged to go home and may succumb to death.

Purpose

The purpose of this project was to examine the occurrence of injury identification in NSF patients by comparing subjective symptoms disclosed by the NFS patient and the physical injury identified to the neck region, the occurrence of injury presentation without subsequent radiological studies completed, and the percentage of NSF patients that present with no injury presentation to the neck region, but had abnormal radiological findings. The focus of the study was on NFS patients presented to the emergency department Forensic Assessment Consultation and Treatment (FACT) program with a disclosure of strangulation from May 2010 to November 30, 2016. The FACT program is a comprehensive forensic program in a large metropolitan city located in Kansas.

The three research questions used to guide the study are: (a) What is the incidence of strangulation without physical findings to the neck region? (b) What types of diagnostic interventions were completed? and (c) What were the results of the diagnostic interventions? This information will assist in ensuring the severity of the strangulation is effectively managed, providing patients evidence-based care focused on a disclosure that a strangulation event has occurred and not by the physical presentation of injuries alone.

Background

The injuries sustained from strangulation account for approximately 2.5% of all traumatic deaths in the world (Banwari, 2015). Vascular injuries sustained by strangulation are not completely uncommon, however, hyoid bone fractures in comparison are rare in the surviving strangulation victim (Banwari, 2015; Erdogan et al., 2015; Green, 2013). The hyoid bone is located in the upper portion of the anterior neck at the C3 vertebra, between the mandible and the

thyroid cartilage. The hyoid bone is responsible for the movement of the tongue and assists with strangulation and respiratory capability (Porr, Laframboise, & Kazemi, 2012). Arterial injuries sustained include dissections and tears, which result in slow bleeding and possible hematoma formation. These injuries may not be evident in the recently strangled patient and may not accompany a hyoid bone or cervical fracture, thus increasing the risk of death if not identified in a timely fashion (Dayapala, Samarasekera, & Jayasena, 2012).

There are five types of strangulation: (a) manual strangulation, (b) choke hold, (c) ligature, (d) postural, and (e) hanging. Manual strangulation is the grabbing and squeezing of the neck while applying pressure with the use of an individual's hands. Manual strangulation may also be called throttling, which is considered an act that can cause blunt force trauma to the region of the neck (Di Paolo et al., 2009). In IPV, the most common type of strangulation is manual strangulation, which has been estimated to occur in 97% of all strangulation cases (Holbrook & Jackson, 2013; Strack & Gwinn, 2011). The other forms of strangulation identified in IPV, but less commonly, are ligature and postural strangulation (Faugno et al., 2013). Ligature strangulation is the application of an item around an individual's neck to apply pressure. Postural strangulation is the application of pressure onto the chest causing a decrease in the diaphragmatic expansion, thus decreasing the ability to breathe (Faugno et al., 2013).

Strangulation is a common cause of homicide in the female population in the United States as half of the homicides of women are caused by a current or former significant other (Riley et al., 2015). Women are more likely to disclose strangulation than men when asked about strangulation by a significant other (Sorenson, Joshi, & Sivitz, 2014). If women do not disclose that the event has taken place and there are no injuries to the neck region, the incident

may be minimized, minimized not only by law enforcement, but by medical professionals in the emergency department (Strack & Gwinn, 2011).

There are 38 states that currently have a law making the act of strangulation a felony (Jeltson, 2015). In the state of Kansas, strangulation remains a misdemeanor crime under the statute of battery, unless there is intent to cause bodily harm or death. If the patient sustained bodily injury, then the offender is charged with an aggravated assault, which is a felony charge in the state of Kansas. The court must prove that the intent to cause bodily harm was evident with injuries sustained as a result of the strangulation. Medical providers and forensic nurse examiners can assist with the classification of injuries that coincide with bodily harm and have the ability to articulate the implications of those injuries on the potential loss of life.

Significance of the Problem

If patients are relatively asymptomatic, the extent of underlying injury could be underestimated in the absence of respiratory complications. Respiratory complications or collapse may occur after the event for more than 24-hours post strangulation. If the patient is not exhibiting pain or persuasive injury to the neck region, diagnostic evaluation may not be completed. Patients with mild symptoms should be evaluated in the same fashion as those that exhibit visible neck injury, breathing difficulty, and neurological changes (Clarot, Vaz, Papin, & Proust, 2005). Neurological complaints have been reportedly present in approximately 70% of non-homicidal strangulation survivors (Le Blanc-Louvy, Papin, Vaz, & Proust, 2013).

In the absence of physical signs of injury, the triage nurse and primary nurse may fail to question the patient further, leading to minimization of the event and missing potential life-threatening complications. If nurses are unaware, and without verbal disclosure by the patient,

the physician or nurse practitioner has an inability to initiate appropriate interventions due to lack of imperative information (Holbrook & Jackson, 2013). Empowering nurses to ask the question about strangulation upon placement in the emergency department could lead to increasing the identification of patients requiring specialized evaluation and activation of the forensic nurse examiner to provide a thorough medical forensic examination.

There are barriers to care and treatment which can begin with the victim. Victims of strangulation lack the knowledge of the level of lethality of the event that took place. The victim may not recognize or could be unaware that there is an injury that is severe, which places them at greater risk for death. Most victims do not present to the emergency room because they believe there is no need for a medical evaluation because they survived (Funk & Schuppel, 2003; Holbrook & Jackson, 2013). Additionally, the medical provider may omit treatment when the neck injury is not recognized or omission of treatment can occur when the neck injury is not recognized or identified in the emergency department due to the lack of visible signs of injury (Strack & Gwinn, 2011).

Practice Support for Project

As a women's health nurse practitioner (WHNP-BC), advanced forensic nurse (AFN-BC), certified forensic nurse (CFN), board certified sexual assault nurse examiner for adults, adolescents, and pediatrics (SANE-A, SANE-P), and program coordinator for a comprehensive forensic program in Kansas City, strangulation has always been an interest. Before May 2010, sexual assault examinations were the only type of medical forensic examinations being completed by forensic nurses employed by Shawnee Mission Health. The facility and the program increased the service of sexual assault forensic evidentiary examinations to

comprehensive forensics. Comprehensive forensics includes all crime victims, regardless of age and the type of criminal act that has taken place. This advancement in service provides more types of forensic care assessments, but it became apparent that strangulation was one of the issues that required further attention.

Shawnee Mission Health is a leader in the community not only as a provider of medical treatment, but as a conduit to provide education, support, outreach, and resources to patients and health care providers. Shawnee Mission Health currently consists of two emergency departments, two urgent care locations, and five primary care locations. Shawnee Mission Health is part of the Adventist Health System, a nonprofit healthcare organization totaling 46 facilities located throughout 10 states, with the corporate office located in Florida. As a faith-based health care organization with a custom of caring for the physical, emotional, and spiritual needs of every patient, the FACT program is providing quality care through specially trained professionals who treat efficiently and care for patients affected by all types of violence.

The FACT program provides forensic medical examinations to those who have sustained injuries due to abuse, neglect, under suspicious circumstances, or strangulation. Victims are encouraged on their own accord by local law enforcement agencies to present to the emergency department for medical and forensic evaluation. Upon FACT initiation, the individual is provided further assessment, evidence collection, and law enforcement, and child enforcement activation. The program provides consistent, comprehensive, competent, and compassionate care as the key factors in effectively breaking the cycles of violence. The program consists of 21 nurses and two advanced practice nurses with training and expertise in forensic nursing. The FACT program is part of an interdisciplinary group at Shawnee Mission Health that aids in the

care of the strangulation patient. These members include emergency room medical providers, radiology technician, radiologist, emergency room nurses, security, and social services. In addition to the interdisciplinary team, the outside multidisciplinary team consists of responding police officers, criminal investigator, domestic violence advocate, and county attorney. These groups provide assistance to Johnson County, Miami County, Franklin County, Douglass County, Leavenworth County, and Wyandotte County located within the state of Kansas.

Benefit of Project to Practice

The primary goal of the project was to identify and develop a standard for all emergency departments in the state of Kansas and throughout the United States to provide the same evidence-based care, intervention, and assessment to all non-homicidal strangulation patients regardless of the physical presence of injury. This program is needed because the program is dedicated to providing individualized, consistent, evidence-based medical care tailored to the needs of each strangulation patient. The team members will utilize the information obtained in developing strategies for best practice in the treatment of patients, along with providing assistance to law enforcement to accurately investigate and determine criminal charges for the offender and to the judicial system to ultimately hold the offender accountable (Schwartz, 2010).

Conclusion

Strangulation is a gender crime with the victims predominantly being female and the offenders being male (McLean, 2012; Strack & Gwinn, 2011). Victims of NFS are seven times more likely to become a homicide victim since most strangulation occurrences produce minimal or no visible injury, therefore all victims should have a thorough medical examination (Strack & Gwinn, 2011).

CHAPTER II: LITERATURE REVIEW

Introduction/Scope of Problem

Non-fatal strangulation (NFS) exists in our communities, however, there is an absence of information concerning treatment of the patient's physical injuries related to NFS upon a patient's presentation to the emergency department. This is in stark contrast to the vast amount of literature and research on death by the mechanism of strangulation. This disparity of literature and research between the two forms of strangulation leads NFS to be often misjudged (Niort et al., 2015).

Women who present to the emergency department with disclosure that there is intimate partner related violence may not be forthcoming when asked about strangulation. Patients present with a vast variety of objective and subjective findings along with no visible injuries, such as, neck pain and the absence of petechial hemorrhage. In strangulation, the jugular vein requires compression for approximately 15 to 30 seconds for petechial hemorrhages to occur (Armstrong & Strack, 2016; Stapczynski, 2010). The petechiae may be the result or consequence of the strangulation, but the presence alone does not prove that a strangulation has occurred. However, the presence of petechiae along with a disclosure from an individual is a clear sign of a life-threatening assault (Armstrong & Strack, 2016). Nevertheless, this lack of patient disclosure may result in limited or a complete lack of diagnostic evaluation for NFS, especially if the patient does not exhibit profound bruising, redness, petechiae, and or manual or ligature marks that may be consistent with strangulation.

