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# FACTORS THAT CONTRIBUTE TO THE OCCURRENCE OF WORK-RELATED INJURIES AMONG NURSES

A systematic literature review



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# FACTORS THAT CONTRIBUTE TO THE OCCURRENCE OF WORK-RELATED INJURIES AMONG NURSES

## - A SYSTEMATIC LITERATURE REVIEW

Across the United States, nursing and residential care facilities ranked third among the top 10 industries with the highest rates of nonfatal injuries and illnesses in the workplace. (Perhats et al. 2012, 542.) Approaches to employee safety in most healthcare organizations have been of only modest benefit in reducing injuries. There is a need for the theoretically sound understanding of the interrelationships among individual, environmental, and organizational factors that affect safe job performance. (Mark et al. 2007, 432.)

The purpose of this research is to investigate what are the most common work-related injuries among nurses in the present day and what factors contribute to the occurrence of such injuries. The aim is to publish the results of the research onto the Hoito Netti web pages in order to provide material for nurses, the nursing students and anyone else, who could be interested in preventing work-related injuries among nurses. The research question is, "What factors contribute to the occurrence of the most common work-related injuries among nurses".

A systematic review to find peer reviewed articles that provide information needed to answer the research question was conducted. PRISMA flow diagram was used to show the search, inclusion and exclusion activities. The methodological quality and the risk of bias in chosen for the review articles have been judged according to criteria from the STROBE initiative. Latent content analysis was used to analyze the results of the research papers.

Physical and psychological work-related injuries occurred frequently among nurses. The musculoskeletal injuries were found to be the most common type of injuries. Most musculoskeletal injuries were caused by patient handling activities; the manual lifting was found to be the most frequent cause of back injuries among nurses. This research also found nurses to be regularly exposed to needlestick and sharps injuries. The findings suggest that the following factors were strongly associated with both physical and psychological injuries among nurses: overtime, inadequate staffing, poor management and social support. Some other factors were found to be unique for the certain types of injuries.

### KEYWORDS:

Nurse, factor, work-related injury.

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## List of abbreviations

CINAHL	Cumulative Index to Nursing and Allied Health Literature
HIV	Human Immunodeficiency Virus
ICU	Intensive Care Unit
IV	Intravenous
NCHWA	The National Center for Health Workforce Analysis
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analysis
PTSD	Post-traumatic Stress Disorder
STROBE	Strengthening the Reporting of Observational studies in Epidemiology
WHO	World Health Organization

# 1 INTRODUCTION

Health care workers are more likely to experience work-related injuries than are workers in most other occupations. Across the United States, nursing and residential care facilities ranked third among the top 10 industries with the highest rates of nonfatal injuries and illnesses in the workplace. (Perhats et al. 2012, 542.) Nurses are at high risk for work-related injury due to the physically demanding work and the environment in which it is conducted.

Vecchio et al. (2011, 1068) stated that over half of 955 Australian nurses surveyed in the research commissioned by the Australian Safety and Compensation Council (2008) reported that at some stage of their career they experienced at least one work-related injury or disease that required time off work. The most common injuries or diseases reported by the Australian nurses were musculoskeletal (6%), stress (8%), bullying (1%) and infection (1%). In the United States, nurses and other healthcare workers are among the highest risk professions for back injury, ranking healthcare workers in the six (6) of the top ten (10) occupations at highest risk. Sharps and needlestick injuries are also commonly reported. Sharp or needlestick injuries are particularly hazardous as they increase the risk of contracting infectious disease. Work-related injuries often have an impact on the health and economic well-being of nurses. (Vecchio et al. 2011, 1068.)

Along with higher employer costs due to medical expenses, disability compensation, and litigation, nurse injuries also are costly in terms of chronic pain and functional disability, exposure to serious and potentially lethal infectious agents, absenteeism, and turnover, since as many as 20% of nurses who leave direct patient care positions do so because of risks associated with the work. (Mark et al. 2007, 432.)

Perhats et al. (2012, 542) noted that the risk factors for injuries impact nurses' decisions regarding whether or not to return to their job or to stay in their field of practice, thereby exacerbating workforce shortages and hindering recruitment and retention efforts.

Drysdale, S. (2011) stated that injury prevention programs are being developed and instituted by government agencies and employers in an attempt to reduce the frequency of occurrence of injuries. In spite of attempts to prevent the injuries, musculoskeletal injuries of the upper extremity, neck, and back continue to occur in healthcare workers including nurses.

Approaches to employee safety in most healthcare organizations have been limited to modification of individual behavior through enforced compliance with safety rules and procedures and mandatory participation in safety training. Because these approaches have been of only modest benefit in reducing injuries, there is an emerging consensus that successful safety initiatives will depend on a theoretically sound understanding of the interrelationships among individual, environmental, and organizational factors that affect safe job performance. (Mark et al. 2007, 432.)

Given the high risk of injury among nurses, an important question then becomes: what factors can be modified to reduce work-related injury among the nursing profession (Vecchio et al. 2011, 1068)?

## **2 BACKGROUND**

### 2.1 Job-related hazards

#### **Definitions of work-related injuries**

Occupational injury is any wound or damage to the body resulting from an event in the work environment. An injury or illness is considered by the Occupational Safety and Health Administration to be work-related if an event or exposure in the work environment either caused or contributed to the resulting condition or significantly aggravated a pre-existing condition. (United States Department of Labor #1 2012.)

Work-related injuries range in severity from minor cuts and bruises to death. Various conditions may affect a person's health, through short or long-term pain or disability, and may also affect their financial situation through health expenses and lost income. (Australian Bureau of Statistics 2008.) Nature of injury names the principal physical characteristic of a disabling condition, such as sprain, strain, cut. Part of body affected is directly linked to the nature of injury, for example, back sprain, finger cut. Exposure signifies the manner in which the injury was produced, for example, overexertion while lifting. Source of injury identifies the objects or equipment that were responsible for the injury incurred by the worker. (United States Department of Labor #1 2012.)

#### **Physical work-related injuries**

Nursing professionals routinely encounter risk-prone working conditions associated with musculoskeletal disorders (Fischer and Martinez 2013). Musculoskeletal disorders include cases where the nature of the injury or illness is pinched nerve; herniated disc; meniscus tear; sprains, strains, tears; hernia; pain, swelling, and numbness; carpal or tarsal tunnel syndrome; musculoskeletal system and connective tissue diseases and disorders, when the event or exposure leading to the injury or illness is overexertion and bodily reaction; overexertion involving outside sources; repetitive motion involving microtasks. (United States Department of Labor #1 2012.)

Needle-stick injuries are defined as “a penetrating wound with an instrument that is potentially contaminated with another person’s body fluid”. The United States National Institute of Occupational Safety and Health, defined needle stick injuries as injuries caused by needles such as hypodermic needles, blood collection needles, intravenous

stylets, and needles used to connect parts of IV delivery systems. (Galougahi 2010.) Every needlestick and sharps injury carries a risk of infection from a bloodborne pathogens (Foley and Leyden). Transmission of at least 20 different pathogens by needlestick and sharps injuries has been reported (Beltrami et al. 2010). Exposures carry the risk of infection with syphilis, herpes, Hepatitis B, Hepatitis C, and HIV (Foley and Leyden). It is worth pointing out that healthcare workers are occupationally exposed to a variety of infectious diseases during the performance of their duties (United States Department of Labor #1 2013). Bernard et al. (2009) mentioned that the fact that nurses contact with potentially infectious persons probably places them at higher risk than the general population for infectious diseases.

### **Psychological work-related injuries**

Orly et al. (2012) stated that health care professionals are prone to continuous stress as part of their occupational demands. Among the health professions, nursing is considered a particularly stressful and emotionally demanding job (Orly et al. 2012).

Work-related stress arises where work demands of various types and combinations exceed the person's capacity and capability to cope. The signs or symptoms of the work-related stress can be physical, psychological and behavioral. (Better Health Channel 2012.) Job stress is not in itself a disorder or a psychological injury (Safe Work Australia 2014). However, prolonged stress can lead to chronic problems, ultimately an exhaustion of all reserves and energies and depression. Such, the term "burnout" describes the emotional and psychological results of long continued stress. In this condition mental and emotional exhaustion leads to apathy and revulsion against everything and everybody. (Onciul 1996.)

Psychological injury may include such disorders as depression, anxiety or post-traumatic stress disorder (Safe Work Australia 2014). Psychologically and physically demanding nursing work environment may lead to depressive symptoms. Depression is a common mental disorder characterized by sadness, loss of interest in activities, decreased energy, thoughts of death and suicide, and disturbance of sleep and appetite. (Gao et al. 2011, 1167.) Anxiety encompasses a feeling of intense and indeterminate fear, accompanied by physical disturbances, such as sweating or palpitations. Moderate to severe anxiety may lead to panic reactions and to impair nurses' concentration and effective problem solving. (Stathopoulou et al. 2011.) Adriaenssens et al. (2012, 1412) defined post-traumatic stress disorder (PTSD) as



an anxiety disorder that occurs as a result of experiencing or being confronted with an emotionally traumatic event. PTSD is characterized by intrusive psychological re-experiencing of the traumatic event, mental numbness, and symptoms of increased arousal (Onciul 1996). The incidence of PTSD symptoms is found to be higher in Emergency nurses than in other nursing specialties. (Adriaenssens et al. 2012, 1412.)

## 2.2 Prevalence of work-related injuries among nurses

In the United States, health care and social assistance sector experienced an incidence rate of about 28 nonfatal occupational injuries and illnesses cases per 10,000 full-time workers in 2012. (United States Department of Labor #2 2013.)

In the research commissioned by the Australian Safety and Compensation Council in 2008, just over half of the 955 nurses surveyed had sustained in their career, at least one work-related injury or disease that required time off work (Vecchio et al. 2010).

Nurses routinely encounter risk-prone working conditions associated with musculoskeletal disorders (Fischer and Martinez 2013). In the study of more than 1,000 registered nurses almost one-third of the nurses had suffered a back injury, 20% had suffered a neck injury, and 17% had suffered a shoulder injury within a year (Hunter 2010). According to the United States Department of Labor #3 (2013), patient handling is a cause of injuries that is unique to health care field and accounts for 25% of all claims in the country.

The prevalence of needlestick injuries is also high worldwide. Based on data from the 1998-2000 National Electronic Injury Surveillance System, the rate of exposure to bloodborne pathogens from a needlestick injury has been estimated at 15 per 1,000 full-time equivalents for nurses. (Mark et al. 2007.) United States Center for Disease Control reported that about 600,000 to 800,000 needlestick injuries occur annually among eight million health care workers in the United States. Accidental needlestick injuries result in more than 100,000 injuries in health-care workers in UK hospitals annually. (Galougahi 2010.) Results of a study by Hoffman et al. (2002) on the epidemiology of needlestick injuries among healthcare workers in two German hospitals indicated that 500,000 needlestick injuries occur annually in Germany. Galouhani (2010) surveyed 158 nursing workers in Khanevadeh hospital (Tehran), in the study almost 57% of participants had at least one exposure to

needlestick injury during their professional life and 22% were exposed to such type of injury during last year.

