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Nursing students' knowledge and practices related to sharp object injury and management at a university in the Western Cape Province

Research

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Declaration

I declare that content of this research entitled **"Nursing students' knowledge and practices related to sharp object injury and management at a university in the Western Cape Province"** is my own work, that it has not been submitted for any degree or examination in any other university, and that all the sources I have used or quoted have been indicated and acknowledged by complete references. Furthermore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology.

Full name: Ramadan Khalifa Amer **Date:** 08 November 2019

Signed: 

Dedication

This hard work

is dedicated

to my family,

my supervisors,

nursing students

and friends

who are behind me all the time

until the completion of my work.

The Researcher

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Abstract

Background: Like other health care providers, nursing students are unprotected from occupational dangers such as sharp object injuries (SOIs) due to imperfect knowledge and experience. These students face a great risk of exposure to blood borne infections by pathogens such as HIV and the hepatitis B and C viruses while executing their clinical actions in hospitals. SOIs are a significant problem for nursing students, as they increase the risk of contracting blood-borne infections.

Purpose: The purpose of this study was to determine nursing students' knowledge and practices related to SOIs and their management at a university in the Western Cape Province.

Objectives: The objectives of this study include determining the occurrence of SOIs, and knowledge of risk of SOIs, as well as the reporting and management of SOIs at a university in the Western Cape.

Method and sample: A cross-sectional descriptive survey was conducted with nursing students from the second to fourth year of study, registered at a university in the Western Cape Province for the 2017 academic year. Quota sampling was applied to select respondents who, after providing informed consent, then completed and handed the self- administered questionnaires back to the researcher on the same day that they were distributed. Data were obtained from nursing students about whether or not they had experienced an SOI, what they did after the SOI, their perception of the risk, and management of and preventive measures for SOIs. Validity and reliability were ensured, and all ethical principles were adhered to. SPSS was used for the quantitative data analysis.

Results: A total of 252 nursing students from the second to fourth years participated in this study. The average age of respondents was 24 years, with a minimum of 19 and maximum of 46 years; 211 (83.7%) of them were females. During their course 63 (25%) respondents experienced SOIs; only 42 (66.67%; N=63) of them reported the occurrence of an SOI, most (25 or 59.52%) reporting it to the professional nurse in charge. The highest occurrence of SOIs was reported by fourth-year students (26 respondents, 41.3%). It was found that 21 (33.3%) of SOIs were not reported, and the main reason for this was because there was little or no perception of associated risk (15, 71.43%). Forty-six (73.02%) respondents experienced a single SOI, while 11 (17.46%) had two SOIs, 4 (6.35%) reported having had three SOIs, and one each (1.59%) had more than four and more than ten SOIs. The activity causing most of the SOIs was administration of medication by injection (48 cases, 76.2%), and in most cases (57, 90.47%) the instruments causing injury were needles or hollow-bore needles. Most of the affected respondents squeezed the puncture site after the SOI (42, 66.7%), followed by washing the area with water and soap (40; 63.5%), and cleaning the site with antiseptic (15,

23.8%). Among those students exposed to SOIs, only 22 (52.4%) had undergone blood tests, and very few of them took post-exposure prophylaxis or treatment (16, 25.40%). The emotion that most of them felt after the SOI was fear (42, 66.7%), and the main reason for not getting treatment was fear of side effects (18, 38.29%). Also, only 61 (24.2%) respondents reported recapping needles after use, while most reported incomplete vaccination against hepatitis B (195, 77.38%). The main reason for not using personal protective equipment (PPE) was noted as the unavailability thereof at the institution (43, 49.4%).

Conclusion: This study documented a low rate of reporting SOIs among nursing students. It is plain that there are inadequate levels of knowledge and practice related to SOI management among these students at a university in the Western Cape. One would imagine that because the majority of nursing students had a measure for the practice of universal precautions and used PPE, their management after exposure to SOIs during work training in hospital would be efficient. This was not the instance in this study, where application of these actions in their practical training was poor.