Purpose Statement

The purpose of this scholarly qualitative descriptive project was to evaluate the incidence of strangulation in a large metropolitan area via a comprehensive forensic program in collaboration with emergency services. Via identification of patients presenting with a disclosure of strangulation and have physical injury consistent with strangulation. The project involved utilization of subjective and objective findings in correlation with the appropriate diagnostic assessment to decrease sentinel events and to assure evidence-based appropriate care. Identification of the percentage of NSF patients who were evaluated and lacking physical injury presentation consistent with strangulation could lead to a decrease in the minimization of potentially life-threatening conditions sustained in the strangulation act. If patients are not evaluated properly, they may sustain life-threatening injuries when discharged to go home and hence succumb to death, increasing liability to the facility and the care providers for failing to deliver evidence-based care. The goal is to aid in a clear medical forensic assessment to provide appropriate medical care to NFS survivors, assist law enforcement investigation, and support prosecution of the offender. McClane, Strack, and Hawley (2001) validated the need for further assessment, statistical analysis, and careful monitoring of the strangulation modality. The result of this project will aid in lessening the incidence of minimization of the event and evaluating the patient appropriately for the potentially life-threatening complication strangulation carries.

Chapter two is a comprehensive literature review of NFS. The major themes presented include IPV, the prevalence of strangulation, neck injuries, traumatic brain injury (TBI), post-traumatic stress disorder (PTSD), lethality, medical assessment, and the legal implications of strangulation as an event to cause grave bodily harm as a felonious act. The literature review

also includes a foundation for the strengths of the project as well as identification of current weaknesses due to the lack of information from prior research with regard to the major themes presented.

An evidence-based practice conceptual framework was applied to this project to identify and move toward acceptance of a practice change. The purpose of this framework was to drive changes in standards of patient care. Therefore, information received from the NFS patient along with increased knowledge of strangulation care will result in evidence-based changes in NFS care.

Search History

A scholarly literature search was conducted using CINAHL, PubMed, and Clinical Key. Keywords used from the literature search included manual strangulation, intimate partner violence, strangulation injuries, hyoid bone fracture, traumatic brain injury, medical assessment of strangulation, and forensic nursing standards of care for strangulation. A total of 454 articles were identified before exclusion of articles greater than 10 years old, without mention of strangulation, or not written in English. The exclusion criteria narrowed the literature search to 150 articles. Of the 150 articles, 43 articles were selected for inclusion in this review.

Integrated Review of Literature

Intimate Partner Violence

IPV is a health care, global, and human rights issue; IPV does not discriminate against race, geographical region, sex, or age (Carmo, Grams & Magalhaes, 2011; Dourado & Noronha, 2014; Montgomery et al., 2015; Smith et al., 2014; Sorenson et al., 2014; Suffla & Seedat, 2015). The World Health Organization has recognized IPV as a public issue since 2002 (Wong et al.,

2014). More than four out of 10 women in the United States have experienced at least one form of violence in their lifetime (Messing, Thaller, & Bagwell, 2014; Reijnders & Ceelan, 2014). In comparison, one in three female veterans experience abuse in their lifetime (Iverson & Pagoda, 2015). Most of the IPV occurs in the residence in which the female lives (Kristoffersen, Lilleng, Maehle, & Morild, 2014; Reijnders & Ceelan, 2014).

A preponderance of previous studies was focused on women as the victim and men as the perpetrators; few studies have men as participants. However, the number of men who have sustained documented strangulation is minimal (Carmo et al., 2011; Kristoffersen et al., 2014; Li et al., 2010; Reijnders & Ceelan, 2014; Sheilds, Corey, Weakley-Jones, & Stewart, 2010; Smith et al., 2014). Carmo et al. (2011) evaluated men as victims with the perpetrators in the women and interestingly, the study indicated no incidence of strangulation committed by women and only 8% of the men sought medical intervention for the injuries sustained.

Intimate partner homicide is the ultimate form of IPV, which accounts for 14% of all murders and 70% of those victims being women in the United States (Smith et al., 2014). Homicide by a current or previous significant other was reported by Riley et al. (2015) as the leading cause of death among the female African-American population for those 15 to 34 years of age. Kristofferen et al. (2014) assessed the rate of homicide in Norway from 1985-2009 along with the incidence of strangulation and identified eight cases of female offenders of homicide, but not by strangulation. Further findings indicated a significant other or spouse resulting in 41 cases of intimate partner homicide involving a significant other or spouse amounted to 48% of the murders in Norway. Manual strangulation was the method of death for more women than men in the study. If men succumbed to death by strangulation, it was a result of a ligature

application rather than manual. In 21% of the deaths, the mechanism of death was a direct consequence of asphyxia, which the authors postulated was due to strangulation (Kristoffersen et al., 2014).

Prevalence of Strangulation

Strangulation accounts for 10 to 20% of all violent intimate partner deaths in the United States. However, there is a lack of specific information with regard to the percentage of NFS (Armstrong & Strack, 2016; Shields et al., 2010; Suffla & Seedat, 2015). Suffla and Seedat (2015) studied the epidemiology of homicidal strangulation in South Africa. They identified 334 cases of strangulation and noted that the incidence was higher among women than men. The largest number of strangulation events were in those older than 60 for both males and females, and the primary location for the occurrence was in a private setting, which is consistent throughout the literature (Suffla & Seedat, 2015).

Manual strangulation is the most used form of strangulation against women (Holbrook & Jackson, 2013; Kristoffersen et al., 2014; Sheilds et al., 2010). Nevertheless, the NFS survivor and incidence of NFS continues to be underreported in literature. However, as the numbers of forensic nurse examiners increase, it has become evident that a new era of strangulation research and practice is on the horizon (Henderson, Harada & Amar, 2012; Sheilds et al., 2010).

Mcquown et al. (2016) identified 1,596 individuals presented to a facility that evaluated sexual assault, and intimate partner examinations were completed by a sexual assault nurse examiner. Of the participants, 97% were female and 23% of the women had sustained NFS, but the incident lacked complete documentation. Thirty-six percent of the identified NFS victims reported they had survived more than one strangling event in the past. Only half of the survivors

sought emergency evaluation after the occurrence. This research indicates further support of the concept that strangulation occurs more frequently as IPV than in sexual assault cases. The authors postulated that the reasoning is due to the act of strangulation being a personal act against another in which to cause physical harm. They further identified that pregnancy significantly increased the risk of strangulation or if the offender owned a firearm (Mcquown et al., 2016).

Neck Injuries

In IPV, the most prominent locations for injuries are the head, face, or neck region, as evidenced in 77% of the women researched by Wong et al. (2014). Another report of head, face, or neck injuries revealed the injury occurs in 50 to 80% of cases on IPV, with the left side of the face being a primary location of blunt force trauma (Bhole et al., 2014). Most of these injuries result in soft tissue damage, but serious injuries can occur. Identified head, face, and neck injuries included abrasions 16% of the time, edema 10%, contusion 28%, hematoma formation 6%, and laceration 5% (Wong et al., 2014). The most common event of physical violence was blunt force trauma sustained from a fist 60%, slapping 17.6%, physical restraint or pushing 15.4%, use of a weapon 11.8%, and strangulation 7% (Wong et al., 2014). The women reported more than one act occurring and that this was not the first event of physical violence (Wong et al., 2014).

The most severe injury is the compression of the neck by strangulation. Strangulation obstructs the flow of blood and decreases the flow of air. The constriction on the neck region results in venous obstruction with subsequent loss of consciousness due to the lack of oxygen and blood reaching the brain (Sheilds et al., 2010). The increased pressure may lead to arterial

blockage and airway collapse, leading to death (Shields et al., 2010). Sorenson et al. (2014) reported that the symptoms experienced are immediate. The symptoms include loss of consciousness and voice changes. Symptoms can appear hours later and include petechiae, but even days after the NFS, bruising may become evident as well as there could be prolonged neurological changes, bleeding from the ears, and possibly a cerebrovascular injury (Sorenson et al., 2014).

The most common fracture in strangulation, the thyroid cartilage, was accounted for in 89% of the 48 cases that were studied by Godin, Kremer, and Sauvageau (2012), with only 20% presented with fractures of the hyoid bone. In cases of homicidal strangulation, 34% sustained no fractures. There is, however, an increased risk of fracture as the person ages because of brittleness due to calcification (Godin et al., 2012). In comparison, hyoid bone fractures are identified in less than half of all cases of death by strangulation (Lebreton-Chakour et al., 2013; Niort et al., 2015).

Hyoid bone fractures in homicidal strangulation cases are the most discussed type of fracture (Dunsby & Davidson, 2011; Godin et al., 2012; Lebreton-Chakour et al., 2013; Niort et al., 2015; Porr et al., 2012; Sharma, Harish, Sharma, Sharma, & Singh, 2008). Unfortunately, their presence in NFS is rare. Hyoid fracture studies revealed that the variables that affected the fracture were the thickness of the bone, the amount of force applied, and the stature of the individual as the shorter the individual, the greater amount of pressure is required to result in a fracture (Lebreton-Chakour et al., 2013). No studies to date, however, involved the identification of the relationship of the stature of the NFS survivor and that of their abuser.

Fractures are not the only injury to the neck region; cervical artery dissection (CAeD) from strangulation can go undiagnosed is a serious modality (Cronlein et al., 2015; Garcia-Zornoza et al., 2012; Grond-Ginsbach et al., 2013; Le Blanc-Louvry, Papin, Vaz, & Proust, 2013; Robertson & Koyfman, 2016). The cervical arteries include both the vertebral and internal carotid arteries (Robertson & Koyfman, 2016). These injuries may be silent, uncommon, but can be deadly if not assessed urgently. The onset of CAeD symptoms can be evident a few hours after injury or months later (Le Blanc-Louvry et al., 2013). Dissection may include one or both of the structures and symptoms can range from the absence of any symptoms to significant sequela, such as blindness, cerebral edema, cerebrovascular events, or subarachnoid hemorrhage (Robertson & Koyfman, 2016). Robertson and Koyfman (2016) further stipulated that diagnosis is challenging because 20 to 30% of those experiencing a CAeD will report nonspecific symptomology, such as a headache and neck pain, both common complaints in the NFS patient.

Severe trauma accounts for 4% of carotid artery dissections trauma (Cronlein et al., 2015) . Le Blanc-Louvry et al. (2013) reported that CAeD occurs in less than 1% of strangulation cases, although the authors reported three unique cases in which three patients suffered a cervical arterial injury (CAI). In two of the three cases, dissection was identified, one woman presented with complaints of mild breathing difficulty, right-sided headache, hemiplegia, and slight bruising to the right cervical area. The other individual, a man presented with bruising to the neck region, had major respiratory complications and a loss of consciousness. Sadly, the male mentioned succumbed to death. These case studies show that minimization of injuries, loss of consciousness, or lack of petechiae should not preclude appropriate diagnostic evaluation (Le Blanc-Louvry et al., 2013; Volochinsky, 2012).