The prevalence of anxiety in nurses is higher than that of the whole population, although it may vary greatly from country to country or between different nursing specialties (Gao et al. 2012, 141). Such, a total of 1,437 questionnaires completed by registered nurses from seven city hospitals in China were analyzed in the research by Gao et al. (2012). In the given research the prevalence of anxiety symptoms was 43,4%. In the United States, about 20% of ICU and general care nurses from different hospitals had symptoms consistent with possible anxiety. (Gao et al. 2012, 141.)

The prevalence of depression also varies across populations (Gao et al. 2011, 1167). A total of 1,171 registered nurses working in United States took part in the research conducted by Letvak et al. (2012). Data analysis in this research demonstrated a depressive symptom rate of 18% among nurses, which is high comparing to 9,4% in adult population in the United States. More than half of the 1,592 Chinese nurses who participated in the study of Gao et al. (2011, 1173) had depressive symptoms. Kim and Yoon (2013, 169) reported that approximately 38% of 441 South Korean nurses who participated in their study experienced depressive symptoms.

### 2.3 Financial costs of work-related injuries among nurses

Absenteeism and presenteeism associated with injuries at work impose considerable costs to employers in terms of lower productivity, escalating workplace insurance and financial compensation (Vecchio et al. 2011, 1068). Mark et al. (2007) mentioned that the consequences of work-related injuries are substantial with expenditures as high as \$90 million annually in the United States for registered nurses alone.

Across United States, worker's compensation losses result in a total annual expense of \$2 billion for hospitals. Estimated cost of replacing a nurse in US, including separation, recruiting, hiring, and training is \$27,000 to \$103,000. (United States Department of Labor #3 2013.)

In the period 2002-2004, Northwest Texas Healthcare System averaged 20 injuries per year caused by patient handling activities. These injuries had an average direct cost of \$27,402 per claim. Indirect costs to the organization were two to three times higher for an outlay of \$54,804 to \$82,206 per claim.

In British Columbia, Canada, 13,348 claims first paid in 2008 were awarded to healthcare and social assistance workers. The overall cost of claims paid in this sector in 2008 was \$56,323,889. (Drysdale 2011, 27.)

#### 2.4 Effects of injuries on the nurse shortage problem

Injuries and stress are common reasons why nurses leave their jobs (United States Department of Labor #3 2013). An estimated 12% of nurses leave the profession annually because of back injuries (Hunter et al. 2010). Early retirement of nurses is a concern, and nursing workers with low work ability, for all age groups across countries, more frequently consider leaving the profession (Fischer and Martinez 2013). As many as 20% of nurses who leave direct patient care positions do so because of risks associated with the work (Mark et al. 2007, 432). Perhats et al. (2012, 542) noted that the risk factors for injuries impact nurses' decisions regarding whether or not to return to their job or to stay in their field of practice, thereby exacerbating workforce shortages and hindering recruitment and retention efforts. These findings are alarming since the nurse shortage issue has been repeatedly addressed across the world.

Buerhaus et al. (2007, 854) noted that in US many hospitals are struggling with nurse shortage. NCHWA in United States projects that, if current trends continue, by 2020 the national shortage of registered nurses will be more than 800,000 (Deloras 2005).

World Health Organization (2010) mentioned, that while there is a shortage of nurses in most countries of the world, yet it is even more acute in the developing world. In India, for instance, nurse shortages occur at every level of the health-care system; there is a shortage of 2,4 million nurses (WHO 2010).

Next, Michie and Williams (2003) stated that most health care is provided by staff working in teams, ill health and sickness absence in any one individual is likely to cause increased work and stress for other staff. Overtime is frequently used in healthcare settings to meet staffing needs (Olds and Clarke, 2010). The results of the research conducted by Olds and Clarke (2010, 156) suggested that increased time at work may have negative consequences for nurse occupational health.

## 2.5 Effects of injuries among nurses on patients

Nurses' work performance undoubtedly affects the overall quality of patient care in the hospital (Gao et al. 2012). A better process of care may lead to fewer treatment errors and adverse events (Hanrahan et al. 2010, 570). Prolonged work stress may compromise the quality and safety of delivered nursing care (Stathopoulou et al. 2011).

Perhats et al. (2012, 542) noted that the risk factors for injuries among nurses exacerbate workforce shortages. Job-related injuries also contribute to inadequate staffing in such a way that they cause nurses to miss work. Then, a growing body of research has established a relationship between inadequate hospital nurse staffing and increased risk of adverse patient outcomes, including mortality (Buerhaus et al. 2007).

Overtime is frequently used in healthcare settings to meet staffing needs (Olds and Clarke 2010). However, the results of the research conducted by Olds and Clarke (2010, 156) also suggested that increased time at work may have negative consequences for patient safety and nurse occupational health. Relationships were found between work hours and nurse reports of occasional/frequent patient falls with injury. Nurses working more than 40 hours per week have an increased likelihood of experiencing adverse events and errors in health care, particularly wrong medication and dose administration. (Olds and Clarke 2010, 157.)

Hunter et al. (2010) mentioned that a culture of patient safety includes increasing the understanding that what is good for nurses is also good for patients. Studies have found higher patient satisfaction levels in hospitals where fewer nurses are dissatisfied or burned out (United States Department of Labor #3 2013).

## 2.6 Factors that contribute to work-related injuries

Perhats et al. (2012, 542) stated that literature points to five (5) major risk factors for occupational injuries: heavy workloads, the aging nursing workforce, obesity, work environment, and work schedules.

The findings of the study by Drysdale, S. (2007) suggested that working full-time was a significant predictor of increased injury (see Drysdale 2011, 26). Working more than 12 hours per shift has been linked with needlestick risk in hospital staff. Musculoskeletal

disorders also have been linked with hours of work per day and per week. (Olds and Clarke 2010.) Further, non-standard schedules that are erratic contribute to an increased risk of injuries among nurses (Perhats et al. 2012, 542).

Trinkoff et al. (2006) claimed that adequate nurse staffing has been consistently linked to fewer work injuries (see Mark et al. 2007, 434). Mark et al. (2007, 433) also observed that availability of support services was strongly associated with a positive practice environment.

The age of nurses was mentioned in several articles as a factor that contributes to the occurrence of work-related injuries. Such, Perhats et al. (2012), Vecchio et al. (2011) and Drysdale, S. (2011, 28) stated that age has a negative effect on the occurrence of job-related injuries among nurses. Karahan et al. (2009) found age to be a significant risk factor in the prevalence of low back pain (see Vecchio et al. 2011, 1068). The older average age of nurses places them at higher risk for musculoskeletal injuries and slips, trips, and falls (Perhats et al, 2012, 542).

Perhats et al. (2012, 542) stated that obesity among nurses increases the risk of an injury. Drysdale, S. (2011, 28) mentioned that physical activity in leisure time might be an important factor in reducing the incidence of soft tissue injuries in all workers.

The workplace environment seemed to affect the safety for nurses in several ways. For instance, the safety of both patients and the nurses is compromised by the crowded and unkempt workplace environments (Perhats et al. 2012, 542). Mark et al. (2007, 432) mentioned that studies found increased musculoskeletal injuries among employees in organizations with intensified job demands and work pace. Poor management and low social support also seemed to contribute to the occurrence of injuries. According to Shannon et al. (1997), the employee perceptions about the importance of safety depend on managerial behaviors that are committed to safety (see Mark et al. 2007, 434). Then, Boyer et al. (2009) found that the risk for injuries decrease with psychosocial rewards and supervisor support (see Drysdale 2011, 28). Van de Ploeg and Kleber (2003) stated that lack of social support and poor team communication have been found to be related to higher levels of fatigue, burnout and post-traumatic stress responses among emergency nurses (see Adriaenssens et al. 2012, 1413). Soto-Quijano and Rivera-Tavarez (2005) added that low support from colleagues was one of the factors that were associated with shoulder disorders (see Drysdale 2011, 28).

According to Vecchio et al. (2011), the availability of safety devices is another factor that may have an effect on the occurrence of injuries. Vecchio et al. (2011, 1068) stated that injuries within the nursing profession can be prevented by the use of safer devices, such as disposal containers and lifting devices. However the previous research had shown that safer devices alter the type, but not necessarily the overall number of sharps injuries. (Vecchio et al. 2011, 1068.)

According to the United States Department of Labor #3 (2013), patient handling is a cause of injuries that is unique to health care. The research carried out by Alexopoulos, Burdorf, and Kalokerinou in 2006, showed that physical load handling seems to put nurses at risk for the occurrence of musculoskeletal disorders (see Drysdale 2011, 28). Karahan et al. (2009) found heavy lifting to be a significant risk factor in the prevalence of low back pain (see Vecchio et al. 2011, 1068). Additionally, rise in obesity among patients causes strain on health care workers (Perhats et al. 2012, 542).

Mealer et al. (2007) claimed that the repetitive exposure to significant stressors and the inability to cope effectively with the traumatic experience may result in the development of psychological disorders (see Adriaenssens et al. 2012, 1412). Meanwhile, Bennett et al. (2005) noticed that all nurses have to deal with potentially traumatizing situations, especially the emergency nurses who are routinely confronted with severe injuries, death, and are frequently exposed to verbal and physical aggression (see Adriaenssens et al. 2012, 1412).

Some other factors that were claimed to have an influence on the occurrence of work-related injuries among nurses were their experience on the job, gender, existing health problems, and the presence of bad habits. For instance, Vecchio et al. (2011, 1071) noted that previous studies have identified low nursing experience as a significant factor in work-related injury. Nevertheless, Laposa et al. (2003) found the more time on the job and the professional seniority to be predictors of PTSD symptoms (see Adriaenssens et al. 2012, 1412). Laposa et al. (2003) also mentioned that female gender was a predictor of PTSD symptoms in emergency nurses (see Adriaenssens et al. 2012, 1413). In addition, Karahan et al. (2009) found the female gender to be a significant risk factor in the prevalence of low back pain (see Vecchio et al. 2011, 1068). Lastly, Drysdale, S. (2011, 28) mentioned that upper extremity musculoskeletal disorders in females were associated with diabetes mellitus.

### **3 AIM AND RESEARCH QUESTION**

The purpose of this research is to investigate what are the most common work-related injuries among nurses in the present day and what factors contribute to the occurrence of such injuries. The aim is to publish the results of the research onto the Hoito Netti web pages in order to provide material for nurses, the nursing students and anyone else, who could be interested in preventing work-related injuries among nurses.

The research question is, "What factors contribute to the occurrence of the most common work-related injuries among nurses".

## 4 METHODS

### 4.1 Research rational and design

Approaches to employee safety in most healthcare organizations have been limited to modification of individual behavior through enforced compliance with safety rules and procedures and mandatory participation in safety training. Because these approaches have been of only modest benefit in reducing injuries, there is an emerging consensus that successful safety initiatives will depend on a theoretically sound understanding of the interrelationships among individual, environmental, and organizational factors that affect safe job performance. (Mark et al. 2007, 432.)