Key words: nursing student, sharp object injuries, clinical skill, management, risk, survey, nursing

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Definition of concepts

- **Clinical skills:** Practical tasks that are learnt and practised during training to develop competency. These skills are used in clinical settings on patients and clients.
- **Management of sharp object injuries (SOIs):** Activities undertaken after experiencing an SOI and the prescribed manner in which to deal with SOIs.
- **Sharp object injuries (SOIs):** Percutaneous injuries to the body of an HCW during the carrying out of his or her duties in clinical practice, caused by hollow bore or sharp instruments, including but not limited to needles, suturing needles, scalpels, lancets and contaminated broken glass (Kurşun, 2014; Centers for Disease Control and Prevention, 2008).
- **Risk:** Exposure of HCWs to transmission of blood borne infections (HIV, hepatitis B and hepatitis C) via SOIs that could happen (Mohohammadnejad & Dopolani, 2015: 34).
- **Needle or hollow-bore needle:** Sharp instruments with a smooth surface with a light silicone covering designed to minimize discomfort, colour-coded hubs for identification, a wide range of diameters and lengths, and gauges from 18G to 27G, with ultra-sharp, tri-bevelled stainless-steel tips designed to result in minimal pain (e.g. suture needle) (De Castillo & Werner-McCullough, 2016: 188–189; Goswami et al., 2011: 398; Niir Project Consultancy Services Board of Consultants and Engineers, 2014: 224–225).
- **Nursing student:** A person registered in an accredited nursing programme being prepared to become a future competent registered nurse and is also registered with South African Nursing Council as a learner nurse (Mahlanze & Sibiya, 2017: 80).

List of acronyms and abbreviations

BBPs	Blood-borne pathogens
CDC	Centers for Disease Control and Prevention
HBV	Hepatitis B virus
HCV	Hepatitis C virus
HCWs	Health care workers
HIV	Human immunodeficiency virus
IV	Intravenous
NIOSH	National Institute for Occupational Safety and Health
NSIs	Needle-stick injuries
OSHA	Occupational Safety and Health Administration
PEP	Post-exposure prophylaxis
PN	Professional Nurse
PPE	Personal protective equipment
SANC	South African Nursing Council
SOIs	Sharp object injuries
WHO	World Health Organization

CHAPTER 1: ORIENTATION TO THE STUDY

1.1 Introduction

As part of clinical learning, nursing students spend time providing nursing care in health care institutions. This includes performing a number of invasive and non-invasive procedures. Like other health care workers (HCWs), nursing students are at risk of sharp object injuries (SOIs) (Zungu et al., 2008: 48). There is a danger of spread of blood borne infectious diseases, such as hepatitis B virus (HBV) and hepatitis C virus (HCV) and human immunodeficiency virus (HIV), that are transmitted via body fluids, especially in hospitals and for those who deal with sharp objects, such as nursing students (Singh et al., 2015: 231). It is therefore necessary to carry out studies that assist in improving the understanding of the occurrence of such injuries during clinical training among nursing students, in addition to prevention, reporting trends, management as well as knowledge related to these injuries. This research study assessed nursing students' knowledge of their risk of SOIs, the occurrence of SOIs among nursing students, the reporting trends in cases of SOIs in actual practice after an SOI incident, and nursing students' use of prevention measures for SOIs, as well as their knowledge and management practices after SOIs at a university in the Western Cape.

1.2 Background

The acquisition of new clinical skills is one of many learning outcomes in the training of nurses, allowing nursing students to become competent in various nursing skills, which include using needles and syringes for administration of injectable medications to patients. Initially nursing students perform non-invasive actions such as washing and feeding patients, followed by invasive actions such as measuring blood sugar, and perform progressively more invasive actions, such as blood tests, suturing and giving intramuscular doses, through the final-year programme (Naidoo, 2010: 1). With the advent of simulation as a teaching and learning approach, many nursing schools have planned their education and training in such a way that the nursing students are able to practice these events in the skills lab at the school, before carrying them out on live patients in the real-world setting (Naidoo, 2010: 1). The skills laboratory provides a safe environment where the students are able to practice on real-life simulated patients or models (Jeffries et al., 2016: 304). The clinical procedures that need to be mastered may be practised repeatedly in the simulated setting until the students master the procedures (Naidoo, 2010: 2; Jeffries et al., 2016: 304). This allows the students to make mistakes, and encourages learning from these mistakes. Workable skills can be developed in an orderly and supported way, which can be hard to achieve in the active environment in which clinical practicals are completed.