Traumatic Brain Injury (TBI)

TBI is a result of receiving physical blows to the head region, pushing the head against a hard surface forcefully, and NFS (Iverson & Pagoda, 2015; Kwako et al., 2011). Iverson and Pagoda (2015) assessed veteran women, the incidence of IPV, and the correlation between severe physical abuse and TBI sustained from the event and not from a wartime injury. Of the participants, 85% sustained a loss of consciousness encountered with the physical assault and 15% reported being strangled (Iverson & Pagoda, 2015). Among survivors of NFS, cerebral edema can result in brainstem herniation or other brain injuries resulting in brain death or vegetative coma (Armstrong & Strack, 2016).

Post-Traumatic Stress Disorder (PTSD)

All survivors of violence have an increased possibility of experiencing symptoms of PTSD, such as the flashbacks, nightmares, anxiety, difficulty sleeping, and hyper-vigilance (Kwako et al., 2011; Montgomery et al., 2015). Iverson and Pogoda (2015) reported after researching TBI and the association with IPV there was more of an increase in PTSD in individuals with TBI than the individuals who experienced IPV without a TBI sustained in the assault.

Lethality

Patients are in a life-threatening situation from strangulation if there is the presence of congestive ophthalmic petechial hemorrhages, known loss of consciousness, or incontinence. If the patient is at home with no other individuals in the residence, does not disclose incontinence, and has an inability to remember, medical care and assessment are typically minimized. However, the provider should error on the side of caution and evaluate the patient thoroughly.

Li et al. (2010) evaluated the morphology of astrocytes in the hippocampus along with serum S100B levels of individuals who had sustained a strangulation due to pressure application to the throat. Manual strangulation accounted for 16 of the 52 cases identified. The authors concluded a decline of astrocytes was identified, while the S100B levels increased, and a direct correlation was noted regarding the presence of petechiae and fractures of either the hyoid or thyroid cartilage due to the neck compression sustained. A hippocampus injury sustained by strangulation due to cerebral hypoxia and subsequent congestion led to confirmation that strangulation can result in brain injury as well as damage to the structures of the neck (Li et al., 2010).

Sorenson et al. (2014) stated waterboarding is the equivalent of NFS within IPV. Waterboarding is an act commonly considered torture in which the individual has the sensation of drowning due to water poured in both the mouth and nasal cavity. Both can result in injury presentation, the loss of consciousness, and proclaim to the individual that the victimizer is in control, causing fear, anxiety, and terror (Sorenson et al., 2014).

In a homicidal strangulation, the decedent is autopsied. Part of the autopsy is to recognize if there is a fractured hyoid bone. A fractured hyoid bone is a positive and affirmative finding that the death resulted from pressure applied to the neck region. Remarkably, in homicidal strangulation cases, hyoid fractures are identified in half of the decedents (Niort et al., 2015). To isolate the hyoid bone, a neck dissection must be completed or the medical examiner can implement the use of computerized tomography (CT; Maise et al., 2014; Thomsen, Jurik, Uhrenholt, & Vesterby, 2009). In recent research, the use of the CT scan has been referred to as the post-mortem CT (PMCT; Maiese, Gitto, dell'Aquila, & Bolino, 2014).

Thomsen et al. (2009) evaluated the successfulness of the CT scan in post-mortem evaluations to aid in the decision-making process for purchasing and implementing this piece of equipment to be an additional intervention for assessment of injuries. The study consisted of 20 decedents, 15 males, and five females, with death occurring from various modalities, of which 11 were classified as homicides. There was one decedent who died as a result of strangulation and the CT showed a positive finding of a spiral fracture that was not previously noted in the autopsy report, which was completed before initiation of the CT scan. The PMCT was determined to be an added benefit to the autopsy examination (Thomsen et al., 2009).

Maiese et al. (2014) conducted a study specifically on the use of the PMCT in those who succumbed to death via strangulation. The PMCT was completed before the autopsy of a case involving ligature strangulation with no research noted for PMCT use on manual strangulation examination. In deaths by asphyxia similar to NFS, some injuries may not be evident with an examination. The use of the PMCT can be instrumental in the identification of injuries to the smaller structures of the neck, which may be difficult to visualize if bleeding or soft tissue swelling is present. The PMCT can be employed in the identification of displacement or fracture of the hyoid bone, thyroid cartilage fracture, and the presence of ligature marks. In the particular case in which the PMCT was implemented, the scan identified a thyroid cartilage fracture sustained from the placement of a ligature around the neck (Maiese et al., 2014).

Medical Assessment of Non-Fatal Strangulation

In the clinical setting, it is imperative that the medical team assess IPV, sexual violence, and the act of strangulation (Henderson et al., 2012; Riley et al., 2015). Screening of patients should begin at age 13 as an increase in dating violence among adolescents is noted (Wong et al.,

2014). There is an urgent need for all medical providers to understand the significance of strangulation as a risk factor for homicide with regard to the current event or those in the future (Glass et al., 2008). The addition of forensic nurses in collaboration with physicians can improve documentation and ensure a thorough assessment (Faugno et al., 2013). According to Armstrong and Stack (2016), clinical evaluation is deemed imperative as most survivors of NFS have no symptoms after the event based on their study, but approximately 18% reported pain, 2% reported dysphagia, and only 1% had a raspy or hoarse voice. Sheilds et al. (2010) identified 102 NFS victims with 22% having the presence of subconjunctival hemorrhage, 24% the presence of injuries to the inner oral cavity, and 85% of the cases had visible neck injuries identified (Shields et al., 2010).

Medical forensic examination completion is required for all patients who present with the disclosure of NFS. Therefore, it is imperative that these patients receive care and intervention from the emergency room physician and an advanced practice nurse or registered nurse who has forensic expertise (Faugno et al., 2013; Pasqualone, 2015; Seifert, Lambe, Anders, Pueschel, & Heinemann, 2009). The forensic nurse examination includes documentation, photography, and evidence collection (Faugno et al., 2013, Holbrook & Jackson, 2013; Verhoff, Kettner, Laszik, & Ramsthaler, 2012) as well as reporting to law enforcement (based on state statute) and coordinating care with the emergency room physician (Carlson, 2014, Faugno et al., 2013; Henderson et al., 2012; Pasqualone, 2015; Seifert et al., 2009).

Evidence collection in the NFS patient can provide linkage of the patient to the offender. This evidence may be epithelial cell transmission or fingerprints. Kristensen, Lynnerup, and Sejrsen (2006) completed an experimental study following a homicidal strangulation in which

there were two males identified as possible perpetrators of the crime. The decedent had bruising to the neck region that was consistent with fingertip contusions. The police requested a further evaluation at the time of autopsy to identify latent prints. This request yielded inconclusive results, but yielded insight into a study. With the use of an artificial head that had the same consistency as human skin, the authors were able to obtain latent prints using blue paint. The results of the study to identify the correct fingerprints of the perpetrator varied in accuracy, but the findings were interesting enough to warrant further research (Kristensen et al., 2006).

In the living patient who has sustained a NFS, the CT with contrast, MRI, or magnetic resonance angiography can be implemented in the care plan (Christie et al., 2009, Christie et al., 2010; Cronlein et al., 2015). Consequently, research has shown that the use of a CT angiography of the carotid and or vertebral arteries as a more specialized and specific diagnostic test for diagnosis neck dissections, a life-threatening condition (Vilke & Chan, 2011). However, regarding the discussion of the use of a MRI for assessment of NFS, Christe et al. (2010) conducted a study involving 56 NFS individuals, 35 females and 21 males. Manual strangulation was responsible for 37 of the cases. Of the individuals who sustained injuries, 27% were life-threatening as evidenced by the presence of petechiae, loss of consciousness, and the presence of a hematoma in the neck region. Individuals had an MRI within 36 hours of the strangling event. The authors identified subcutaneous hemorrhage in 31 of the 56 (n = 55%) cases and bleeding into the surrounding skin in 16 of the 56 (n = 29%) cases. The preference of MRI over CT was because the MRI was believed to have increased sensitivity for the identification of soft tissue swelling and it did not expose the individual to radiation (Christie et al., 2010). Nevertheless, Cronlein et al. (2015) stipulated that the gold standard for carotid artery dissection is the use of

CT angiography when a mechanism of injury could result in a dissection, such as with strangulation.

Unfortunately, not all facilities have access to the differing types of diagnostic testing. Given this, facilities should use some test to ensure for increased accurate assessment of the absence of neck dissections, hyoid bone fractures, and cricoid and thyroid cartilage fractures on all patients who exhibit life-threatening presentation of NFS.

Legal Implications

The risk of homicide in intimate partner NFS is a major risk factor for women. Glass et al. (2008) noted that women who had sustained a NFS event previously had a seven-fold risk of becoming a victim of a homicide in the future. From the sample of participants, the researchers noted that 27% of those in the study identified with having had at least one NFS event. Additionally, African-American women have a significantly higher risk of homicide than Caucasian or Hispanic women regardless of a previous strangulation event. Nevertheless, any incidence of NFS increases the risk of homicide for all race and or ethnicity groups, although African-American's risk for homicide is four-fold (Glass et al., 2008).

If a woman's injuries resulting from strangulation are not adequately documented, there may be an impediment of criminal charges (Armstrong & Strack, 2016). Further, some states lack definitive laws regarding strangulation and the intent to cause grave bodily harm, which lessens the likelihood of prosecution as an attempted homicide or felonious aggravated battery (Armstrong & Strack, 2016; Glass et al., 2008).

IPV is not a mandatory report in all states within the United States (Lincoln & Lincoln, 2010); however, Kansas is a mandatory arrest state for individuals who perpetrate IPV.

Specifically, mandatory reporting to police for individuals over the age of 18 is required for gunshot wounds, penetrating injuries (e.g., knives), and lethal injuries, but strangulation in not included in this statute (K.S.A. 21-6319, 2012). Under current Kansas law, most incidents of strangulation are charged as a simple domestic battery. Unless a victim losses consciousness, urinated or defecated, and had visible signs of injury, a level seven aggravated battery (causing bodily harm in a manner whereby great bodily harm or death could occur) could not be charged (K.S.A. 21-5413, 2012). The current state law renders strangulation on par with a simple push or a slap. Nevertheless, in Kansas, there is a specific statute for battery and aggravated battery, K.S.A. 21-5413. K.S.A. 21-5413 (2012) specifically describes the criteria for battery in that it states that the person has to be aware that they are causing bodily harm to another, knowingly having physical contact with another individual in a rude, angry, or assaulting manner. Aggravated battery further states that there is use of a weapon or the individual purposefully intended to cause disfigurement or death could occur.