The aim is to provide material for nurses, the nursing students and anyone else, who could be interested in preventing work-related injuries among nurses. A systematic review to find peer reviewed articles that provide information on the injuries that occur among nurses and the factors that contribute to the occurrence of such injuries was conducted. Systematic reviews can be broadly termed as "research on research". It is sometimes called secondary research because it does not collect new information but makes use of the findings of previous research. Systematic review can be defined as the rigorous search, selection, appraisal, synthesis and summary of the findings of primary research in order to answer a specific question. (Parahoo 2006.) The research question is, "What factors contribute to the occurrence of the most common work-related injuries among nurses". The purpose of this research is to investigate what are the most common work-related injuries among nurses in the present day and what factors contribute to the occurrence of such injuries.

### 4.2 Search terms

A computerized search of the relevant scientific literature was conducted using Medline and CINAHL through the portal of the University of applied Science, Turku on the 2<sup>nd</sup> and 3<sup>rd</sup> of April 2014 respectively using the open ended search term nurs\*, factor\* and work-related injur\*. Medline database was searched from 1946 and CINAHL from 1983. Both databases were searched to the present day. The terms of the strategy were formulated using the PICO (population, intervention, comparison, and outcome)



method. Step 1 identified all texts using the open ended search term “nurs\*” as the target population of the research. Step 2 searched the open ended search term “factor\*” as an intervention pertinent to the study. Step 3 used the open ended word “work-related injur\*” to signify the outcome. Step 4 combined steps 1, 2 and 3 with the integer AND. The results of the search are displayed in table below.

Table 1. Database search result.

Data base	Search word(s)	Result	Selected by the title	Selected by the abstract	Selected by the whole text
CINAHL	Nurs*	574,346			
CINAHL	Factor*	572,955			
CINAHL	Work-related injur*	607			
CINAHL	Nurs*&Factor*&Work-related injur*	39	3	22	54
Medline (Ovid)	Nurs*	967,407			
Medline (Ovid)	Factor*	3,963,329			
Medline (Ovid)	Work-related injur*	1,097			
Medline (Ovid)	Nurs* & Factor* & Work-related injur*	44		40	8

#### 4.3 Inclusion and exclusion criteria

Medline returned 48 results and CINAHL returned 39 articles. After the process of screening for duplicate publications a total of 56 papers were left for the review.

The titles and abstracts were then screened in a two stage process outlined in the flow diagram, which was adopted from the PRISMA statement (figure 1).

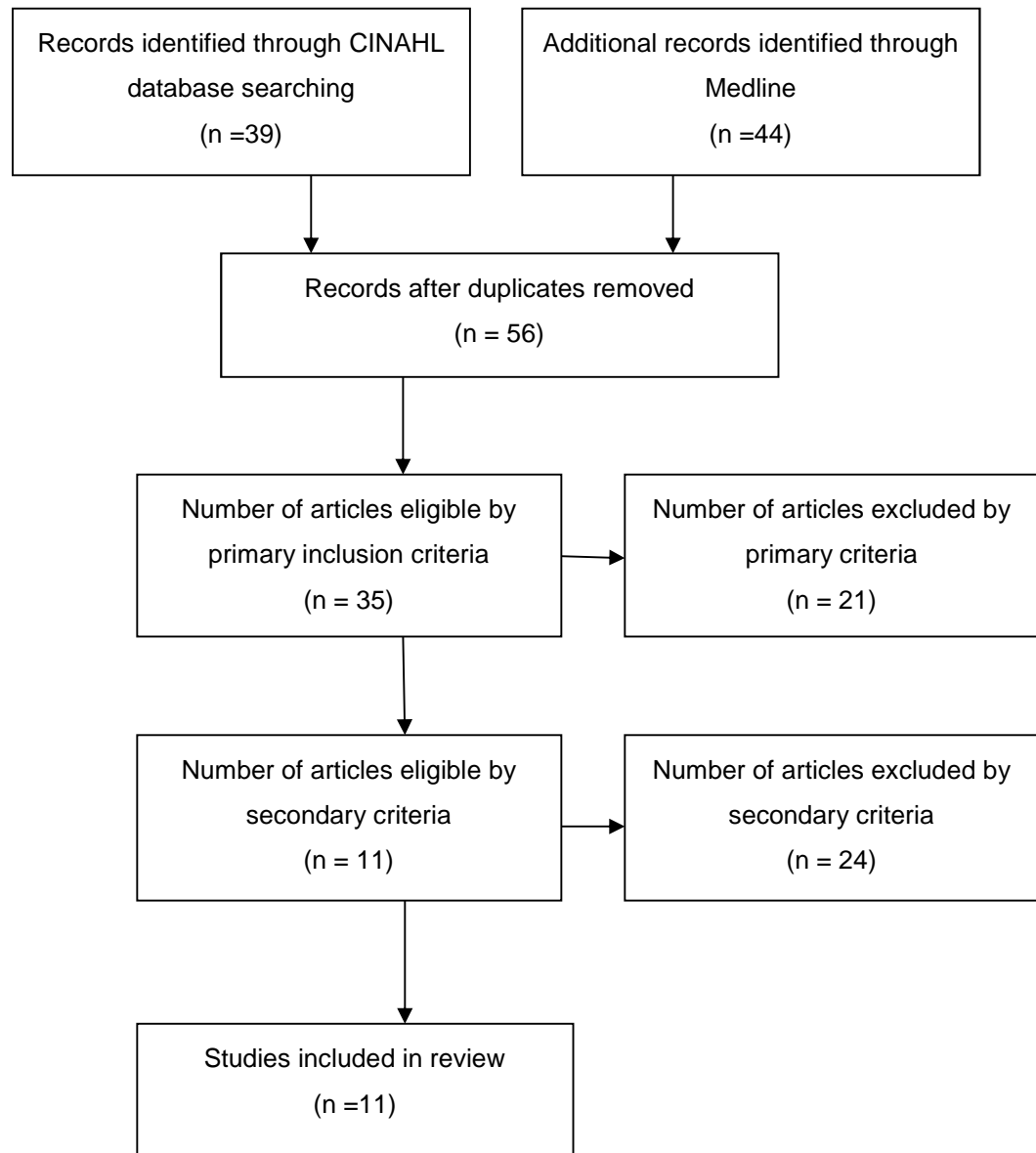


Figure1. PRISMA flow chart (Moher 2009).

The first stage of screening determined if the articles were suitable to answer the research question, by excluding all papers not published in English, systematic literature reviews and theoretical research. Systematic reviews were excluded, because they don't collect any new information but make use of previous research. It was important to gather primary data to ensure the correct answer to the research question. The articles of CINAHL were limited to those that were peer reviewed.

The first round of screening reduced the amount of articles available for the review to 35, with 22 of them being from CINAHL and 13 from Medline.

During the second round of screening the abstracts of the remaining articles were reviewed to determine if the articles contained information related to the research question. Only articles concerning nursing population and the work-related injuries were included. A total of eleven articles were left for the review after the second stage of screening.

## 5 RESULTS

A total of eleven potentially eligible for the research articles were subject to additional descriptive observations analysis and checking for reliability and validity. The results of the preliminary data analysis are summarized in the Table 2 below.

Table 2. Characteristics of articles.

Title	Author and year	Sample	Method	Results	Limitations and ability to answer the research question
1. The Incidence of Upper Extremity Injuries in Canadian Endoscopy Nurses.	Drysdale, S. (2011)	147 Endoscopy nurses working in endoscopy centers in Canada.	Quantitative. Cross-sectional design.	This group of nurses has a higher than average upper extremity disability score. 32% of the nurses in this study missed work because of pain.	Limited in subject number, only endoscopy nurses were included. The sample did represent nurses as the population group of interest. <u>Included.</u>
2. Does safety climate moderate the influence of staffing adequacy and work conditions on nurse injuries?	Mark et al. (2007)	3,272 RN's in 143 hospitals in USA.	Quantitative. Cross-sectional design.	The interaction between safety climate and work conditions was significantly related to the number of back injuries.	Some hospital units were excluded. Some accidents could have been not reported. <u>Included.</u>
3. The effect of work hours on adverse events and errors in health care.	Olds & Clarke (2010)	11,516 RNs from 188 Pennsylvania hospitals.	Quantitative. Cross-sectional.	All of the adverse event and error variables were significantly related to working more than 40 hours in the average week.	Overtime was examined only in terms of the hours, but not shifts length or rotating shifts. <u>Included.</u>
4. The impact of traumatic events on emergency room nurses: Findings from a questionnaire survey.	Adriaenssens et al. (2012)	248 Emergency Nurses, from 15 Belgian general hospitals.	Quantitative. Cross-sectional study.	Almost 1 out of 3 nurses met sub-clinical levels of anxiety, depression and somatic complaints and 8.5% met clinical levels of PTSD.	Due to the cross-sectional design of the study, one cannot draw conclusions regarding causal relationships. <u>Included.</u>
5. Work-related injury in the nursing profession: an investigation of modifiable factors.	Vecchio et al. (2011)	5724 employed registered and enrolled Queensland nurses.	Quantitative. Cross-sectional study.	Psychological distress contributes to the occurrence of an injury among nurses. Nurses with 3 or more existing health conditions have greater odds of work-related injury.	Possible responder bias. Self-reported data. <u>Included.</u>
6. Non-violence-related Workplace Injuries Among Emergency Nurses in the United States: Implications for Improving Safe Practice, Safe Care.	Perhats et al. (2012)	2294 nurses from the Emergency Nurses Association (ENA).	Quantitative. Cross-sectional study.	1 in 5 nurses reported that they experienced a non-violence-related injury in previous year. 3 factors were found to be significantly related to the experience of these injuries.	A low response rate of 9%. Possible respondent bias. <u>Included.</u>

(Continued)

Table 2 (continued).

7. Individual features, working conditions and work injuries are associated with work ability among nursing professionals.	Fischer & Martinez (2013)	514 nursing professionals from a hospital in São Paulo, Brazil.	Quantitative. Cross-sectional.	Various factors were associated with work ability.	The design of study did not allow establishing causal relationships. Workers that were absent from work for medical reasons were not included in study. <u>Included.</u>
8. Reports of work related musculoskeletal injury among home care service workers compared with nursery school workers and the general population of employed women in Sweden.	Ono et al. (1995)	105 006 home care service workers and 108 252 nursery school workers.	Quantitative.	Home care service workers have higher annual injury incidence of musculoskeletal injuries than nursery school workers.	<u>The study was excluded</u> from research as the population of interest in the article was different from the ones of the research.
9. Adverse Events Associated With Organizational Factors of General Hospital Inpatient Psychiatric Care Environments.	Hanrahan et al. (2010)	353 psychiatric registered nurses working in 67 Pennsylvania general hospitals.	Quantitative. Cross-sectional study.	Verbal abuse toward registered nurses, complaints, patient falls with injuries, and work-related injuries were frequent occurrences. Better management skill was associated with fewer patient falls and fewer work-related injuries to staff.	Results may not be generalizable outside of the 1 state in which data were examined. There may be a response bias. <u>Included.</u>
10. Development and evaluation of a multifaceted ergonomics program to prevent injuries associated with patient handling tasks.	Nelson et al. (2006)	Direct patient care nursing staff from 7 facilities in USA. Among the staff with specified job titles, 36% were RN's.	Quantitative. Experimental	The multi-faceted program resulted in an overall lower injury rate, fewer modified duty days taken per injury, and significant cost savings. The program was well accepted by patients, nursing staff, and administrators.	Self-report data, long post-intervention data not available. Does not answer the research question. Sample includes other healthcare workers, not just nurses. <u>Excluded.</u>
11. Staff assaults and injuries in a psychiatric hospital as a function of three attitudinal variables.	Ray & Subich (1998)	78 of the 150 staff members at a Midwestern psychiatric hospital in the United States.	Quantitative. Cross-sectional.	The findings suggest that locus of control, authoritarianism, and trait anxiety on the part of staff members are connected with patient assaults and injuries.	Relatively small sample size. Some participants submitted incomplete data. The population of interest is healthcare workers in general, not just nurses. <u>Excluded.</u>

The remaining eleven articles were then once again analyzed for content. Information in Table 2 was used to appraise the articles in order to select the articles which provided the information related to the research question and represented the nursing population.