The inclusion of students in an actual setting with actual patients may magnify the risk of sustaining SOIs, particularly when the students, who are still novices, are still inexpert and unskilled (Naidoo, 2010: 1–2). Nursing students in training are no exception to risks of exposure, and risk being unintentionally exposed to needle stick injury and contamination during their hospital activities (Zungu et al., 2008: 48). SOIs are the most common route of transmission of blood borne infections from patients to HCWs including students during the clinical learning period (Zungu et al., 2008: 48). Globally for nurses, SOIs such as needle-stick injuries are the primary cause of transmission of infection, and the most common source of occupational exposure to blood borne pathogens (BBPs) (Gupta et al., 2015: 17).

SOIs are defined as a cut or hole made with a needle or sharp instrument, which can be contaminated with blood or other body fluids (Wicker, Nürnberger et al., 2008: 743; Ghasemzadeh et al., 2015: 320). According to the United States National Institute for Occupational Safety and Health (NIOSH), needlestick injuries or wounds are caused by needles such as hollow-bore needle and suture needles, blood collection needles and intravenous (IV) needles, as well as cannulas used to join parts of an IV delivery system (Gupta et al., 2015: 17; Galougahi, 2010: 172). Nurses are in much more regular contact with patients than medical doctors, and are usually the first to notice problems or to alert the doctor to concerns about a patient's progress. They thus have a major role to play in the health care delivery system (Rhule, 2012: 7–8). A recent increase in the prevalence of diseases, accidents and health problems connected to occupation among health care workers (HCWs) has made hospital administrators interested in employee safety and health (Ikinci, 2015: 2). This has created awareness of more sensitive approaches to improve employees' health and prevent diseases (Ikinci, 2015: 2).

In the nursing profession, the types of health risks encountered are diverse. Some have existed since the birth of the nursing industry, such as exposure to SOIs and body fluids, but due attention has only recently been accorded to them (Rhule, 2012: 8). From the position of the health sector, occupational risks which staff face and employee safety are extremely topical, and the health sector includes greater risks than to many other sectors (Ikinci, 2015: 1). Major occupational risk factors are classified as biological, physical, biochemical and psychosocial. These risk factors have led to a new increase in occupational diseases, work accidents, and health complications (Ikinci, 2015: 2). Subsequently, nurses in hospitals have a high rate of SOIs, and have a clinically significant risk of potential transmission of blood-borne viruses, exposure to other body fluids, physical injury, psychological effects and associated costs (Kable et al., 2011: 246). Hospital nurses are known to work in psychologically and physically hard environments, which may lead to depression or depressive symptoms after exposure to SOIs (Gao et al., 2011: 1166).

1.2.1 Jobs related to SOIs

This section will discuss conditions in the workplace that could lead to wounds or injury to the body subsequent to an SOI. This section will present information on physical working conditions and SOIs; as well as SOIs and psychological wellbeing.

1.2.1.1 Physical working conditions and SOIs

Those in the occupation of nursing routinely perform in risk-prone working conditions, with physical tasks that may lead to SOIs (Pik, 2014: 7). Moreover, HCWs are at danger of SOIs such as needle injuries while performing their routine tasks, and this is known to be a work-related health hazard (Dhaini, 2016: 19). Elstad and Vabø (2008: 468) state that physical work or disorders that are related to work designs include: immovable or controlled body placement, constant repetition of movements, strength concentrated on small parts/portions of the body, such as the hand, and high work volume that does not allow enough recovery time.. Additionally, workplace psychosocial factors such as structural culture, the health and safety environment and human factors may create conditions for physical work (heavy or hard work) that may expose HCWs and nurses to SOIs (Health and Safety Executive, 2016: 2).