Literature Critique

This research project began for a couple of reasons. First, an increased incidence of NFS patients presenting to the emergency department identified the need for an evidence-based practice change to occur with regards to the evaluation of the patient disclosing a NFS. Second, two female NFS presented to the emergency department within 12 hours of the strangling event lacked physical findings to the neck region after disclosure of a manual strangulation by their male significant other. The providers minimized the severity of the strangulation due to the lack of bruising, absence of petechiae, no identifiable red marks to the neck, and no witnessed loss of consciousness or incontinence reported. However, following a consultation with the forensic

nurse examiner with respect to complaints of neck pain, difficulty swallowing, and visible, but minimal, neck edema, radiological studies were reluctantly ordered. The findings of the CT with contrast indicated multiple fractures sustained by both of the women.

Strengths

There is a wealth of literature focusing on the neck injuries sustained by strangulation in direct relationship to the topic of intimate partner homicide in the United States (Armstrong & Strack, 2016; Faugno et al., 2013; Montgomery et al., 2015; Smith et al., 2014; Sorenson et al., 2014; Strack & Gwinn, 2011). The researchers provided insight into the importance of asking questions of the patient about the strangulation, identifying the presence of injuries that corroborate the strangulation, and information to solidify that even without physical findings, the patient could succumb to death. The commonalities identified throughout the research include homicide risk (Armstrong & Strack, 2016; Faugno et al., 2013; Montgomery et al., 2015; Smith et al., 2014; Sorenson et al., 2014; Strack & Gwinn, 2011), anoxia (Sauvageua & Boghossian, 2010), increased medical complications, IPV, and the need for standardization, evaluation (Sauvageua & Boghossian, 2010), and documentation by all medical providers (Faugno et al., 2013; Pasqualone, 2015).

Weaknesses

Though the literature review search, it was evident that NFS research is not in vast quantity. Fatal and homicidal strangulation dominates the strangulation literature and many authors stated that additional research of NFS is imperative to understand the presentation and the significance of the potential for death (Armstrong & Strack, 2016; Turkel, 2007).

Gaps

The relationship of IPV and men as victims of IPV is lacking in the literature. IPV literature and research is centralized on female abuse, while the incidence of strangulation in the male victim is virtually unknown. Violent injury and death by strangulation reporting through the National Violent Death Registry, National Trauma Registry, and state bureaus of investigation could provide a greater understanding of the incidence, geographical regions, mechanism used, and other meaningful information on NFS (Riley et al., 2015). Standardization should include the types of strangulation and the mechanism, specifically using the terminology of ligature strangulation, manual strangulation, and hanging, and categorization of asphyxia into four main categories consisting of (a) suffocation, (b) mechanical asphyxia, (c) strangulation and (d) drowning would possibly lead to a decrease in confusion among law enforcement and medical providers as well as prosecution for injuries that are sustained from hypoxia or anoxia (Sauvageua & Boghossian, 2010).

Limitations

The limitations identified throughout the literature included the inability of the individual to present to a medical facility for medical evaluation immediately or within the first 24-48 hours after the assault (Mcquown et al., 2016; Wong et al., 2014). There has also been issues of limitations regarding failure of the person to remember the exact events that occurred could be a result of an anoxic event suffered from the strangulation (Mcquown et al., 2016; Wong et al., 2014), omission of the event in the medical record leading to lack of follow-up (Al-Thani et al., 2015; Glass et al., 2008; Wong et al., 2014), and small sample size or limiting of the sample (Montgomery et al., 2015; Reijnders & Ceelan, 2014; Smith et al, 2014).

Concepts and Definitions

Asphyxia: The application of pressure that impedes the flow of oxygen through inability to breathe, characterized by compression of the vasculature and airway (Sauvageau & Boghossian, 2010).

Hyoid bone: Located in the upper portion of the anterior neck at the C3 vertebra between the mandible and the thyroid cartilage. It is responsible for the movement of the tongue and assists with respiratory capability (Porr et al., 2012).

Strangulation: The application of any pressure on the neck or upper torso by hands or objects causing hypoxia to the brain while sustaining compression of the blood vessels and airway (Mcquown et al., 2015; Sauvageau & Boghossian, 2010; Sorenson et al., 2014).

Manual Strangulation: The grabbing or squeezing of the neck while applying pressure with the use of an individual's hands while compressing blood vessels and impeding the airway (Shields et al., 2010).

Lethality: The risk of death of an individual that has a firearm in the home, threat of death, threat of suicide by the intimate partner, sustaining any significant bodily harm or strangulation with a loss of consciousness, voice changes, dysphagia, or incontinence (Mcquown et al., 2016).

Intimate partner violence (IPV): A current or previous significant other, regardless of gender, in an intimate relationship with another (Kristoffersen et al., 2014).

Domestic violence: An older term of IPV, the term also includes individuals who reside in the same residence with another without an intimate relationship, such as a roommate, adult children, parents, or family members.

Theoretical Framework

Evidence-Based Practice Conceptual Framework

The evidence-based practice conceptual framework is a reference for healthcare providers that provides a systematic process to execute practice refinement (Rossurm & Larrabee, 1999). The framework is built on the use of research and literature related to evidence-based practice, research utilization, standardizing of specific language, and change theory. The theory is dependent on six to eight steps and how they relate to the identification of the needs assessment to implement change. For this project, some of the steps were merged for better understanding. Step one is the identification of the need for change in practice and step two is noting the problem interventions and outcomes by linking the two categories together. Step three involves compilation and synthesis of all the best evidence that is available. Step four is the design stage wherein the practice change is defined and identified, and a plan design is originated. Step five is the implementation and assessment phase of the proposed change. Lastly, step six is integration into practice and maintenance for a new standard of care (Terry, 2015).

Conclusion

It is unmistakably understood that the act of placing pressure around someone's neck and impeding the flow of blood and oxygen is one of the most lethal forms of IPV (Montgomery et al., 2015; Shields et al., 2010; Sorenson et al., 2014; Strack & Gwinn, 2011). Strangulation produces many different types of injuries: minor injury, bodily injury, and or immediate or prolonged death. The clinical manifestations of life-threatening or NFS may include visual changes, incontinence of bowel or bladder, and petechial hemorrhages, and it is imperative that

medical providers provide a thorough examination and assessment to prevent subsequent death in this vulnerable population, NFS victims (Armstrong & Strack, 2016).

The aim of this capstone is to set the standard for all emergency departments in the state of Kansas and throughout the United States to provide the same evidence-based care, intervention, and assessment to all NFS patients. Providing assessment and treatment not determinate on the visible injuries, but based on disclosure of events and subjective symptoms described by the patient, are needed in order to halt omission of treatment due to minimization of the act (Volochinsky, 2012). This would provide individualized, consistent, evidence-based medical care specifically tailored to the needs of each strangulation patient.

CHAPTER III: METHODS

NFS exists in every community, every race, and predominately in female victims of IPV (Carmo et al., 2011; Dourado & Noronha, 2014; Montgomery et al., 2015; Smith et al., 2014; Sorenson et al., 2014; Suffla & Seedat, 2015). Manual strangulation is the act of placing pressure on the throat while compressing the carotid and jugular vascularity causing anoxia using a person's hands (Holbrook & Jackson, 2013; Kristoffersen et al., 2014; Shields et al., 2010). People are being evaluated post strangulation in emergency departments across the country and injuries are undocumented and the lethality minimized (Armstrong & Strack 2016). The significance of strangulation is often determined by the presence of physical findings consistent with the event visualized by the medical staff (Armstrong & Strack, 2016; Faugno et al., 2013; Michel & Pasqualone, 2015). However, if the physical signs of strangulation are not apparent, minimization will lead to omission of care, unsafe discharge, and other medical complications that can result in death. If the strangulation victim survives, the individual is seven times more likely to become a victim of homicide with the next manual strangulation (Strack & Gwinn, 2011).

The purpose of this research project was to evaluate patients disclosing NFS, the incidence of physical injuries visualized to the neck region, subjective symptoms noted by the individual, and the diagnostic intervention completed and their findings. The research questions were: What is the incidence of strangulation without physical findings to the neck region? What types of diagnostic interventions were completed? and What were the results of the diagnostic interventions? The aim was to provide medical providers, prosecution, law enforcement, and emergency medical personnel with data on the frequency of NFS and the prevalence of patients

presenting with subjective symptoms without physical presentation to validate the need for evidence-based care and diagnostic studies to be completed on all NFS patients. The outcome was to identify whether NFS occurrences have the potential for high mortality and morbidity, thus the need for medical facility to develop interventions specific to the evaluation of patients who have sustained a NFS. The rationale was that patients who sustain a NFS and are not encouraged, transported, or presented to a medical facility for appropriate medical and forensic evaluation, may succumb to death and ultimately, the perpetrator will not be held accountable for the crime committed.

In this chapter, the following are presented: methodology, needs assessment, design, data collection instruments, analysis plan, resources needed, budget, timeline; and protection of human participants.

Methodology

The methodology was a nonexperimental, retrospective quantitative descriptive study. This model was formulated based on previous knowledge and will mark the embarkments toward providing new evidence for the development of protocols and interventions to evaluate NFS patients. The data analyzed was from May 2010 to November 2016, initially obtained by the FACT program. Specifically, informational data were obtained from electronic medical records, electronic forensic medical records, forensic photography, and statistics currently being recorded by FACT program personnel. The data also include the information provided on the assessment statistical tool completed by the forensic nurse examiner at the time of the medical forensic examination. The electronic record was reviewed with respect to diagnostic testing completed and the results identified by the radiologist. The FACT program currently compiles

information from all forensic patients evaluated at the facility, including those who have identified as NFS patients.

Analysis of the electronic medical records and the case specifics from the FACT program access database was initiated after approval had been received from the Maryville University Internal Review Board (IRB). The project was discussed with the director of emergency services, chief nursing officer, and risk management at Shawnee Mission Health with approval in written form for completion of the scholarly project within the facility. The chief nursing officer and director of emergency services were notified once IRB approval was received and the initiation of the research project.