In the studies of Ono et al. (1995) the population of interest was different from the ones of the research; hence the given article was excluded from the studies. Further, the research by Nelson et al. (2006) has been excluded because the main focus in the study was mostly on the injury prevention program and not on the factors that contribute to the occurrence of injuries, therefore the article did not answer the question of the research.

The article "Staff assaults and injuries in a psychiatric hospital as a function of three attitudinal variables" by Ray and Subich, was also excluded. The sample in that study included not just nurses but also other health professionals, such as psychologists and psychiatrists. Additionally, the work environment of mental health nurses was different from that of their colleagues working in general settings (Roche et al. 2010). The factors that contribute to the occurrence of work-related injuries among mental health nurses may be different than nurses who work in general hospitals, and the findings of the research by Ray and Subich may be applicable only to psychiatric hospitals and misleading to the rest of the nursing population. Therefore, in order to avoid potential bias the article has been excluded from the further research.

The sample in the article by Hanrahan et al. (2010) also included psychiatric nurses. However, after assessing the full text, the article has been included in the research since it contained valuable information which can be used to answer the research question. Additionally, Hanrahan et al. (2010) stated that the study was about inpatient psychiatric care in general hospitals, and it does not apply to other types of psychiatric settings. Furthermore, the population in the article did represent the population of the research, considering that the sample included only registered nurses working in general hospitals.

## 5.1 Appraisal process

A total of eight (8) articles were left for the review, all of which were quantitative, observational, cross-sectional studies. All studies were published between 2007 and 2013. The oldest study by Mark et al. was published in 2007. Newest studies included studies by Fischer and Martinez published in 2013 and studies by Adrianssens et al. and by Perhats et al. which were published in 2012.

Four (4) out of eight (8) articles were conducted in the United States; one (1) article was from Brazil, one (1) from Canada, one (1) from Belgium and (1) from Australia. These eight populations comprised 24,068 nurses. The amount of hospitals that participated in studies was reported in five (5) of the included articles. A total of 15,903 nurses worked in 414 hospitals.

The methodological quality and the risk of bias in these articles have been judged according to criteria from the STROBE (Strengthening the Reporting of Observational studies in Epidemiology) initiative. Assessment included a total of eleven questions. Questions and results of assessment are summarized in the table 3. Setting, location, dates for recruitment, eligibility criteria and sources and methods of selecting participants were provided in seven (7) studies. In the study by Drysdale, S. (2011) the dates for recruitment and sources of selecting participants were not provided.

A total of five (5) of the included surveys used non-probability participants sampling techniques, while only three (3) articles used random participant sampling. Probability sampling maximizes the extent to which the study sample is representative of the population from which it is drawn (Pettus-Davis 2011, 382). Non-probability sampling does not involve random selection. Samples constructed with non-probability sampling may or may not well represent the larger population. (Pettus-Davis 2011, 384.)

Explaining the reasons for non-participation helps to judge if the study population was representative and whether bias was possibly introduced. In a cross-sectional survey, non-participation due to reasons unlikely to be related to health status will affect the precision of estimates but will probably not introduce bias. However, if many individuals opt out of the survey because of illness, results may underestimate or overestimate the prevalence of ill health in the population. (Vandenbroucke 2007, 1641.) Thus, if due to illnesses, some nurses did not participate in the research that



investigates the prevalence of the work-related injuries, the results of the research may be biased.

Missing data are common in observational research. Questionnaires posted to study participants are not always filled in completely. Despite its importance, few papers report in detail on the problem of missing data. (Vandenbroucke 2007, 1639.) Out of eight (8) included in the review articles only the paper by Hanrahan et al. (2010) explained how the missing data was addressed.

Statistical methods, as well as statistical methods used to control for confounding, limitations to studies were discussed, efforts to address potential bias described, and the variables were defined in each of the eight (8) articles. The generalisability (external validity) of the study results were discussed in seven (7) articles. It was not discussed in the study by Drysdale, S. (2011). The sources of funding were not given only in the article by Perhats et al. (2012).

None of the eight (8) included articles provided sufficient data to answer all of the questions included the assessment (see Table 3). Therefore, all eight (8) studies were judged to have some risk of bias. Further, in order to judge the degree of bias, all the “yes” answers to the questions in the assessment were counted for each study. Since, the random sampling may decrease the risk of bias in a study; the random sampling was judged and counted also as a positive answer to a sampling question.

Six (6) studies had ten positive answers to eleven questions. These studies were judged to have a low risk of bias. Therefore, articles by Adrianssens et al. (2012), Fischer and Martinez (2013), Hanrahan et al. (2010), Olds and Clarke (2010), Mark et al. (2010) and Vecchio et al. (2011) were all judged to have a low risk of bias.

The article by Perhats et al. (2012) was judged to have an intermediate risk of bias since it had seven (7) positive answers questions. Then, the study by Drysdale, S. (2011) was judged to have a higher risk of bias, since it had just five (5) positive answers to the questions, which means that it didn't provide sufficient data to answer over a half of assessment's questions.

However, since all studies were judged to be of sufficient methodological quality, all eight (8) articles were left for further review.

Table 3. STROBE appraisal questions and results.

Question	Perhats et al. 2012	Adrianssens et al. 2012	Hanrahan et al. 2010	Drysdale, 2011	Olds & Clarke 2010	Mark et al. 2007	Fischer & Martinez 2013	Vecchio et al. 2011
Were setting, location, and dates for recruitment provided?	yes	yes	yes	subjective	yes	yes	yes	yes
Were the eligibility criteria and sources and methods of selecting participants provided?	yes	yes	yes	subjective	yes	yes	yes	yes
Non-probability or random participant sampling?	non-probability	non-probability	random	non-probability	random	random	non-probability	non-probability
Were the reasons for non-participation provided?	no	yes	no	no	yes	yes	yes	yes
Were statistical methods described?	yes	yes	yes	yes	yes	yes	yes	yes
Were the variables defined?	yes	yes	yes	yes	yes	yes	yes	yes
Were statistical methods for confounding described?	yes	yes	yes	yes	yes	yes	yes	yes
Were limitations discussed and efforts to address potential bias described?	yes	yes	yes	yes	yes	yes	yes	yes
Was it explained how missing data was addressed?	no	no	yes	no	no	no	no	no
Was the generalisability of the results discussed?	yes	yes	yes	no	yes	yes	yes	yes
Sources of funding acknowledged?	no	yes	yes	yes	yes	yes	yes	yes

## 5.2 Content analysis

A total of four (4) out of the eight (8) articles were conducted in the United States; one (1) article was from Brazil, one (1) from Canada, one (1) from Belgium and (1) from Australia. The sample sizes ranged between 147 to 11,516 nurses. The study by Olds and Clarke (2010) included the biggest sample, which consisted of 11,516 nurses, while the study by Drysdale, S. (2011) included only 147 nurses. These eight (8) populations comprised 24,068 nurses. The amount of hospitals that participated in studies was reported in five (5) of the included articles. A total of 15,903 nurses worked in 414 hospitals. Therefore, the sample of the research consisted of 24,068 nurses.

Then, the sample characteristics were analyzed. The results of the analyzing process are displayed in Table 4. The gender was reported in four (4) studies, the majority of nurses in all studies were females. Such in the study by Olds and Clarke (2010) in the sample of 11,516 nurses as many as 10,813 nurses were women. The mean age of nurses was reported in six (6) studies and the overall mean age of nurses in those studies was calculated to be 42 years. The marital status was reported in three (3) studies, the percentages of married nurses varied from 52,5% to 74%.

Years of experience were reported in five (5) articles, the mean number was 14,6 years. Mean numbers of hours worked in a week were reported in only two (2) studies, the mean number of hours for those two studies was 47,5. This may confirm the previous research findings that overtime is common in the field of healthcare.

The next step of content analysis was reading through the finding, discussion and conclusion parts of each article, in order to identify the findings of each study and to select the meaning units. According to Graneheim and Lundman (2004), a meaning unit includes words, sentences or paragraphs containing aspects related to each other through their content and context. The meaning units that contained information that could answer the question of the present study were identified and then, condensed. Therefore, the meaning units included information about nurse injuries, work ability and factors that are connected with the occurrence of work-related injuries.

Then the condensed meaning units were coded. Results of the coding process are outlined in the Table 5, found below.

Table 4. Sample characteristics.

Variables	Olds & Clarke (2010)	Fischer & Martinez (2013)	Vecchio et al.(2010)	Adriaenssens et al. (2012)	Hanrahan et al. (2010)	Mark et al. (2007)	Drysdale (2011)	Perhats et al. (2012)	Mean number
Where conducted	US	Brazil	Australia	Belgium	US	US	Canada	US	
Number of nurses	11,516	514	5,724	248	353	3,272	147	2,294	-
Female gender	93,9% (10,813)	77,2% (397)	90% (5152)	55,6% (138)	-	-	-	-	-
Age (years)	39,55	35,5	43	37,76	45	-	49,8		42
Marital status (married)	-	52,5%	70%	74%	-	-	-	-	-
Years of experience	-	11,5	23	11,2	16,5	-	11	-	14,6
Mean number of hours worked per week	35,1	59,9	-	-	-	-	-	-	47,5
Reports for work injuries	32,8%	10,5%	10%	-	39%	-	32,7%	19%	-

Table 5. Coding of the articles.

Name of the article	Author, year of publication	Code
The Incidence of Upper Extremity Injuries in Canadian Endoscopy Nurses.	Drysdale, S. 2011	Almost every third nurse in the study missed work because of upper extremity symptoms. More than a half of nurses have seen a doctor for upper extremity symptoms. Occurrence of upper extremity injury and increased age were correlated. Working full-time variable did not increase amount of injuries.
Does safety climate moderates the influence of staffing adequacy and work conditions on nurse injuries?	Mark et al. 2007	Safety climate at the hospitals had effect on back injuries. Fewer injuries reported for units characterized by a strong safety climate. Manual patient lifting is the most frequent cause of back injuries among nurses. Manual lifting is less likely to result in injury when at least two nurses assist each other. Nurses can sustain a back injury even when they have followed safe lifting precautions. Back injuries were not much amenable to reduction through equipment redesign. Safety devices that reduce are not readily available; also they typically require the assistance of at least two nurses. Safety devices have been highly successful in preventing injuries. Managerial behaviors are critical to the development of a strong safety climate. Work engagement is important in developing a strong safety climate. Nurses who work in settings where employees perceive that they are not valued or supported may be more reluctant to report injuries.
The effect of work hours on adverse events and errors in health care.	Olds & Clarke 2010	Nearly 10% of nurses indicated that they have sustained a needlestick or sharp injury in the last year. Overtime seemed to be related to fatigue in nurses. Physical fatigue can increase the risk of injury. Increased time at work may have negative consequences for patient safety and nurse occupational health. Overtime is significantly related to adverse events and errors in patients and nurses. Medication errors and needlestick injuries had the strongest and most consistent relationships with overtime. Overtime was significantly related to the reports of nosocomial infections. Increased odds of nurses reporting patient falls with injury were found to be related to working overtime.