Physical disturbance includes conditions where injuries could be pinched nerves; sprains, pain, swelling, and numbness; or musculoskeletal disorders, while the events or exposure that may lead to SOIs in HCWs and nurses are overexertion and bodily reaction, such as repetitive motions during work or training that involve micro-tasks such as administering medications by injection, drawing blood or stitching wounds (Pik, 2014: 7). HCWs have different physical responsibilities that are strenuous, such as lifting, positioning and moving of patients, and working in difficult positions; this can place them at risk of SOIs (Dhaini, 2016: 17). Further to bodily tension and injuries, nurses are at risk of intellectual health problems, such as stress and symptoms of anxiety after experiencing SOIs (Elstad & Vabø, 2008: 468; Dhaini, 2016: 17).

1.2.1.2 SOIs and psychological wellbeing

Nursing has been recognized as a job associated with high levels of anxiety, especially for nurses who have been exposed to an SOI (Gholamzadeh et al., 2011: 41). Pik (2014: 8) further stated that HCWs are likely to experience stress as part of their vocation, and that nursing is considered a particularly stressful and challenging job. Work-related stress increases where work demands surpass the person's ability to manage numerous types of sharp objects and the mixture of body fluids. HCWs are a primary constituent of the health care system staff, and thus nurses' task performance exerts effects on the general quality of patient care (Gao et al., 2011: 1167). HCWs can be exposed to a psychological disorder after an SOI, which include

complaints such as depression, anxiety or post-traumatic stress (Pik, 2014: 8). Psychological and physical disorders in the nursing work situation may cause depressive symptoms.

Depression is a common intellectual complaint categorized by loss and sadness, loss of attention and vigour, reduced energy, ideations of demise and suicide, reduced appetite, sleep loss, and sometimes somatic symptoms, especially after an SOI (Gao et al., 2011: 1167). The signs or symptoms of the work-related stress can be physical, psychological and behavioural, especially when handling sharp objects such as needles, scalpels and scissors (Vecchio et al., 2011: 1068; Gao et al., 2011: 1157; Pik, 2014: 8). In a study on the psychological effects of SOIs, Green and Griffiths (2013) established that the severity of disease resulting from needlestick injuries is as important as other psychological disturbances. Moreover, fear subsequent upon this status is like other psychological disturbances, and the period of the disturbance is related to the wait until getting the results of the viral blood investigation. This has an intense influence on relations with other people and attendance at work (Green & Griffiths, 2013: 183). Investigators have stated that stress in nurses is due to the fear of exposure to infectious diseases and SOIs (Adib-Hajbaghery & Lotfi, 2013: 75). In addition, HCWs may suffer anxiety because of injury with a possibly unclean sharp object, which is a stressful incident (Elseviers et al., 2014: 2; Prüss-Üstün et al., 2005: 1).

SOIs impact HCWs; while this effect is hard to calculate, it influences the psychological health of HCWs (Saia et al., 2010: 41; Elseviers et al., 2014: 2). For instance, Lee et al. (2005: 741) reported that 60% of nurses characterized a greater fear of needles and 42% feel anxious or depressed after SOIs. A study at the University of Antwerp, Belgium, showed that exposure to HIV leads to acute and severe distress, resulting in many nurses leaving their job, especially after contact with the patient (Elseviers et al., 2014: 2). Also, posttraumatic stress has also been noted in nurses who experienced a needlestick injury whilst caring for a patient living with HIV (Elseviers et al., 2014: 2). Current legislation in the European Union does not include provision for reparations for mental hardship. According to existing guidelines, there are no grounds for recompense for inconvenience, although occupational disease may cause emotional harm, which results in nurses leaving their work (Vuoriluoto, 2009: 18).