Needs Assessment

NFS is a chief complaint frequently evaluated in emergency departments across the United States (Armstrong & Strack, 2016; Faugno et al., 2013; Michel & Pasqualone, 2015). As a women's health nurse practitioner and advanced forensic nurse at Shawnee Mission Health, I have encountered hundreds of individuals who have been strangled and survived. Since May of 2010, there have been more than 4,000 forensic cases evaluated through the FACT program. The program involves evaluations of men, women, and children of all ages injured in a criminal act, including manual strangulation. The program personnel provide care to an area covering approximately 70 miles, surrounding the two emergency departments located in Johnson County, Kansas. Many of the surrounding areas lack sexual assault nurse examiners, forensic nurse examiners, or nurses who have specialized training in the care of forensic patients. Victims are encouraged by local law enforcement to come from the crime scene to have their injuries evaluated and treated. The program currently provides forensic medical examinations to many

jurisdictions throughout Johnson County, Miami County, Franklin County, Douglass County, Leavenworth County, Wyandotte County, and Jackson County. As of May 2016, 85 law enforcement agencies have provided access to Shawnee Mission Health's FACT program for victim assessment and evaluation of injuries sustained in a criminal act.

The acknowledgement of the need for further research and investigation into NFS and IPV had its beginning in 1995 when the district attorney's office in San Diego completed a retrospective research study wherein 300 women survivors of NFS intimate partner cases were evaluated. The cases were evaluated for incidence, occurrence, injury presentation, and the lack of physical findings (McClane et al., 2001). The FACT program began to document case specific information for the FACT access database to aid in locating patients and identifying the type of medical forensic examination completed to assist the law enforcement investigation and subsequent criminal prosecution. As the number of NFS patients increased, it became apparent that on-going statistical tracking would prove beneficial not only in the assessment of strangulation, but also providing current statistics to law enforcement, medical providers, emergency medical personnel, and the courts.

NFS patients present to the facility on their own, by law enforcement, and by emergency medical services for medical evaluation. The types of injuries identified are neck swelling, bruising, petechiae, cricoid cartilage fractures, thyroid cartilage fractures, hyoid bone fractures, and no visibly identifiable injury. In those who present without injury identification, radiological studies are completed following soft tissue CT testing to determine if there are findings consistent with the strangulation. These findings include fractures, soft tissue swelling, and carotid neck dissections. Further validation of the underlying injury can result from a manual

strangulation, even without external injuries visualized in the neck region. As a forensic nurse practitioner who coordinates and is responsible for the forensic standards within a facility, it is imperative that these patients receive the same care per disclosure of NFS and the need for change in the facility.

There are barriers in providing evidence-based care to the NFS patient. One barrier is the lack of knowledge and unfamiliarity in the medical community of the deadly consequences of NFS to facilitate change in treatment, evaluation, and reporting. There is a need to provide evidence-based care to ensure airway safety, preserving life along with a physical assessment; pursuing a psychological evaluation, and ensuring a safe location for the victim after discharge. Victims of strangulation lack the knowledge of the level of lethality of the event. If the victim does not recognize or is unaware that there is a potential for loss of life, minimization will occur, particularly if the victim does not seek emergency services. This research project will be utilized to assist in education to the community about strangulation and consequences. This research project will also be employed to help patients who present to one of the many locations throughout Johnson County with sustained injuries due to abuse, neglect, or have suspicious injuries; they will be referred to the FACT program for further assessment and evidence collection as well as law enforcement and child enforcement activation as required.

Design

The design for this research project was a quantitative retrospective review of NFS data. The rationale for this quantitative retrospective project was to examine the occurrence of injury identification in NSF patients by comparing subjective symptoms disclosed by the NFS patient and the physical injury identified to the neck region, the occurrence of injury presentation

without subsequent radiological studies completed, and the percentage of NSF patients that present with no injury presentation to the neck region, but had abnormal radiological findings.

The NFS data was obtained using the following four databases: (a) electronic medical record, (b) medical forensic electronic record, (c) forensic photography database, and (d) FACT program access database. The electronic medical record of the patient encounter in the emergency department provides a wealth of information about the visit and the care that was implemented. The electronic medical forensic record provides a descriptive disclosure of the event, the treatments completed, evidence collected, and injury identification noted at the time of the examination. The forensic photography record provides an accurate depiction of the patient's appearance and injuries present at the date of examination. The FACT program access database contains case-specific information about forensic patients who presented to the emergency department for medical evaluation. Data gained from this research project will potentially be useful in providing evidence-based interventions and quality improvement among those patients disclosing a NFS.

Setting

The setting for this research project was a 504-bed facility with 47 emergency room beds, 38 examination rooms at the main campus, and nine beds at the west campus. Shawnee Mission Health is part of the Adventist Health System, a nonprofit healthcare organization totaling 46 facilities located throughout 10 states, with the corporate office located in Florida. The facility is a faith-based health care organization with a tradition of caring for the physical, emotional, and spiritual needs of every patient. This research project is aligned with the mission of the health care system and facility.

The FACT program responds to either campus for any criminal event that resulted in a patient presenting for medical evaluation. When the patient arrives at the emergency department and discloses to the triage or primary nurse that a criminal offense occurred or there is a suspicion that a criminal act has occurred, the FACT nurse is contacted to respond to the facility. When the forensic nurse examiner responds, consultation with the patient is completed to gain information about the acts, methods, and disclosure of the event. The forensic nurse examiner counsels the patient about their rights with regard to reporting to law enforcement, completion of a medical forensic examination, evidence collection, forensic photography, mandatory reporting to appropriate state agencies if indicated, and applying for crime victims' compensation. If the patient consents to a medical forensic examination, the forensic nurse examiner completes the consent for treatment specific to a physical assault or a sexual assault. If the patient desires law enforcement activation, the forensic nurse examiner contacts the appropriate law enforcement agency and requests an officer to respond to the facility.

Participants

This research project did not require direct participation of patients, just information from the examination in the emergency department and medical forensic examination. A retrospective review of documentation was used for the research of NFS patients. The inclusion criteria included information obtained from the electronic medical record, electronic medical forensic record, forensic photography, and the FACT program access database as it related to NFS. The inclusion criteria for NFS included any patient over 18 years of age, relationship with the offender, lack of physical findings, and or activation of law enforcement. Exclusion criteria were physical or sexual assaults without a disclosure of NFS and minors under the age of 18.

Implementation

The research project proceeded after approval from the Maryville University IRB. Once approved, the preliminary step in the implementation of the collection phase of this research project consisted of the initial review of the FACT access database for patients with a disclosure of strangulation during the timeframe of May 2010 to November 2016. Once identified, data was placed into an Excel spreadsheet for compiling. This data included information previously gathered from the FACT medical forensic examination data sheet completed at the time of the medical forensic examination by the forensic nurse examiner. The medical record number and visit number were initially used to access the electronic medical record to review diagnostic testing and results of tests completed, then included in the Excel spreadsheet. The medical record was utilized to gather information omitted from the FACT access database as needed or identified. The forensic photography database was used for verification of the presence or absence of injuries on NFS patients who had positive radiological findings. Lastly, the medical record number and visit number were removed to protect the patient's confidentiality after the previously mentioned steps had been completed.

Data Collection Instruments

The data collection instruments used for this retrospective descriptive design research project provided information required to gain insight into the incidence and findings from NFS evaluation. The electronic medical record provided the information from the emergency room visit, radiological diagnostic testing, interventions provided, and discharge information. The electronic medical forensic record provided the case specific information, including the disclosure, forensic photography, evidence collection, methods used in the assault, and injury

identification of visualized injuries or the absence of physical findings thought to be consistent with NFS. The FACT access database provides demographics of the patient, relationship of the offender to the patient, law enforcement activation, time frame from event to presentation at the facility, type of assault, evidence collection, completion of forensic photography, location of the examination, subjective symptoms experienced by the NFS patient, physical injury presentations, methods of strangulation, approach of the strangulation, objects used, and what part of the offender's body was used to strangle the patient, if applicable.

Analysis Plan

A descriptive design was facilitated for this research to identify the phenomena of NFS without physical findings consistent with the strangulation disclosure. Sampling for this research project of NFS patients was estimated at 95% CI and $p = 0.5$ for the precision level of +/110% of an estimated population size of 418, with 201 participants being recommended for analysis (Gogtay, 2010). Multiple regression analysis using SPSS was conducted to report frequencies, averages, variations, similarities, and significance between criterion and NFS (Laerd Statistics, 2013).

Resources Needed

The resources required for this research project were available to me at the project site location and included the electronic medical record, medical forensic electronic record, forensic photography database, and the FACT program access database. The FACT program has an office that contains the medical forensic electronic medical record, forensic photography, and the FACT program access database, and the project site has an Excel program access database for compiling of information. The resources required for the project were accessible and available

for use. The research project data was maintained on a facility approved, encrypted, password protected, thumb drive already in my possession. This research project did not require the use of additional forensic nurse examiners; however, a statistician from the facility that built the FACT access database was involved with respect to computation of statistics as identified. Nevertheless, the SPSS program was used for data analysis.

Budget

There were no budgetary requirements for the completion or execution of this research project. The resources required for completion were readily available at the research location. The research project did not require any additional programs not previously available through Maryville University or the research site. The director of emergency services and the chief nursing officer received information that the project required no additional funds. The aim of the project was to provide evidence-based information to formulate and execute a practice change to reduce liability, preserve life, and hold offenders ultimately accountable for the crime they commit as it relates to NFS.

Timeline

Application to the Maryville University IRB was completed in November 2016. Upon approval from the IRB, data collection was initiated. Data collection began in December 2016, Data collection was completed January 26, 2017.

Protection of Human Subjects

The risks to the human participants were minimal in this project; however, as with any research that involves confidential patient information, there is a risk of a breach of confidentiality. Information identified to assist with data collection specific to NFS was

removed. Adherence to HIPPA and the privacy and protection policy and procedure for the facility were followed. The four databases utilized for data collection remained password protected per information technology and risk management policy of the institution. The FACT program database information remained on the secure server at the research site. When the data was de-identified, the data was then removed from the premise on an encrypted, password protected, thumb drive available to this researcher. This researcher followed all the rules and regulations set forth by the Maryville University IRB.