(Continued)

Table 5 (continued).

The impact of traumatic events on emergency room nurses: Findings from a questionnaire survey.	Adriaenssens et al. 2012	<p>Emergency nurses are regularly exposed to occupation-related traumatic incidents. General nurses are less exposed to traumatic events than Emergency nurses. Confrontation with sudden death, especially of children and adolescents, was reported as the most distressing event in Emergency nurses.</p> <p>Almost one out of three nurses met sub-clinical levels of anxiety, depression and somatic complaints. Almost one in four nurses exceeded the sub-clinical cut-off for PTSD-symptoms. One out of seven Emergency nurses reached clinical levels for PTSD. More than one in four nurses reached clinical scores for fatigue. Fatigue was not directly related to experience of traumatic event. Emotional coping was related to an increase in all outcomes. Avoidant coping was related to more somatic complaints. Problem focused coping strategy was related to less psychological distress and fatigue. Social support from colleagues and supervisor was found to reduce PTSD symptoms.</p>
Work-related injury in the nursing profession: an investigation of modifiable factors.	Vecchio et al. 2011	<p>Only 11% of respondents report no existing health conditions. The mean age of 43 years reflects the ageing of the nursing workforce. About 10% of nurses reported a work-related accident, injury or poisoning that required medical attention. Men and unmarried individuals have a 2% higher probability of injury. There is a link between work-related injury and physical fitness. Psychological distress increases probability of injury. Since injuries can be reduced through prevention and intervention strategies, managers should be aware of the symptoms of prolonged psychological distress. Number of existing health conditions increases the probability of work-related injury's occurrence. There seems to be little difference in the likelihood of injury on the basis of work experience.</p>
Non-violence-related Workplace Injuries Among Emergency Nurses in the United States: Implications for Improving Safe Practice, Safe Care.	Perhats et al. 2012	<p>Almost 20% of the respondents reported experience a non-violence-related workplace injury. Almost three quarters of the reported injuries occurred during activities related to patient handling. Sprains/strains/spasms and blunt traumas are the most common types of injuries. The back and the shoulder are the areas of the body most likely to be injured. Moving/transporting patients was the most common cause of injuries, followed by walking/running to get somewhere, and lifting patients. Most common personal factors were time pressure, work-related stress, muscle fatigue, low level of fitness. Administrative support helps to reduce the risk of work-place injuries. Three factors were found to be significantly related to the experience of non-violence-related workplace injuries: 1) the hospital having safe patient handling program and policies, 2) access to decontamination and postexposure treatment, 3) emergency nurses' perception of staffing in their emergency department.</p>

(Continued)

Table 5 (continued).

Adverse Events Associated With Organizational Factors of General Hospital Inpatient Psychiatric Care Environments.	Hanrahan et al. 2010	<p>Almost half of the nurses reported the frequent occurrence of patient falls with injuries.</p> <p>Almost 40% of nurses reported work injuries.</p> <p>Almost 80% of nurses reported verbal abuse against nurses.</p> <p>Almost 20% of nurses reported the occurrence of medication errors.</p> <p>There is a significant relationship between organizational factors of the care environment and adverse events.</p> <p>Better-skilled managers were associated with fewer injurious patient falls and with fewer work-related injuries to staff.</p> <p>Fewer work-related injuries to staff were associated with better nurse-physician relationships.</p> <p>Fewer work-related injuries to staff were associated with lower patient-to-nurse staffing ratios.</p>
Individual features, working conditions and work injuries are associated with work ability among nursing professionals.	Fischer & Martinez 2013	<p>Work ability is associated with the occurrence of work injuries.</p> <p>Social support is an important prerequisite for the work ability.</p> <p>Obesity is a risk factor for good work ability.</p> <p>Practice of physical exercise is a predictor of good work ability.</p> <p>Time as a nurse was negatively related to work ability and was also associated with age.</p> <p>Women have a higher risk of impaired work ability than men do.</p> <p>Verbal abuse is negatively related to work ability. Almost 40% of the participants reported violence at work.</p> <p>Verbal abuse was the most prevalent.</p> <p>The higher perception of work activities that may contribute to pain/injury was negatively associated with lower work ability.</p> <p>Nurses with low work ability, for all age groups, more frequently considered leaving the profession.</p>

Further, the codes with similar meanings were grouped together into sub-categories and categories. A total of eight (8) categories were formed.

The categories were formulated into three (3) themes. The results of the process of creating the categories and the themes are outlined in the Table 6.

### 5.3 Themes

Overall, a total of three (3) themes were formulated. The themes included the adverse events theme, the personal factors theme, and the hospital risk factors theme.

#### **The adverse events theme**

The work-related injuries and the adverse events in patients' categories formed the adverse events theme.

Sub-categories in the work-related injuries were: occurrence of injuries, physical injuries and psychological injuries among nurses. Perhats et al. (2012) stated that the emergency room nurses are more exposed to traumatic events than general hospital nurses. Such, almost 20% of the emergency room nurses in the study by Perhats et al. (2012) reported that they experienced a non-violence-related workplace injury, compared to 10% of nurses reporting a work-related injury in the study by Vecchio et al. (2011). However, in the study by Hanrahan et al. (2010) 39% of psychiatric nurses reported occurrence of staff injuries, and 32% of endoscopy nurses in the study by Drysdale, S. (2011) missed work because of upper extremity pain alone. Therefore, work-related injuries seemed to occur frequently among all the populations of nurses.

The physical injuries sub-category contained information about the prevalence of musculoskeletal injuries and needle-stick injuries. Throughout the studies musculoskeletal injuries were reported to be the most common type of physical work-related injuries among nurses. Perhats et al. (2012) mentioned the sprains/strains/spasms were the most common types of injuries, and that the areas of the body most likely to be injured were the back and the shoulder. This finding complements the statement by Drysdale, S. (2011), who said that workers in the healthcare sector experience one of the highest rates of musculoskeletal injuries,



and the group of nurses in the study had a higher than average upper extremity disability score.

Needlestick were also reported in several studies, for instance, in the study by Olds and Clarke (2010) almost 10% of all the nurse respondents indicated that they sustained a needlestick or sharps injury in the last year.

Psychological injuries were mentioned in most of the articles, which signifies the high prevalence of such injuries among nurses. Verbal abuse was reported as the most prevalent adverse event among nurses, 80% of nurses in the research by Hanrahan et al. (2010, 571), and almost 40% of nurses reported violence at work in the article by Fischer and Martinez (2013, 514). In the research by Adriaenssens et al. (2012) more than one in four nurses reached clinical scores for fatigue and one out of seven Emergency nurses reached clinical levels for PTSD.

The adverse events theme also included the adverse events in patients' category. The information in the adverse events in patient's category does not directly answer the research question, however it was included in the review since it was mentioned constantly in several articles. Also the same factor was found to contribute to the occurrence of the adverse events in patients and to the occurrence of injuries among nurses. Such, in the research by Olds and Clarke (2010) overtime at work was found to be significantly related to adverse events and errors in patients and nurses. This supports the statement by Hunter et al. (2010), who mentioned that a culture of patient safety includes increasing the understanding that what is good for nurses is also good for patients. Patient falls and medication errors were the adverse events that were widely reported by nurses throughout the articles. Patient falls were reported by as many as 44% of psychiatric nurses in the research by Hanrahan et al. (2010), and almost 20% of nurses in the research by Olds and Clarke (2010).

### **Personal Factors Theme**

The nurses' psychosocial individual factors category, nurses' physical individual factors and nurses' individual occupational factors categories were grouped into one personal factors theme. This theme answers the question "How the personal factors contribute to the occurrence of the job-related injuries among nurses". Psychological individual factors seemed to have a strong connection with the occurrence of injuries among the nurses throughout the studies. For instance, Vecchio et al. (2010, 1073) found unmarried individuals to have a 2% higher probability of injury. Adriaenssens et al.

(2012) has found that nurses' emotional and avoidant coping strategies were related to the occurrence of psychological work-related injuries, such as depression, anxiety and PTSD. Avoidant coping was also found to be related to more somatic complaints (Adriaenssens et al. 2012).

Then, the nurses' perception of their work environment seemed to also have some influence on the occurrence of work-related injuries. Such, Perhats et al. (2012, 546) found the nurses perception of staffing in their department to be one of the three factors that were significantly related to the experience of job injuries. This finding may, however, signify the importance of the staffing factor on the occurrence on injuries at work more than of the nurses' perception factor. Fischer and Martinez (2013) also found that the nurses' higher perception of work activities that may contribute to pain/injury was negatively associated with lower work ability. Then, in the same research, the health-related outcome associated with work ability was work injury. Therefore, the nurses' higher perception of work activities that may contribute to pain/injury was negatively associated not only with lower work ability, but also with the occurrence of work injuries.

Nurses' physical individual characteristics also seemed to have a role in the occurrence of job-related injuries. For instance, the age factor was mentioned in two (2) out of the eight (8) studies. Drysdale, S. (2011, 30) noted that occurrence of upper extremity injury and increased age were correlated. In the research by Fischer and Martinez (2013) the age of nurses was negatively associated with the work ability. The gender factor was also mentioned throughout the articles. However, authors seemed to disagree if the male or female gender is negatively associated with the injuries. Such, Fischer and Martinez (2013, 514) stated that women have a higher risk of impaired work ability than men do, which could lead to the work injury. While Vecchio et al. (2011, 1074) found men to be more vulnerable to work-related injury. The nurses' states of health factor also seemed to contribute to the occurrence of injuries. Such, the nurses with three or more conditions have greater odds of work-related injury than individuals with no health conditions (Vecchio et al. 2011, 1072). The role of physical shape on the occurrence of work-related injuries was mentioned in two out of eight articles. First, Fischer and Martinez (2013, 514) have found association between inadequate work ability and obesity. Authors also mentioned that practice of physical exercise could help to prevent work injuries. Secondly, in the study by Perhats et al.

(2012, 543) muscle fatigue/weakness and low level of fitness were reported as ones of the most common personal factors that contributed to the injuries.