1.2.2 Factors that contribute to work-related injuries

Five points of major risk factors for occupational injuries, especially SOIs, were found in the literature, namely heavy workloads, aging nurses, obesity, work setting, and work schedules (Perhats et al., 2012: 542; Pik, 2014: 13). One thing to note in the findings of the study by Drysdale (2013: 26), is that working full time was proposed as an important predictor of increased SOIs. Additionally, nonstandard work schedules also lead to an increased risk of SOIs among nursing staff (Pik, 2014: 12–13; Perhats et al., 2012: 542). Furthermore, working shifts longer than 12 hours has also been associated with needlestick risk in hospital staff

(Drysdale, 2013: 26). Age also has been noted to have a negative effect on the occurrence of job related injuries among nurses (Old & Clarke, 2010: 154). The older nurses in the workplace seem to be at higher risk for musculoskeletal injuries and slips, trips, falls, and more exposure to SOIs and body fluids (Pik, 2014: 13). As noted by Drysdale (2013: 28), Perhats et al. (2012: 542) and Pik (2014: 13), obesity among nurses also increases the risk of SOIs. Physical activity during rest time might be an important factor in reducing the incidence of SOIs in all HCWs, as it will not only contribute to the reduction of obesity, but also to enhanced wellbeing and reduction of stress (Drysdale, 2013: 28).

The work situation appears to influence the safety of nurses in several ways. For instance, the safety of both nurses and patients is impacted by whether the workplace environment is full or messy (Drysdale, 2013: 27; Pik, 2014: 13). Adriaenssens et al. (2012: 1412) stated that absence of public support and poor team relationships have been found to be related to higher levels of fatigue, anxiety and posttraumatic stress; this applies especially among nurses, after exposure to SOIs. Drysdale (2013: 28) added that a low level of support from colleagues was one of the factors related to exposure to SOIs. As noted by Mealer et al. (2007: 693), repetitive exposure to important stressors and the inability to cope successfully with the traumatic experience may result in the development of psychological disorders associated with SOI. Prolonged work pressure may also lead to SOIs and effectively compromise the value and safety of nursing care (Pik, 2014: 12).

Working extra hours is often used in health care locations to meet demand due to lack of staff and patient flow. With a documented lack of nurses and HCWs, working extra time has been a major tool used by the administration to meet patient requirements (Old & Clarke, 2010: 154). However, Old and Clarke (2010: 159) recommended that increased periods at work may have a negative impact for patient care and nurses' occupational health, while a relationship was found between work hours and nurses' reports of infrequent and frequent SOIs. Nurses employed more than 40 hours per week have an increased probability of adverse events and mistakes in health care, which may also lead to SOIs (Old & Clarke, 2010: 157; Pik, 2014: 12). The job often requires nurses to work longer than normal work days, and typically needs on-call facilities; with repeated contact with the challenges of the work comes the possibility of bodily injury, such as exposure to SOIs (Drysdale, 2013: 329). Inadequate staffing and a high work pace could make HCWs fatigued in body and mind, and studies indicate that higher workload is a high risk factor for SOI, especially when combined with low work control (Elstad & Vabø, 2008: 467).

SOIs are common and increasing in frequency throughout all healthcare settings, and some of them are not reported (Thomas & Murray, 2009: 12). In a study in 2008 among German medical students, 58.8% stated that they had at least one occurrence of an SOI during their

studies, with 37.2% reporting being injured more than once (Wicker, Nürnberger et al., 2008: 743). Another study was conducted among 198 nursing students in Namibia (Small et al., 2011: 1), and showed that 17% of the students participating in the study had an incident of SOI, but only 55% of these reported the occurrence. Similarly, as noted by Smith and Leggat (2005: 449), in nursing students over a 12month period in Japan, 13.9% reported SOIs. A study conducted on medical interns in South Africa showed that 55% of them had at least one incident of exposure to blood or body fluids, and 70% reported exposure to SOIs (Karani & Rangiah, 2011: 462). Kumakech et al. (2011: 454) noted that in 224 HCW participants at Mbarara Hospital, Uganda, 19.2% reported having sustained injection needle-stick injuries, of which 4.46% occurred with HIV-infected blood.