Conclusion

NFS is a potentially lethal act upon an individual by another person. Due to the lethality of the assault, all persons who have sustained a strangulation must be medically evaluated in the emergency department to assess injury to the internal structures of the neck region (Turkel, 2007). Injury or death caused by strangulation is determinate by the type of strangulation, the amount of pressure applied to the neck, and the time frame of the application of pressure (Armstrong & Gael, 2016). The act of strangulation may result in physical findings consistent with the strangulation or may not leave any evidence behind that the act occurred. The presence of injury findings or lack of injury findings does not validate that the strangulation could have taken place. The combination of subjective and physical findings with further medical examination can ultimately hold the perpetrator accountable and save the life of the NFS survivor for life-threatening injuries that may have been missed (Armstrong & Gael, 2016). Therefore, it is imperative that all NFS patients receive the same medical evaluation that is not determined by the physical signs that may be present (Armstrong & Gael, 2016; Faugno et al., 2013; Stapczynski, 2010). The project included the types of physical and subjective signs

identified with the medical strangulation assessment in a large comprehensive forensic program to validate the need for standardized care and testing for all NFS patients regardless of the type of assault in which the strangulation occurred.

CHAPTER IV: FINDINGS

Data Analysis

This chapter provides an overview of the data analysis of the Doctorate of Nursing Practice scholarly project titled, *Non-Fatal Strangulation: Client Presentation without Physical Injury*. The purpose of this research project was the evaluation of patients disclosing NFS, the incidence of physical injuries visualized to the neck region, subjective symptoms provided by the individual, and the diagnostic intervention completed and their findings. The aim of this research project was to provide medical providers, criminal prosecutors, law enforcement, and emergency medical personnel with data on the frequency of NFS along with the prevalence of patients presenting with subjective symptoms without physical presentation to validate the need for specific treatments and diagnostic studies to be presented on all NFS patients. Providing assessment and treatment not determinate on the visible injuries, but based on disclosure of events and subjective symptoms described by the patient, are needed to halt omission of treatment due to minimization of the act (Volochinsky, 2012). The research questions used to guide the scholarly project were: What is the incidence of strangulation without physical findings to the neck region? What types of diagnostic interventions were completed? and What were the results of the diagnostic interventions?

Participants

The participants were selected through convenience sampling with a target of 201 participants being recommended for analysis of NFS. The study was initiated with the identification of those patients who presented to the FACT program from May 2010 to

November 30, 2016. The inclusion criteria consisted of males and females over 18 years of age of any race or ethnic background, and a specific diagnosis of strangulation. The participants who were excluded from inclusion were forensic patients not disclosing a NFS event, minors, patients who were pregnant at the time of the NFS event, and those with a behavioral health history or forensically evaluated by the primary researcher.

Analytical Process

The pre-analysis phase consisted of accessing the FACT program database and identifying the NFS patients from the remaining clinical forensic patients evaluated by the FACT program. The access database information was placed in an Excel spreadsheet with the specific data categories listed horizontally across the top of the worksheet. The information obtained from the access database was cross verified with the medical record, the medical forensic record, and the forensic photography completed at the time of evaluation in the emergency department. This additional data was added to the Excel spreadsheet.

Data Results

There were initially 418 NFS patients identified, but 123 were removed due to the exclusion criteria, thus leaving 295 potential participants. Of the 295 NFS patients who met the criterion for analysis, 113 NFS patients met the criterion of no physical injury visualized to the neck region and 182 NFS patients presented with physical characteristics consistent with strangulation. In terms of gender, there were more females than males (see Table 1), ages ranged from 18 to older than 50 (see Table 2), and regarding race, there were significantly more Caucasians than any other race (see Table 3.)

Table 1: Gender and Strangulation

Gender and Strangulation

Strangulation Indication	Gender	
	Female	Male
Disclosed	255/86%	40/14%
With physical presentation	155/85%	27 /15%
Without physical presentation	100/88%	13/12%

Table 2: *Strangulation and Age*

Strangulation and Age

Strangulation Indication	Age Ranges					
	18-20	21-25	26-30	36-40	41-50	≥51
Disclosure	33/11%	78/26%	54/18%	78/26%	41/14%	11/4%
With physical presentation	23/13%	52/29%	30/16%	46/25%	24/13%	7/3%
Without physical presentation	10 / 9%	26/23%	24/21%	32/28%	17/15%	4/4%

Table 3: *Characteristics of Race*

Characteristics of Race

Strangulation Indicator	Race					
	Caucasian	African-American	Hispanic	American Indian	Two or More Races	Other	Asian
Disclosure	212	50	25	1	2	4	1
With physical presentation	133	28	15	1	2	2	1
Without physical presentation	79	22	10	0	0	2	0

The NFS patients disclosed symptoms included the most frequently expressed symptom, neck pain as well as a few experiencing a complaint of incontinence of bowel or bladder function. These symptoms were experienced by both those with and without physical injury (see Table 4).

Table 4: *Symptoms Disclosed by NFS Patients*

Symptoms Disclosed by NFS Patients

Strangulation Indication	Neck Pain	Sore Throat	Symptoms Red Eyes	Difficulty Swallowing	Nausea/ Vomiting	Fainting/ Loss of consciousness
Disclosure	160/54%	77/26%	44/15%	74/25%	35/12%	40/14%
With physical presentation	47/26%	60/33%	40/22%	59/32%	26/14%	31/17%
Without physical presentation	17/15%	4/4%	15/13%	9/8%	9/8%	12/11%
	Light headed	Incontinence	Voice Changes	Breathing Pattern Changes	Difficulty Breathing	Loss of memory
Disclosure	51/17%	7/2%	35/12%	10/3%	28/9%	26/8%
With physical presentation	39/21%	7/4%	28/15%	9/5%	22/12%	20/11%
Without physical presentation	0/0%	7/4%	4/4%	9/9%	9/9%	9/9%
	Coughing	Headache				
Disclosure	22/7%	53/18%				
With physical presentation	16/9%	37/20%				
Without physical presentation	16/14%	0/0%				

There were five to seven different radiological tests evaluated in those who disclosed strangulation (see Table 5). These radiological studies can detect structural injury within the neck region, such as fractures and carotid artery neck dissections. Given that some of the patients who presented with a disclosure of strangulation may have also sustained other injuries, a CT head/brain without contrast may have been ordered to note other potential fractures.

Table 5: *Radiological Studies Completed*

Radiological Studies Completed

	Radiological Tests						
Strangulation Indication	CT Soft Tissue with contrast	4-View cervical X-Ray	CTA	CT soft Tissue without contrast	CT Cervical Spine without Contrast	CT Head/Brain without Contrast	XR Soft Tissue Neck
Disclosure	42/20%	17/8%	4/2%	9/4%	26/13%	97/47%	10/5%
Without physical presentation	19/17%	3/3%	1/1%	3/3%	11/10%	30/27%	3/3%

The specific radiological testing indicated an increase in the number of radiological studies completed in the strangulation with physical presentation than those without physical findings. The two fractures consistent with strangulation were noted in the NFS group without physical presentation presenting for care (see Table 6)

Table 6: *Radiological Findings*

Radiological Findings

			Findings			
Strangulation Indication	Radiological studies completed	Positive X-Ray Findings	Cricoid Cartilage Fracture	Thyroid Cartilage Fracture	Hyoid Fracture	Cervical Spine Fracture
Disclosure	206/71%	23/11%	0/0%	1/0.4%	0/0%	1/0.4%
With physical presentation	129/71%	16/12%	0/0%	0/0%	0/0%	0/0%
Without physical presentation	77/68%	7/9%	0/0%	1/0.4%	0/0%	1/0.4%

Descriptive Statistics

The initial statistical test completed was frequency analysis for identifying individuals who disclosed a strangulation (N = 295), but did not present with any physical findings (n = 113). The physical findings initially identified included the presence of ligature marks 6% (n = 11), bruising to the neck region 54% (n = 99), presence of petechiae 25% (n = 45), circumferential marks 27% (n = 27), neck swelling 13% (n = 24), or scratch marks to the neck 54% (n = 98). Frequency statistical analysis provided additional information for the demographics of the total number of NFS patients with regards to sex and race.

The ordinal statistical analysis was completed for the identification of the ages of those disclosing an NFS event to identify percentages of patients in specific age ranges. The frequency data was placed onto the Excel spreadsheet under the particular criterion being analyzed. Once the nominal data was identified, the data were then analyzed for statistical ratio analysis to identify the percentage of patients who exhibited the physical presentation types as well as the subjective information that was provided by the patient.

Once the non-injury presentation subjects were clearly identified and the data were cross verified assuring there were no physical findings, it was discovered that four patients who were initially scored as having no injury noted at the time of examination were incorrectly scored for the absence of physical injury. The physical presentation categories were analyzed and found to be incorrect, ergo, the data were edited to reflect the corrected information.

Frequency statistical analysis was completed to identify what radiological testing was completed and the results of those tests for the total number of NFS subjects and then further analyzed for the non-injury NFS subjects. Once the nominal data from the databases were collected, the data were then translated to numeric values of 1 meaning yes, and 2 meaning no for SPSS Version 2.0 final analysis.

In Chapter 5 is an exploration of the summary of the problem, implications for practice, education and policy, future research, limitations, and conclusions.

CHAPTER V: IMPLICATIONS AND CONCLUSIONS

Implications

This quantitative descriptive scholarly project was initiated to determine the significance of strangulation injury to individuals who present without a physical presentation of injury visible to the neck region. The purpose was to gain further insight and provide medical providers, criminal prosecutors, law enforcement, and emergency medical personnel with data on the frequency of NFS. Along with the prevalence of patients presenting with subjective symptoms without physical presentation, there is the need to validate the use of specific treatments and diagnostic studies on all NFS, not just patients who exhibit petechiae, scratch marks to the neck region, ligature marks, circumferential marks, and bruising.

This scholarly project provided valuable data with regards to NFS victims. The initial subjective information provided by the patients, then disclosed to the forensic nurse examiner and subsequently added to the FACT Program access database provided a wealth of data. The types of symptomology disclosed were consistent with a strangling event, with some causing concern with respect to the structural integrity of the neck and the potential to succumb to death.

The 295 patients who met the criteria for inclusion in this study exhibited concerning symptoms, such as ligature marks, bruising to the neck region, circumferential marks, neck swelling, difficulty swallowing, loss of consciousness, and incontinence of bowel or bladder. These symptoms can indicate significant injury to the underlying vasculature, the skeletal frame, and tissue of the neck region (Dayapala et al., 2012).