Nurses' individual occupational factors that could possibly contribute to the occurrence of job-related injuries, such as time pressure, patient lifting and handling activities and working time experience were also discussed throughout the articles. Such, in the research by Perhats et al. (2012, 543) time pressure and rushing were cited as the most common personal factors that contributed to injuries. Then, in the same research more than 15% of sustained injuries were caused by walking/running to get somewhere. The work experience factor was mentioned in the research by Vecchio et al. (2011) and in the article by Fischer and Martinez (2013). Vecchio et al. (2011, 1073) found that work experience plays insignificant role on the occurrence of injuries. However, in the research by Fischer and Martinez (2013, 514) time as a nursing professional was negatively related to work ability. Throughout the articles patient lifting and handling activities were reported as the most common reason for the occurrence of injuries. Such, in the research by Perhats et al. (2012, 543) almost three-quarters (72%) of the reported injuries occurred during activities related to patient handling and movement, almost 23% of injuries were directly caused by moving/transporting patients and over 13% were caused by lifting patients. Mark et al. (2007, 442) named the manual lifting to be the most frequent cause of back injuries among nurses. Nurse' individual adherence to safe work precautions also may contribute to the job-related injury. For instance, patient lifting devices can reduce the risk of injury if a nurse is willing to expend the time and energy to use them. Nurses are also responsible for their own individual adherence to safe needle precautions. (Mark et al. 2007, 442.)

### **The hospital risk factors theme**

This theme answers the question "How the hospital risk factors contribute to the occurrence of the job-related injuries among nurses". The hospital risk factors theme consisted of working team environment, hospital staffing climate and organization of human resources categories.

The poor team environment factor was mentioned in as many as six (6) out of the eight (8) articles. Such, in the research by Hanrahan et al. (2010, 573) a lack of skilled managers and a poor nurse-physician relationship were significantly associated with more frequent work-related injuries among staff. The better-skilled managers were associated not only with fewer injuries to staff, but also with fewer patient falls with

injuries (Hanrahan, et al. 2010, 572). Mark et al. (2007, 442) noted that it takes an active participation of the entire workgroup to prevent back injuries. Vecchio et al. (2011, 1074) mentioned that nurse managers should be aware of the signs and symptoms of prolonged psychological distress, because most injuries can be avoided and psychological distress can be reduced through prevention and early intervention strategies. Results of the research by Perhats et al. (2012, 545) also indicated that administrative support helps to reduce the risk of work-place injuries. Fischer and Martinez (2013, 514) found a direct relationship between social support at work and work ability. Adriaenssens et al. (2012) stated that while social support from colleagues and supervisor was found to have a protective effect on the occurrence of PTSD symptoms, the lack of it was a significant predictor of occupational stress in Emergency Nurses.

The category of hospital safety climate included the safe lifting precautions, safety climate of the hospital and safety medical devices sub-categories. The positive effect of workplace safety policies on reducing the rates of injuries among staff was mentioned in the articles by Perhats et al. (2012) and Mark et al. (2007). Results of the research by Perhats et al. (2012, 545) indicated that staff training and workplace safety policies and programs help reduce the risk on occupational injuries among emergency nurses. However, to be successful, safety policies and programs should also include good access to safe patient handling equipment, decontamination and postinfection exposure measures. (Perhats et al. 2012, 546.) It was noted by Mark et al. (2007, 442) that needleless systems for medication administration, puncture-resistant disposal containers and other devices that reduce the risk of needlestick have been highly successful in preventing needlesticks. Back injuries were less amenable to reduction through equipment redesign. Devices that reduce the risk of back injury are less readily available; also they typically require the assistance of at least two nurses. (Mark et al. 2007, 442.)

The findings in the articles suggest that the organization of human resources in hospitals also had influence on the occurrence of occupational injuries. The category of the organization of human resources included the duration of the working week and the staffing at the hospital sub-categories. Hanrahan et al. (2010, 573) found that inadequate staffing was significantly associated with more frequent work-related injuries among staff, with fewer injuries associated with lower patient-to-nurse staffing ratios. Perhats et al. (2012) also found that the nurses' perception of staffing in

the department was one of the factors that were related to the occurrence of injuries. Mark et al. (2007, 442) stated that manual lifting is less likely to result in injury when a nurse has at least one assistant, and that lifting devices typically require the assistance of at least two people. These statements also add to the idea of importance of adequate staffing at the hospitals, since the nurse would less likely find an assistant in the hospital with inadequate staffing. Overtime is frequently used in healthcare to meet the staffing needs. Such, in the study by Olds and Clarke (2010, 155), as many as 7,216 (63%) of 11,516 nurses reported working at least one type of overtime. While Drysdale, S. (2011, 30) has found no statistical significance between working full-time and increased injury. However, the results of the study by Olds and Clarke (2010, 158) suggested that overtime may have negative consequences for patient safety and nurse occupational health. The relationships were also found between work hours and nurse reports of patient falls and nosocomial infections. Likelihood of reporting medication errors and needlestick injury in the past year had the strongest and most consistent relationships with the work hour. (Olds and Clarke 2010.)

Table 6. Categories and themes.

Code	Sub-category	Category	Theme
<p>Almost every third nurse missed work because of upper extremity symptoms.            More than a half of nurses have seen a doctor for upper extremity symptoms.            Nearly 10% of nurses indicated that they have sustained a needlestick or sharp injury in the last year.            Emergency nurses are regularly exposed to occupation-related traumatic incidents.            General nurses are less exposed to traumatic events than Emergency nurses.            About 10% of the sample reported a work-related accident, injury or poisoning that required medical attention.            Almost 20% of the respondents reported experience of a non-violence-related workplace injury.            39% of psychiatric nurses working in general hospitals reported frequent occurrence of work-related injuries.</p>	Occurrence of work-related injuries		
<p>Confrontation with sudden death, especially of children and adolescents, was reported as the most distressing event in emergency nurses.            Almost one out of three nurses met sub-clinical levels of anxiety, depression and somatic complaints.            Almost one in four nurses exceeded the sub-clinical cut-off for PTSD-symptoms.            One out of seven Emergency nurses reached clinical levels for PTSD.            More than one in four nurses reached clinical scores for fatigue.            Psychological distress increases probability of injury.            Work-related stress is one of the most common personal factors for occurrence of injuries.            Almost 80% of nurses reported verbal abuse against nurses.            Verbal abuse is negatively related to work ability.            Almost 40% of the participants reported violence at work.            Verbal abuse was the most prevalent.            Overtime seemed to be related to fatigue in nurses.            Physical fatigue can increase the risk of injury.            More than one in four nurses reached clinical scores for fatigue.            Fatigue was not directly related to experience of traumatic event.            Muscle fatigue is one of the most common personal factors.</p>	Psychological injuries	Work-related injuries among nurses	Adverse events

(Continued)

Table 6 (continued).

<p>Almost every third nurse missed work because of upper extremity symptoms  More than a half of nurses have seen a doctor for upper extremity symptoms.  Sprains/strains/spasms and blunt traumas are the most common types of injuries.  The back and the shoulder are the areas of the body most likely to be injured.  Nearly 10% of nurses indicated that they have a needlestick/sharp injury in the last year.</p>	Physical injuries	Work-related injuries among nurses	Adverse events
<p>Increased time at work may have negative consequences for patient safety and nurse occupational health.  Overtime is significantly related to adverse events and errors in patients and nurses.  15% of nurses reported occasional/frequent wrong medication or dose.  Almost 20% of nurses reported patient falls with injuries.  Medication errors had the strongest and most consistent relationship with the work hour.  Increased odds of nurses reporting patient falls with injury were found to be related to working over 40 hours per week.  Almost half of the nurses reported the frequent occurrence of patient falls with injuries.  44% of psychiatric nurses working in general hospitals reported patient falls with injuries.  Almost 20% of nurses reported the occurrence of medication errors.</p>	Factors that are related to patient safety problems	Adverse events in patients	
<p>Emotional coping was related to an increase in all outcomes.  Avoidant coping was related to more somatic complaints.  Active, problem focused coping strategy was related to less psychological distress and fatigue.</p>	Nurses' coping strategies	Nurses' psychosocial individual factors	Personal factors
<p>The higher perception of work activities that may contribute to pain/injury was negatively associated with lower work ability.  Emergency nurses perception of staffing in their emergency department was one of the three factors which were found to be significantly related to the experience of non-violence-related job injuries.</p>	Nurses' perceptions of their work environment		
<p>Unmarried individuals have a 2% higher probability of injury.</p>	Marital status		
<p>Only 11% of respondents report no existing health conditions.  Number of existing health conditions increases the probability of work-related injury's occurrence.</p>	Nurses' states of health	Nurses' physical individual factors	
<p>Occurrence of upper extremity injury and increased age were correlated.  The mean age of 43 years reflects the ageing of the nursing workforce.  Age was associated with the work ability.</p>	Age of nurses		
<p>There is a link between work-related injury and physical fitness.  Low level of fitness and muscle fatigue/weakness were ones of the most common personal factors.  Obesity is a risk factor for good work ability.  Practice of physical exercise is a predictor of good work ability.</p>	Physical shape		

(Continued)

Table 6 (continued).

<p>Men have a 2% higher probability of injury. Women have a higher risk of impaired work ability than men do.</p>	<p>Gender</p>		
<p>There seems to be little difference in the likelihood of injury on the basis of work experience. Time as a nurse was negatively related to work ability and was also associated with age.</p>	<p>Nurses' work experience</p>		
<p>Manual patient lifting is the most frequent cause of back injuries among nurses. Almost three quarters of the reported injuries occurred during activities related to patient handling. Moving/transporting patient was the most common cause of injuries. Lifting patients was the third most common cause of injuries.</p>	<p>Patient lifting and handling activities</p>	<p>Nurses' individual occupational factors</p>	<p>Personal factors</p>
<p>Nurses are responsible for their own individual adherence to safe needle precautions Adherence to work practices that reduce the risk of back injuries does not depend only on a nurse, but on the whole workgroup. Nurses can sustain a back injury even when they have followed safe lifting precautions.</p>	<p>Adherence to safe work precautions</p>		
<p>Walking/running to get somewhere was the second most common cause of injuries. Time pressure was one of the most common personal factors.</p>	<p>Time pressure</p>		
<p>Managerial behaviors are critical to the development of a strong safety climate. There is a significant relationship between organizational factors of the care environment and adverse events. Nurses who work in settings where employees perceive that they are not valued or supported may be more reluctant to report injuries Social support from supervisor was found to have a protective effect on the occurrence of PTSD symptoms. Since injuries can be reduced through prevention and intervention strategies, managers should be aware of the symptoms of prolonged psychological distress. Better skilled managers were associated with fewer injurious patient falls and with fewer work-related injuries to staff. Administrative support helps to reduce the risk of work-place injuries.</p>	<p>Nursing management</p>	<p>Working team environment</p>	<p>Hospital risk factors</p>
<p>Social support from colleagues and supervisor was found to have a protective effect on the occurrence of PTSD symptoms. Lack of social support is a significant predictor of occupational stress in Emergency Nurses. Social support is an important prerequisite for the work ability. Fewer work-related injuries to staff were associated with better nurse-physician relationships. An active participation of the entire workgroup is needed to prevent back injuries. Work engagement may be of critical importance in developing a strong safety climate.</p>	<p>Social support</p>		

(Continued)



Table 6 (continued).