Published reports on incidences of SOIs in HCWs and students may be taken lightly, and this could be because their actual occurrence is not reported on time or not accurately reported (Wicker, Nürnberger et al., 2008: 742). In a study conducted on 219 registered nurses in Pakistan, 67% sustained an SOI during work and 99% of nurses did not report these, because of the no-reporting system in the hospital (Habib et al., 2011: 124). Different reasons have been given for the non-reporting of SOI incidents. As noted by Wicker, Nürnberger et al. (2008: 743–744), in a study of medical students in Germany the main reasons for not reporting an SOI were shame (54%), patient not posing an infection threat (33.6%), no perception of risk (24.8%), they were too busy (7%), and other reasons (3.5%). Furthermore, Seng et al. (2013: 498) noted that 27.3% of medical students in Singapore would not report SOIs, especially if they thought the injury was caused by a clean needle. A study conducted on nursing students in the Ivory Coast showed the main reasons for not reporting SOIs to be that they knew the reporting procedure but were ignorant to reporting the incidence of SOIs (49.3%), a feeling of responsibility (26.1%), not having knowledge about the reporting procedure (11.6%), and no time or lack of time (1.4%) (Kra et al., 2015: 45–46).

Although numerous pathogens can be transmitted via SOIs, the most common and risky of these are HBV, HCV, and HIV (Karadağ, 2010: 129). As noted by Elliott et al. (2005: 374), worldwide HCWs are exposed annually through occupational exposure to BBPs, which caused about 2.6% of HCV, 5.9% of HBV and 0.5% of HIV infections. Overall, this equates to approximately 16 000 HCV infections, 66 000 HBV infections and 1000 HIV infections which may have happened worldwide in the year 2000 (Prüss-Üstün et al., 2005: 482).

1.2.3 Most common causes of SOIs

The literature has documented that the most common causes of SOIs are varied, and they include injuries by needles when administering medication, as reported by 20% to 42% of participants in different studies (Afridi et al., 2013: 85; Smith & Leggat, 2005: 451; Zungu et al., 2008: 48), and recapping needles, as reported by 14% to 56% of various participants such

as nursing and medical students (Afridi et al., 2013: 85; Kable et al., 2011: 250; Zungu et al., 2008: 48; Shiao et al., 2002: 198). Other activities include opening caps of needles, opening ampoules, disposal of needles and used sharp objects, and during blood transfusion (Shiao et al., 2002: 198; Zungu et al., 2008: 48; Kable et al., 2011: 250; Smith & Leggat, 2005: 451; Afridi et al., 2013: 85). Unsafe activities like handling of unclean sharps such as needles, reuse of unsuitable sterilized needles, and inappropriate discarding of waste can increase the potential risk of blood- borne infection (Lemessa, 2014: 6).

1.3 Problem statement

SOIs including needle-stick injuries are a big problem worldwide, and their occurrence has remained high (Lee & Ismail, 2005: 33; Elseviers et al., 2014: 152; Pik, 2014: 9; Jaber, 2011: 8). In the USA, the Centers for Disease Control and Prevention (CDC) estimates that 600 000 to 1 million such injuries occur annually (Lee & Ismail, 2005: 33; CDC, 2008; Patrick et al., 2009: 7). The literature study detected that a large number of quantitative studies have been carried out on the topic worldwide; however, these studies considered at most the factors relating to the occurrence of SOIs globally, which were knowledge of risk, and management and prevention. In a study in three Western African countries, needle-stick injuries accounted for 80% of all accidental blood exposure (Tarantola et al., 2005: 276). Also, in South Africa about 69% of intern doctors reported at least one needle-stick injury (Karstaedt & Pantanowitz, 2001: 57), and about 26% of emergency medical staff in a Johannesburg hospital reported incident of NSI (McDowall & Laher, 2019). Nurses are equally exposed to SOIs, and the literature documents about 57% reporting at least one needlestick injury in sub-Saharan Africa (Nsubuga & Jaakkola, 2005: 775–776). Similarly, a study in India documented that 39.76% of nursing students had skilled a needlestick injury (Prasuna et al., 2015: 430). Many of these injuries go unreported (Patrick et al., 2009: 8; Lee & Ismail, 2005: 33). Many reasons are stated in the literature as to why HCWs do not report such injuries, and these include the injured person/s thinking that the injury was due to a clean needle and had a low risk of any disease transmission to themselves; not knowing the proper reporting procedure; no time for reporting; concerns about privacy; and not thinking it was important to report it (Williams, 2005: 35; Seng et al., 2013: 498).