Of the 295 patients, there were 113 patients who presented without the outward physical presentation that a strangulation event had taken place. Without visible injury and based upon

disclosure alone, a question as to whether to provide radiological testing may exist. There were two patients identified in this scholarly project who experienced fractures, one experienced a thyroid cartilage fracture and the other a cervical fracture, both without physical findings to the neck region. The patient who sustained a thyroid cartilage fracture disclosed only neck pain, the feeling of light headedness, and the presence of a cough. In contrast, the patient who sustained a cervical fracture only disclosed a sore throat. These two patients validate the necessity of providing assessments and treatment to all strangulation patients with the requirement of only a disclosure of strangulation and not solely relying on physical signs of strangulation, loss of consciousness, or incontinence, which neither of these two patients reported having occurred.

There was a total of seven patients (2%) of the strangulation data population who disclosed incontinence, and 40 (14%) disclosed fainting or a loss of consciousness. In consideration of physical findings, 11 (6%) exhibited ligature marks, 99 (54%) bruising to the neck region, 45 (25%) presented with visible petechiae, 27 (15%) had circumferential marks to the neck, 98 (54%) had scratch marks to the neck, and 24 (13%) had edema of the neck. Although these data findings are impressive, they did not result in a finding of a fracture or carotid artery neck dissection (CAeD).

Strengths and Limitations

This scholarly project had limitations. First of all, in hindsight, had the PICO questions been expanded, more of the data findings would be included in the initial data analysis. Second, one limitation that could not be avoided was within the excluded patient population there were additional fractures identified consistent with strangulation that had to be omitted due to the protection of human subjects.

An important strength of this project was that the data provided insight into the ability for patients who survive a NFS to present with many different subjective and objective findings. Each finding is important in determining the assessment, diagnostic interventions, and treatment of the NFS patient (Clarot et al., 2005).

Implications for Research

The implications for further research exists using the 295 NFS patients to research the time of day and the relationship between IPV and sporting events. Another avenue of research is to cross correlate the subjective findings with the objective findings to identify increasing subjective symptoms in correlation with physical presentation of injury to the neck region. As more information and studies continue with respect to the NFS population, the more information understood will ultimately assist the medical community and the legal community as well, thus allowing for the perpetrators to ultimately to be held accountable for the crimes they commit while reducing the risk of homicide.

Implications for Practice

This scholarly project supports providing assessments and treatment not determinate on the visible injuries, but based on the disclosure of events and subjective symptoms described by the patient to halt omission of treatment due to minimization of the act (Volochinsky, 2012). This information provides evidence of the need for individualized, consistent, evidence-based medical care specifically tailored to the needs of each strangulation patient. The information will also aid in the development of an assessment algorithm to aid in determining radiological studies to be completed, whether admission is appropriate, and referrals to an ear, nose, and throat specialist. In addition, the findings could be used to provide valuable

information to the legal community to assure that individuals who have survived a strangulation will be encouraged to seek medical intervention to ensure physical safety.

Conclusion

NFS will continue to exist in our communities; it will continue to affect not only women, but men and children. The act of NFS knows no ethnic boundary, it does not discriminate against gender or age as it is simply the means for one individual to control the life or death of another (Armstong & Strack, 2016). With the lack of physical presentation, there are challenges with respect to mounting a successful prosecution as patients will continue to be at the mercy of someone else's hand (Armstong & Strack, 2016). With non-injury presentation, issues arise with respect to uncovering the truth, such as a typical he said/she said situation, the victim who is in a relationship with the offender does not want them arrested, or the victim cannot be located for court litigation. Ergo, the medical provider and the information gathered from an examination and disclosure may prove to be beneficial in conviction and ultimately providing for safety (Carlson, 2014; Volochinsky, 2012). The use of continued research in this area will help reveal and as well as aid in the development of new information that could benefit patients and both the medical and legal communities.

REFERENCES

Al-thani, H., El-Menyar, A., Mathew, S., Khawar, M., Asim, M., Abdelrahman, H., . . . Zarour, A. (2015). Patterns and outcomes of traumatic neck injuries: A population-based observational study. *Journal of Emergencies, Trauma and Shock, 8*(3), 154-158. doi:10.4103/0974-2700.160723

Armstrong, M., & Strack, G. (2016). Recognition and documentation of strangulation crimes a review. *JAMA Otolaryngology-Head & Neck Surgery, 142*(9), 891-897. doi:10.1001/jamaoto.2016.0293

Banwari, M. (2015). A case report on near manual strangulation and Glasgow coma scale. *African Health Sciences, 15*(2), 1038-1040. doi:10.4314/ahs.v15i3.45

Bhole, S., Bhole, A., & Harmath, C. (2014). The black and white truth about domestic violence. *Emergency Radiology, 21*(4), 407-412. doi:10.1007/s10140-014-1225-1

Carlson, S. (2014). Strangulation-asphyxia and terror. *Canadian Journal of Emergency Nursing, 37*(2), 20-23. Retrieved from http://www.nurses.ab.ca/content/carna/home.html/

Carmo, R., Grams, A., & Magalhaes, T. (2011). Men as victims of intimate partner violence. *Journal of Forensic and Legal Medicine, 18*(8), 355-359. doi:10.1016/j.jflm.2011.07.006

Christie, A., Oesterhelweg, L., Ross, S., Spendlove, D., Bolliger, S., Vock, P., & Thali, M. (2010). Can MRI of the neck compete with clinical findings in assessing danger to life for survivors of manual strangulation? A statistical analysis. *Legal Medicine, 12*(5), 228-232. doi:10.1016/j.legalmed.2010.05.004

Christie, A., Thoeny, H., Ross, S., Spendlove, D., Tshering, D., Bolliger, S., . . . Oesterhelweg, L. (2009). Life-threatening versus non-life-threatening manual strangulation: Are there appropriate critera for MR imaging of the neck. *European Society of Radiology, 19,* 1882-1889. doi:10.1007/s00330-009-1353-2

Cronlein, M., Sandmann, G., Beirer, M., Wunderlich, S., Biberthaler, P., & Huber-Wagner, S. (2015). Traumatic bilateral carotid artery dissection following severe blunt force trauma: a case report on the difficulties in diagnosis and therapy of an often overlooked life-threatening injury. *European Journal of Medical Research, 20(*62), 1-6. doi:10.1186/s40001-015-0153-1

Dayapala, A., Samarasekera, A., & Jayasena, A. (2012). An uncommon delayed sequela after pressure on the neck. *American Journal Forensic Medical Pathology, 33*(1), 80-82. doi:10.1097/PAF.0b013e318221bab7

Di Paolo, M., Guidi, B., Brushini, L., Vessio, G., Domenici, R., & Ambrosino, N. (2009). Unexpected delayed death after manual strangulation: Need for careful examination in the emergency room. *Monaldi Archives for Chest Disease, 71*(3), 132-134. http://dx.doi.org/10.4081/monaldi.2009.359

Dourado, S., & Noronha, C. (2014). Visible and invisible marks: Facial injuries suffered by women as the result of acts of domestic violence. *Ciencia & Saude Coletiva*, 20(9), 2911-2920. http://dx.doi.org/10.1590/1413-81232015209.19012014

Dunsby, A.-M., & Davison, A. (2011). Causes of laryngeal cartilage and hyoid bone fractures found at postmortem. *Medicine, Science and the Law, 51*(2), 109-113. http://dx.doi.org/10.1258/msl.2010.010209

Edrogan, B., Erdogan, M., Colak, S., Kibici, O., Bozan, K., & alper, B. (2015). An isolated hyoid bone fracture caused by blunt trauma to the neck. *Journal of Pakistan Medical Association, 65*(11), 1233-1234. Retrieved from http://www.jpma.org.pk/

Faugno, D., Waszak, D., Strack, G., Brooks, M. A., & Gwinn, C. (2013). Strangulation forensic examination best practice for health care providers. *Advanced Emergency nursing Journal, 35*(4), 314-327. http://dx.doi.org/10.1097/TME.0b013e3182aa05d3

Funk, M., & Schuppel, J. (2003). Stangulation injuries. *Wisconsin Medical Journal 2003, 102*(3), 41-46. Retrieved from http://www.wisconsinmedicalsociety.otg/professional/wmj

Garcia-Zornoza, R., Morales-Angulo, C., Gonzalez-Aguado, R., Cerva, L., Vazquez, E., & Aguera, S. (2012). Neck injuries. *Acta Otornnolanngologica Espanola, 63*(1), 47-54. http://dx.doi.org/10.1016/j.otorri.2011.07.003

Glass, N., Laughton, K., Campbell, J., Block, C., Hanson, G., Sharps, P., & Taliaferro, E. (2008). Non-fatal strangulation is an important risk factor for homicide of women. *The Journal of Emergency Medicine, 35*(3), 329-335. http://dx.doi.org/10.1016/j.jemermed.2007.02.065

Godin, A., Kremer, C., & Sauvageau. (2012). Fracture of the cricoid as a potential pointer to homicide A 6-year retrospective study of neck structures fractures in hanging victims.

American Journal of Medical Pathology, 33(1), 4-7. http://dx.doi.org/10.1097/PAF.0b013e3181d3dc24

Green, W. (2013). *Evaluation and management of sexually assaulted or sexually abused patient* (2nd ed.). Dallas: American College of Emergency Physicans. Retrieved from http://www.mncasa.org/assets/PDFs/Sexual-Assault-e-book.pdf

Grond-Ginsbach, C., Metso, T., Metso, A., Pezzini, A., Tatlisumak, T., Hakimi, M., . . . Lichy, C. (2013). Cervical artery dissection goes frequently undiagnosed. *Medical Hypotheses, 80*(6), 787-790. http://dx.doi.org/10.1016/j.mehy.2013.03.012

Henderson, E., Harada, N., & Amar, A. (2012). Caring for the forensic populuation: recognizing the educational needs of emergency department nurses and physicians. *Journal of Forensic Nursing, 8(4),* 170-177. http://dx.doi.org/10.1111/j.1939-3938.2012.01144.x

Holbrook, D., & Jackson, C. (2013). Use of an alternative light source to assess strangulation victims. *Journal of Forensic Nursing, 9*(3), 104-145. http://dx.doi.org/10.1097/JFN.0b013e31829beb1e

Iverson, K., & Pagoda, T. (2015). Traumatic brain injury among women veterans an invisible wound of intimate partner violence. *Medical Care, 53*(4), S112-S119. Retrieved from http://www.lww-medicalcare.com

Kristensen, M., Lynnerup, N., & Sijrsen, B. (2006). Comparison of handmarks in manual strangulation: an experimental study. *Journal of Forensic Science, 51*(2), 381-385. http://dx.doi.org/10.1111/j.1556-4029.2006.00076.x