<p>Nurses can sustain a back injury even when they have followed safe lifting precautions. The hospital having safe patient handling program and policies was one of the three factors which were found to be significantly related to the experience of non-violence-related workplace injuries.</p>	Safe lifting precautions	Hospital safety climate	Hospital risk factors
<p>Safety climate at the hospitals had effect on back injuries. Fewer injuries reported for units characterized by a strong safety climate. Work engagement is important in developing a strong safety climate.</p>	Safety climate at the hospital		
<p>Needleless systems, puncture-resistant disposal containers have been highly successful in preventing needlestick. Back injuries were less amenable than needlestick injuries to reduction through equipment redesign. Devices that reduce the risk of back injury are less readily available; also they typically require the assistance of at least two nurses. Access to decontamination and postexposure treatment was one of the three factors which were found to be significantly related to the experience of non-violence-related workplace injuries.</p>	Safety medical devices.		
<p>Manual patient lifting is less likely to result in injury when at least two nurses assist each other. Patient lifting devices can reduce the risk of injury if nurse can expand the time to use them, if they are more accessible and if the nurse can have at least one assistant. Emergency nurses' perception of staffing in their emergency department was one of the three factors which were found to be significantly related to the experience of non-violence-related workplace injuries. Fewer work-related injuries to staff were associated with lower patient-to-nurse staffing ratios. Inadequate staffing was significantly associated with more frequent injuries among staff.</p>	Staffing at the hospital	Organization of human resources	
<p>Working full-time variable did not increase amount of injuries. Increased time at work may have a negative effect for patient safety and nurse occupational health. Working overtime is significantly related to adverse events and errors in patients and nurses. Overtime was significantly related to the reports of nosocomial infections. Nurses' reports of patient falls with injury were found to be related to overtime.</p>	Duration of the working week		

## 6 LIMITATIONS

All articles included in the review were observational, cross-sectional studies. This in itself may affect the credibility of the findings, as a ranking of evidence from the non-experimental research is lower than of the evidence from randomized controlled trials (WHO 2009). The reporting of observational studies is often of insufficient quality. However, much of clinical or public health knowledge comes from observational research. About nine out of ten research papers published in clinical specialty journals describe observational research. (Vandenbroucke et al. 2007.)

Although there are methods available for synthesizing findings from observational studies, they are less well known and less well developed than those for synthesizing findings from randomized controlled trials (WHO 2009). The articles in this study have been judged for the methodological quality and the risk of bias according to criteria from the STROBE (Strengthening the Reporting of Observational studies in Epidemiology) initiative. However, Marta et al. (2010) recognized that the STROBE Initiative must be seen as an ongoing process, open to reviews, recommendations, criticisms and new evidence.

Then, during the assessment process all eight (8) articles were judged to have some degree of bias. One study was judged to have a higher risk of bias, since it didn't provide sufficient data to answer over a half of assessment's questions. However, all articles were left for further review. This may introduce some bias in this systematic literature review.

Limited skills and experience of the researcher also possibly affected the critical appraisal of the articles. The credibility of the research could have been increased if more than one researcher coded the text and created the themes. Graneheim et al. (2004) stated that communication and the agreement between co-researchers about the labeling and sorting of the data could help to raise the credibility.

The exclusion of the articles that were not published in English and of the article by Ray and Subich (1998) that represented psychiatric nurses working in mental health hospitals may limit the generalisability of the research.

## 7 DISCUSSION

In this research the musculoskeletal injuries were found to be the most common work-related injuries among nurses. This result is consistent with previous research. Drysdale, S. (2011) mentioned that workers in the healthcare sector experience one of the highest rates of musculoskeletal injuries.

According to the United States Department of Labor #3 (2013), patient handling is a cause of trauma that is unique to health care field and accounts for 25% of all claims in the country. For instance, in the period 2002-2004, Northwest Texas Healthcare System averaged 20 injuries per year caused by patient handling activities. Perhats et al. (2012) named the back and the shoulder to be the areas of the body most likely to be injured.

Several factors seemed to contribute to the occurrence of musculoskeletal injuries. Mark et al. (2007, 442) named the manual lifting to be the most frequent cause of back injuries among nurses. Additionally, Perhats et al. (2012, 542) noticed that the rise in obesity among patients causes additional strain on health care workers. However, the manual lifting is less likely to result in injury when a nurse has the assistance of another person (Mark et al. 2007, 442). If there is a shortage of staff at the hospital, it is more likely that the nurse would have to lift the patient alone. Therefore, inadequate staffing at the hospitals may have a negative effect on the occurrence of musculoskeletal injuries. (Mark et al. 2007, 442.)

Overall, back injuries were found not to be very amenable to reduction through equipment redesign. This may be caused by the fact that devices that reduce the risk of back injury are not always available for use; also they usually require the assistance of at least two nurses. Additionally, a nurse must be willing to spend the time and energy to use the lifting devices. (Mark et al. 2007, 442.) Therefore, the patient lifting devices may reduce the injuries among nurses, if they are readily available, if the staffing at the hospital is adequate enough that at least two people can participate in every patient lifting procedure, and if nurses are adherent to safe work precautions.

The better-skilled managers were associated not only with fewer injuries to staff, but also with fewer patient falls with injuries (Hanrahan et al. 2010, 572). Mark et al. (2007, 442) noted that it takes an active participation of the entire workgroup to prevent back

injuries. Therefore, both good management at the hospital and good social support may result in less musculoskeletal injuries among nurses.

Such nurse's individual factor as age also was found to affect the occurrence of injuries. Perhats et al. (2012, 542) claimed that the older average age of nurses places them at higher risk for musculoskeletal injuries and slips, trips and falls. Then, Drysdale, S. (2011, 30) discovered that the occurrence of upper extremity injury and increased age were correlated. The mean age of nurses in this study was calculated to be 42 years. According to Vecchio et al. (2011), the mean age of 43 years reflects the ageing of the nursing workforce. This finding is alarming, since it suggests that the amount of musculoskeletal injuries could increase in the future.

Perhats et al. (2012, 543) noticed that muscle fatigue/weakness, low level of fitness and obesity among nurses increase the risk of injury. The obesity also contributes to the development of chronic diseases. Then, Vecchio et al. (2011, 1072) observed that the nurses with three or more conditions have greater odds of work-related injury than individuals with no health conditions. Therefore, the nurses' states of health factor also seem to contribute to the occurrence of injuries. In this research the gender factor was found to have insignificant role, since authors seemed to disagree whether the male or female gender was negatively associated with the injuries. While, Fischer and Martinez (2013, 514) stated that women have a higher risk of impaired work ability than men do, which could lead to the work injury. Vecchio et al. (2011, 1074) found men to be more vulnerable to work-related injury. Nevertheless, Vecchio et al. (2011, 1074) added that this finding could possibly reflect men nurses' greater exposure to physically demanding tasks.

This research also found the nurses to be regularly exposed to needlestick and sharps injuries. Such, Olds and Clarke (2010) claimed that almost 10% of all the nurse respondents indicated that they sustained a needlestick or sharps injury in the last year. The needlestick injuries are especially dangerous, since very needlestick and sharps injury carries a risk of infection from bloodborne pathogens (see Foley and Leyden). Mark et al. (2007, 442) stated that needleless systems for medication administration, puncture-resistant disposal containers and other devices have been highly successful in preventing needlesticks. Therefore, availability of safety devices is one of the factors associated with the occurrence of needlestick and sharp injuries. However, the good availability of needle safety devices alone cannot fully protect the nurses from the needlesticks. Nurses are also responsible for their own individual

adherence to safe needle precautions. (Mark et al. 2007, 442.) According to Olds and Clarke (2010), overtime also had a negative effect on the occurrence of injuries, in both nurses and patients. Likelihood of reporting medication errors and needlestick injury in the past year had the strongest and most consistent relationships with the work hour (Olds and Clarke 2010). Hanrahan et al. (2010, 573) found that fewer injuries were associated with lower patient-to-nurse staffing ratios. Then, in the research by Perhats et al. (2012, 543) time pressure and rushing were cited as the most common personal factors that contributed to injuries. Inadequate staffing at the hospital cause higher patient-to-nurse staffing ratios, which in it turn increases the amount of injections performed by a nurse in one shift, inadequate staffing may also cause time pressure and rushing. Therefore, inadequate staffing may contribute to the occurrence of needlestick injuries. Overall, the following factors were found to have a strong negative effect on the occurrence of needlestick injuries: poor availability of needle safety devices, nurses' non-adherence to safe needle precautions, overtime, inadequate staffing, time pressure and rushing.

Psychological injuries were also found to be very common among the nurses. Such, in the research by Adriaenssens et al. (2012) more than one in four nurses reached clinical scores for fatigue and one out of seven Emergency nurses reached clinical levels for PTSD. The following factors were found to be associated with work-related psychological injuries among nurses: nurses' coping strategies, better-skilled nurse managers, social support, overtime, and frequent confrontations with sudden death or serious injuries. Such, Adriaenssens et al. (2012) noted that frequent confrontations with sudden death, especially of children and adolescents, were reported as the most distressing events in emergency nurses. The management also seemed to have an effect on the occurrence of psychological injuries. Such, Vecchio et al. (2011, 1074) mentioned that most injuries can be avoided and psychological distress can be reduced through prevention and early intervention strategies, and nurse managers should be aware of the signs and symptoms of prolonged psychological distress. Adriaenssens et al. (2012) has found that nurses' emotional and avoidant coping strategies were related to the occurrence of psychological job-related injuries. Fischer and Martinez (2013, 514) found a direct relationship between social support at work and work ability. Adriaenssens et al. (2012) stated that social support from colleagues and supervisor was found to reduce the occurrence of PTSD symptoms. In addition, overtime may also have a negative effect on the occurrence of psychological injuries,

since the additional time at work increases the exposure to traumatic events. According to Olds and Clarke (2010, 157), increased time at work is related to fatigue.

Several other factors seemed to also have some effect on the occurrence of injuries among nurses. Such, Perhats et al. (2012, 546) found the nurses perception of staffing in their department to be one of the three factors that were significantly related to the experience of job injuries. This finding may suggest that the rate of injuries could possibly decrease if the nurses perceived that their units were staffed to safe levels, while in reality the units were still understaffed. Then, Vecchio et al. (2010, 1073) found unmarried individuals to have a 2% higher probability of injury. Perhats et al. (2012, 545) indicated that staff training and workplace safety policies and programs help reduce the risk on work-place injuries among emergency nurses.

The findings of this research suggest that the following factors are strongly associated with both physical and psychological injuries among nurses: overtime, inadequate staffing, poor management and social support. In this research the work experience and the gender were found to have insignificant role on the occurrence of injuries.

Lastly, the result of this research suggests that the factors that contribute to the work-related injuries among nurses also contribute to the occurrence of adverse events in patients. According to Olds and Clarke (2010), overtime at work is significantly related to adverse events and errors in both patients and nurses. Likelihood of reporting medication errors had the strongest and most consistent relationships with the work hours. (Olds and Clarke 2010.) Then, better-skilled managers were associated not only with fewer injuries to staff, but also with fewer patient falls with injuries (Hanrahan, et al. 2010, 572). Therefore, the finding of this research adds to the previous statement made by Hunter et al. (2010), who mentioned that a culture of patient safety includes increasing the understanding that what is good for nurses is also good for patients.