Kristoffersen, S., Lilleng, P., Maehle, B., & Morild, I. (2014). Homicides in Western Norway, 1985-2009, time trends, age and gender differences. *Forensic Science International , 238*, 1-8. http://dx.doi.org/10.1016J.forsciint.2014.02.013

Kwako, L., Glass, N., Camppbell, J., Melvin, K., Barr, T., & Gill, J. (2011). Traumatic brain injury in intimate partner violence:a critical review of outcomes and mechanisms. *Trauma, Violence & Abuse, 12*(3), 115-126. http://dx.doi.org/10.1177/1524838011404251

Laerd Statistics. (2013). *Multiple regression analysis using SPSS statistics.* Retrieved from http://statistics.laerd.com/spss-tutorials/multiple-regression-using-spss-statistics.php

Lambe, A., Pushel, K., & Anders, S. (2008). Extensive petechiae in attempted self-strangulation. *American Academy of Forensic Sciences, 54*(1), 212-221. http://dx.doi.org/10.1111/ j.1556-4029.2008.00907.x

Le Blanc-Louvry, I., Papin, F., Vaz, E., & Proust, B. (2013). Cervical arterial injury after strangulation different types of arterial lesions. *Journal of Forensic Sciences, 52*(6), 1640-1643. http://dx.doi.org/10.1111/1556-4029.12197

Lebreton-Chakour, C., Godio-Raboutet, Y., Torrents, R., Chaumoitre, K., Boval, C., Bartoli, C., . . . Thollon, L. (2013). Manual strangulation: experimental approach to the genesis of hyoid bone fractures. *Forensic Science International*, *228*(1-3), 47-51. http://dx.doi.org/10.1016/j.forsciint.2013.02.014

Li, D.-R., Ishikawa, T., Quan, L., Zhao, D., Michiue, T., Zhu, B.-L., . . . Maeda, H. (2010). Morphological analysis of astrocytes in the hippocampus in mechanical asphyxiation. *Legal Medicine, 12*, 63-67. http://dx.doi.org/10.1016/j.legalmed.2009.11.005

Lincoln, H., & Lincoln, M. (2010). Role of the odontologist in the investigation of domestic violence, neglect of the vulnerable, and institutional violence and torture. *Forensic Science International, 201*(1-3), 68-73. http://dx.doi.org/10.1016/j.forsciint.2010.03.027

Maiese, A., Gitto, L., dell'Aquila, M., & Bolino, G. (2014). When the hidden features become evident: the usefulness of PMCT in a strangulation-related death. *Legal Medicine, 16*(6), 364-366. http://dx.doi.org/10.1016/j.legalmed.2014.06.009

McLean, M. (2012). Have you missed signs in a victim of strangulation? *College & Association of Registered Nurses of Alberta, 68*(3), 18-19. Retrieved from http://www.nurses.ab.ca/content/carna/home.html/

McClane, G., Strack, G., & Hawley, D. (2001). A review of 300 attempted strangulation cases, part II: clinical evaluation of the surviving victim. *Journal of Emergency Medicine*(21), 311-315. doi:10.1016/SO736-4679(01)00400-0

Mcquown, C., Frey, J., Steer, S., Flethcher, G., Klinkopf, B., Fakler, M., & Prulhiere, V. (2016). Prevalence of strangulation in survivors of sexual assault and domestic violence. *American Journal of Emergency Medicine, 34*, 1281-1285. http://dx.doi.org/10.1016/j.ajem.2016.04.029

Messing, J., Thaller, J., & Bagwell, M. (2014). Factors related to sexual abuse and forced sex in a sample of women experiencing police-involved intimate partner violence. *National Association of Social Workers, 39*(3), 181-191. http://dx.doi.org/10.1093/hsvw/hlu026

Pasqualone, G. (2015). The relationship between the forensic nurse in the emergency department and law enforcement officials. *Critical Care Nurse Quarterly, 38*(1), 36-48. doi:10.1097/CNQ.0000000000000047

Montgomery, B., Rompalo, A., Hughes, J., Wang, J., Haley, D., Soto-Torres, L., . . . Hodder, S. (2015). Violence against women in selected areas of the United States. *American Journal of Public Health, 105*(10), 2156-2166. http://dx.doi.org/10.2105/AJPH.2014.302430

Niort, F., Godio-Raboutet, Y., Torrents, R., Adalian, P., Leonetti, G., Piercecchi-Marti, M.-D., & Thollon, L. (2015). Transmission of force to the hyoid bone during manual strangulation: simulation using finite element numerical models. *Forensic Science International, 257*, 402-424. http://dx.doi.org/10.1016/j.forsciint.2015.10.013

Pasqualone, G. (2015). The relationship between the forensic nurse in the emergency department and law enforcement officials. *Critical Care Nurse Quarterly, 38*(1), 36-48. http://dx.doi.org/10.1097/CNQ.0000000000000047

Porr, J., Laframboise, M., & Kazemi, M. (2012). Traumatic hyoid bone fracture-a case repot and review of the literature. *Journal Canadian Chiropractic Association, 56*(4), 269-274. Retrieved from http://www.chiropractic.ca/jcca-online

Reijnders, U., & Ceelan, M. (2014). 7208 Victims of domestic and public violence: An exploratory study based on the reports of assaulted individuals reporting to the police. *Journal of Forensic and Legal Medicine, 24*, 18-23. http://dx.doi.org/10.1016/j.jflm.2014.02.006

Riley, C., Sarani, B., Sullivan, J., Upperman, J., Kane-Gill, S., & Bailey, H. (2015). Critical violent injury in the United States: A review and call to action. *The Society of Critical Care Medicine, 43*(11), 2460-2467. http://dx.doi.org/10.1097/CCM.0000000000001255

Robertson, J., & Koyfman, A. (2016). Cervical artery dissections: A review. *The Journal of Emergency Medicine, 51*(5), 508-518. http://dx.doi.org/10.1016/j.jemermed.2015.10.044

Rossurm, M. A., & Larrabee, J. H. (1999). A model of change to evidence-based practice. *Journal of Nursing Scholarship, 31*(4), 317-322. http://dx.doi.org/10.1111/j.1547-5069.1999.tb00510.x

Sauvageau, A., & Boghossian, E. (2010). Classification of asphyxia: the need for standardization. *Journal of Forensic Science, 55*(5), 1259-1267. http://dx.doi.org/10.1111/j.1556-4029.2010.01459.x

Seifert, D., Lambe, A., Anders, S., Pueschel, K., & Heinemann, A. (2009). Quantitative analysis of victim demographic and injury characteristics at a metropolitan Medio-Legal Center. *Forensic Science International, 188*, 46-51. http://dx.doi.org/10.1016/j.forsciint.2009.03.011

Sharma, B., Harish, D., Sharma, A., Sharma, S., & Singh, H. (2008). Injuries to neck structures in deaths due to constriction of neck, with a special reference to hanging. *Journal of Forensic and Legal Medicine, 15*, 298-305. http://dx.doi.org/10.1016/j.jflm.2007.12.002

Shields, L., Corey, T., Weakley-Jones, B., & Stewart, D. (2010). Living victims of strangulation A 10-year review of cases in a metropolitan community. *American Journal Forensic Medical Pathology, 31*(4), 320-325. http://dx.doi.org/10.1097/PAF.0b013e3181d3dc02

Smith, S., Fowler, K., & Niolon, P. (2014). Intimate partner homicide and corollary victims in 16 states: National Violent Death Reporting System, 2003-2009. *American Journal of Public Health, 104*(3), 461-466. http://dx.doi.org/10.2105/AJPH.2013.301582

Sorenson, S., Joshi, M., & Sivitz, E. (2014). A systematic review of the epidemiology of nonfatal strangulation, a human rights and health concern. *American Journal of Public Health, 104*(11), e54-e61. http://dx.doi.org/10.2105/AJPH.2014.302191

Stapczynski, J. S. (2010). Strangulation injuries. *Emergency Medicine Reports, 31*(17), 193-204. Retrieved from http://www.ahcmedia.com/newsletters/1

Strack, G., & Gwinn, C. (2011). On the edge of homicide: Strangulation as a prelude. *Criminal Justice, 26*(3). Retrieved from http://www.americanbar.org/publications/criminal_justice_magazine_home.html

Suffla, S., & Seedat, M. (2015). The epidemiology of homicidal strangulation in the city of Johannesburg, South Africa. *Journal of Forensic and Legal Medicine, 37,* 97-107. http://dx.doi.org/10.1016/j.jflm.2015.11.005

Terry, A. (2015). *Clinical research for the doctor of nursing practice* (2nd ed.). Burlington, MA: Jones & Bartlett Learning.

Thomsen, A., Jurik, A., Uhrenholt, L., & Vesterby, A. (2009). An alternative approach to Computerized Tomography (CT) in forensic pathology. *Forensic Science International, 183*, 87-90. http://dx.doi.org/10.1016/j.forsciint.2008.10.019

Turkel, A. (2007). "And then he choked me": Understanding and investigating strangulation. *American Prosecutors Research Institute, 2*(8), 1-4. Retrieved from http://ndaa.org

Utely, K. (2014, April 30). *Health issues result from strangulation.* Retrieved from http://www.strangulationtraininginstitute.com

Verhoff, M., Kettner, M., Laszik, A., & Ramsthaler, F. (2012). Digital photo documentation of forensically relevant injuries as part of the clinical first response protocol. *Deutsches Arzeteblatt Internation, 109*(39), 638-642. http://dx.doi.org/10.3238/arztebl.2012.0638

Vilke, G., & Chan, T. (2011). Evaluation and management for carotid dissection in patients presenting after choking or strangulation. *Journal of Emergency Medicine, 40*(3), 355-358. http://dx.doi.org/10.1016/j.emermed.2010.02.018

Volochinsky, B. (2012). Obtaining justice for victims of strangulation in domestic violence: Evidence based prosecution and strangulation-specific training. *Inquires Journal*, 4(10), 1-2. Retrieved from http://www.inquiresjournal.com

Wong, J., Choi, A., Fong, D., Wong, J., Lau, C.-L., & Kam, C.-W. (2014). Patterns, aetiology and risk factors of intimate partner violence-related injuries to head, neck and face in Chinese women. *BMC Women's Health, 14*(6). http://dx.doi.org/10.1186/1472-6274-14-6