## 8 CONCLUSION

Physical and psychological work-related injuries occur frequently among nurses. The musculoskeletal injuries were found to be the most common work-related injuries. The back and the shoulder were the most regularly injured areas of the body. Most musculoskeletal injuries were caused by patient handling activities; the manual lifting was found to be the most frequent cause of back injuries among nurses. The following factors were found to be negatively associated with the occurrence of musculoskeletal injuries: manual lifting, especially without assistance; inaccessibility to patient lifting devices; nurses' non-adherence to safe work precautions; inadequate staffing; unskilled managers; poor social support; obesity in both patients and nurses; nurses' poor fitness level; presence of health conditions in nurses and increased age of nurses.

This research also found nurses to be regularly exposed to needlestick and sharps injuries. The following factors were found to have a strong negative effect on the occurrence of such injuries: poor availability of needle safety devices, nurses' non-adherence to safe needle precautions, overtime, staffing shortages and time pressure.

The following factors were found to be associated with work-related psychological injuries: nurses' coping strategies, skills of nurse managers, social support, overtime, and frequent confrontations with sudden death or serious injuries. The marital status of nurses, nurses' perceptions of staffing in their department, staff training and workplace safety policies and programs in hospitals were other factors that were found to be associated with the occurrence of injuries. The result of this research also suggests that the factors that contribute to the work-related injuries among nurses also contribute to the occurrence of adverse events in patients.

### **Suggestions for future research**

This research included papers only published in English. Some valuable research papers could have been excluded. This research also excluded the population of mental health nurses working in psychiatric hospitals. Therefore, the future research papers could include articles published in other languages, and/or studies that apply to psychiatric settings.

The included research papers were from different countries, therefore the next research could concentrate on a certain geographical location. This would give the results specific to the certain region. Then, population of this research included endoscopy nurses, psychiatric nurses working in general hospitals, emergency nurses and general nurses. The future research could focus on the certain specialty of nurses.

This research indicated that the gender has some effect on the occurrence of injuries; however the authors seemed to disagree if a male or female gender was negatively associated with the occurrence of musculoskeletal injuries. Vecchio et al. (2011) guessed that the men nurses are more vulnerable to injuries since they are more exposed to physically demanding jobs. Future research could try to connect the gender, exposure to patient lifting and the occurrence of injuries.

This research indicated that the nurses' perception of inadequate staffing and the inadequate staffing itself contribute to the occurrence of all types of work-related injuries. This finding may suggest that the rate of injuries could possibly decrease if nurses perceived that their units were staffed to safe levels, while in reality the units were still understaffed. Next research could focus on indicating the optimal staffing levels to minimize the injuries.

Lastly, future research could include papers published after the search date of this research. This review found the nursing population to be ageing, and the increased age to be negatively associated with the occurrence of work-related injuries. The shortage of nurses was found to be growing worldwide. These findings may suggest that the amount of work-related injuries could increase in the future. Future research may also focus on the prevention of injuries among nurses.



## REFERENCES

- Adriaenssens, J., Gucht, V. & Maes, S. 2012. The impact of traumatic events on emergency room nurses: Findings from a questionnaire survey. *International Journal of nursing studies* Vol.49, 1411-1422.
- Australian Bureau of Statistics 2008. *Work-Related Injuries*, Consulted 10.10.2014  
<http://www.abs.gov.au/AUSSTATS/abs@.nsf/7d12b0f6763c78caca257061001cc588/9e37df09e753eff8ca2573d20010f43b!OpenDocument>.
- Beltrami, E. et al. 2000. Risk and Management of Blood-Borne Infections in Health Care Workers. *Clinical Microbiology Review*. Vol. 13 (3), 385-407.
- Better Health Channel 2012. *Work-related stress*. Consulted 10.10.2014  
[http://www.betterhealth.vic.gov.au/bhcv2/bhcarticles.nsf/pages/Work-related\\_stress](http://www.betterhealth.vic.gov.au/bhcv2/bhcarticles.nsf/pages/Work-related_stress).
- Buerhaus, P. et al. 2007. Impact Of The Nurse Shortage On Hospital Patient Care: Comparative Perspectives. *Health Affairs*. Vol. 26, No. 3, 853-862.
- Deloras, J. 2005. California nurse leaders address the State's nurse shortage. *Nurse Leader*. Vol.3 (1), 46-49.
- Drysdale, S. 2011. The Incidence of Upper Extremity Injuries in Endoscopy Nurses. *Gastroenterology Nursing*. Vol.34 No.1, 26-33.
- Fischer, F. & Martinez, M. 2013. Individual features, working conditions and work injuries are associated with work ability among nursing professionals. *Work: a Journal of Prevention, Assessment and Rehabilitation*. Vol. 45, No. 4, 509-517.
- Foley, M. & Leyden, A. American Nurses Association – Independent Study Module Needlestick Safety and Prevention. Consulted 30.10.2014  
[http://www.who.int/occupational\\_health/activities/1anaism.pdf](http://www.who.int/occupational_health/activities/1anaism.pdf)
- Galougahi, M.H. 2010. Evaluation of needle stick injuries among nurses of Khanevadeh Hospital in Tehran. *Iranian Journal of Nursing and Midwifery Research*. Vol. 15 (4), 172-177.
- Gao, Y.Q. et al. 2011. Depressive symptoms among Chinese nurses: prevalence and the associated factors. *Journal of Advanced Nursing*. Vol. 68 (5), 1166-1175.
- Gao, Y.Q. et al. 2012. Anxiety Symptoms among Chinese nurses and the associated factors: a cross-sectional study. *BMC Psychiatry*. Vol. 12, No. 1, 141.
- Hanrahan, N., Kumar, A. & Aiken, L. 2010. Adverse Events Associated With Organizational Factors of General Hospital Inpatient Psychiatric Care Environments. *Psychiatric services*. Vol. 61, No.6, 569-574.
- Hofmann, F. et al. 2002. Needle stick injuries in healthcare – frequency, causes and preventive strategies. *German Journal for Quality in Health Care*. Vol. 64 (5), 259-256.
- Hunter, B. 2010. Saving Costs, Saving Health Care Providers' Backs, and Creating a Safe Patient Environment. *Nursing Economic\$*. Vol. 28 (2), 130.
- Letvak, S. et al. 2012. Depression in hospital-employed nurses. *Clinical Nurse Specialist*. Vol. 26, No.3, 177-182.

- Mark, B. et al. 2007. Does safety climate moderate the influence of staffing adequacy and work conditions on nurse injuries? *Journal of Safety Research* Vol.38, 431-446.
- Marta M, et al. 2010. STROBE Initiative: guidelines on reporting observational studies. *Revista de Saude Publica*, Vol. 44 (3). Consulted 06.11.2014  
<http://www.revistas.usp.br/rsp/article/viewFile/32803/35315>
- Michie, S. & Williams, S. 2003. Reducing work related psychological ill health and sickness absence: a systematic literature review. *Occupational and environmental medicine*. Vol. 60, No. 1, 3-9.
- Moher, D.; Liberati, A.; Tetzlaff, J.; & Altman, D. 2009. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *PLoS Med* 6(6): e1000097. doi10.1371/journal.pmed1000097
- Nelson, A. et al. 2006. Development and evaluation of a multifaceted ergonomics program to prevent injuries associated with patient handling tasks. *International Journal of Nursing Studies*. Vol. 43, 717–733.
- Olds, D. & Clarke, S. 2010. The effect of work hours on adverse events and errors in health care. *Journal of safety research*. Vol. 41, 153-162.
- Onciul, J. 1996. ABC of work related disorders. Stress at work. *BMJ Journal*, Vol. 313, 745-748.
- Ono, Y. et al. 1995. Reports of work related musculoskeletal injury among home care service workers compared with nursery school workers and the general population of employed women in Sweden. *Occupational and Environmental Medicine*, Vol. 52, 686-693.
- Orly, S. et al. 2012. Are cognitive-behavioral interventions effective in reducing occupational stress among nurses? *Applied Nursing Research*, Vol. 25 (3), 152-157.
- Parahoo, K. 2006. *Nursing research: Principles, Process and Issues*. Second edition. England. Palgrave Macmillan.
- Perhats, C. et al. 2012. Non-violence-related workplace injuries among emergency nurses in the United States: Implications for improving safe practice, safe care. *Journal of emergency nursing*, Vol. 38 (6), 541-548.
- Pettus-Davis, C. et al 2011. A Practitioner's Guide to Sampling in the Age of Evidence-Based Practice: Translation of Research into Practice. *Clinical Social Work Journal*, Vol. 39, 379-389.
- Ray, V. & Subich, L. 1998. Staff assaults and injuries in a psychiatric hospital as a function of three attitudinal variables. *Issues in mental health nursing*, Vol. 19, 277-289.
- Roche, M & Duffield, C. 2010. A comparison of the nursing practice environment in mental health and medical-surgical settings. *Journal of Nursing Scholarship*. Vol. 42 (2), 195-206.
- Safe Work Australia 2014. Worker's Compensation Legislation and Psychological Injury Fact Sheet. Consulted 09.10.2014  
<http://www.safeworkaustralia.gov.au/sites/swa/about/publications/pages/wc-legislation-psychological-injury>
- Stathopoulou, H. et al. 2011. Anxiety Levels and Related Symptoms in Emergency Nursing Personnel in Greece. *Journal of Emergency Nursing*, Vol. 37 (4), 314-320.
- United States Department of Labor #1 2012 Bureau of Labor Statistics. Occupational Safety & Health Definitions. Injuries, Illnesses and Fatalities. Consulted 08.10.2014  
<http://www.bls.gov/iif/oshdef.htm>

United States Department of Labor #2 2013. Bureau of Labor Statistics. Employer-Reported Workplace Injuries and Illnesses-2012. Consulted 09.10.2014  
[http://www.bls.gov/news.release/archives/osh\\_11072013.pdf](http://www.bls.gov/news.release/archives/osh_11072013.pdf)

United States Department of Labor #3 2013. Occupational Safety & Health Administration. Consulted 09.10.2014  
<https://www.osha.gov/dsg/hospitals/>

Vandenbroucke, J.; Elm, E, Altman, D.; Gotzsche, P.; Mulrow, C. et al. 2007. Strengthening the Reporting of Observational Studies in Epidemiology (STROBE): Explanation and Elaboration. PLoS Med 4 (10): e297.doi:10.1371/journal.pmed.0040297

Vecchio, N. et al. 2011. Work-related injury in the nursing profession: an investigation of modifiable factors. Journal of advanced nursing. Vol. 67 (5), 1067-1078.

WHO 2009. Systematic Reviews in Health Policy and Systems Research. Alliance for Health Policy and Systems Research. Consulted 06.11.2014  
[http://www.who.int/alliance-hpsr/resources/AllianceHPSR\\_Brief\\_Note4\\_ENG.pdf](http://www.who.int/alliance-hpsr/resources/AllianceHPSR_Brief_Note4_ENG.pdf)

WHO 2010. Wanted 2,4 million nurses, and that's just in India. Bulletin of the Health World Organization. Past Issues. Vol. 88, No.5, 321-400. Consulted 15.10.2014  
<http://www.who.int/bulletin/volumes/88/5/10-020510/en/>

Yoon, S. & Kim, J.H. 2013. Job-related Stress, Emotional Labor, and Depressive Symptoms Among Korean Nurses. Journal of Nursing Scholarship. Vol. 45 (2), 169-176.