As noted by the World Health Organization (WHO) (2003), the risk of diseases following injury with a needle from a sick patient is 0.3% for HIV, 30% for HBV, and 3% for HCV. Venter and Committee (2008: 37) noted that there is limited information on SOIs in the Southern African region. Furthermore, there is a loss of information related to nursing students' knowledge of their risk for SOIs and the practices in managing such injuries in the Western Cape. Considering the high amount of people living with HIV in South Africa and the considerable occurrence of SOIs in Southern Africa (Du Toit et al., 2009: 128), there is a need to establish

knowledge of SOIs, and the risk for and management of SOIs by nursing students in the Western Cape. In addition, little is known about the occurrence of SOIs and reporting trends of nursing students at the specific university used as a setting in this study.

1.4 Purpose of the study

The purpose of this study was to determine nursing students' knowledge and practices related to SOIs and their management at a university in the Western Cape Province in South Africa.

1.5 Objectives of the study

- To determine nursing students' knowledge of risk of SOIs at a university in the Western Cape.
- To determine nursing students' use of prevention measures before incidents of SOIs at a university in the Western Cape.
- To determine the occurrence of SOIs among nursing students at a university in the Western Cape.
- To determine the reporting trends in cases of SOIs in actual practice after an incident for nursing students at a university in the Western Cape.
- To determine nursing students' awareness of management practices after SOIs at a university in the Western Cape.

1.6 Research questions

- What is the knowledge of nursing students related to their risk of SOIs at a university in the Western Cape?
- What are the prevention measures applied by nursing students to prevent SOIs at a university in the Western Cape?
- What is the occurrence of SOIs among nursing students at a university in the Western Cape?
- What are the reporting trends in cases of SOIs in actual practice after an incident for nursing students at a university in the Western Cape?
- What is the nursing students' awareness of the management practices after SOIs at a university in the Western Cape?

1.7 Significance of the study

Exposure to BBPs via SOIs such as needle-stick injuries is a serious occupational care problem. Although the risk of transmission of infectious disease (HIV, HBV, and HCV) is statistically small (Logan, 2002: 10), it can have devastating impact. Therefore, obligatory agreement with standard and transmission based defences was planned to prevent transmission of infectious disease, irrespective of the patient's known or suspected condition

(Logan, 2002: 10). Nursing students have a high rate of documented SOIs, as referred to in the literature reviewed, such as when recapping used needles and the dangerous collection and disposal of used sharps waste, yet do not always observe safety instructions (Logan, 2002: 10). Identification of the occurrences of SOIs and reporting trends in student nurses as well as their knowledge risk, management and prevention of SOIs have the potential to assist in the identification of gaps in their training as well as in their practice as nurses that need to be dealt with.

1.8 Structural overview of the thesis

The final thesis is presented in five chapters, as follows:

Chapter 1: Orientation to the study

In this section, the research discussed the orientation to the study that includes the introduction, background, problem statement, purpose of the study, objectives, and research questions, as well as the significance of the study.

Chapter 2: Literature review

This section includes an extensive literature review of pertinent literature, discussing the issues that relate to nursing students' perception of SOI risk and management, including the global incidence of SOIs, causes of SOIs worldwide, economic costs of work-related SOIs among HCW, effects of SOIs on the HCWs, risk for transmission of BBPs through SOIs, and prevention and management of SOIs. In addition, the framework that guided the study is presented.

Chapter 3: Research methodology

In this section, the researcher presents the methodology of quantitative study and how the researcher went about applying this, including the research approach, design, setting, population, sampling and sample size, data collection, instrument and process, data analysis, academic rigour and measures used to ensure validity and reliability, as well as ethical considerations. The study limitations are also discussed in this chapter.

Chapter 4: Results

This section presents a discussion of the findings from the data analysis, providing the relevant information to answer the research questions.

Chapter 5: Discussion

In this section, the researcher presents a discussion of the findings.

Chapter 6: Conclusions and recommendations

Here the researcher describes the conclusions of the study and recommendations based on its findings.

Appendices are added at the end of the report to present some the important documents, such as the data collection instrument and ethical clearance certificate.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter will discuss the literature related to SOIs and relevant issues investigated in this study. The aim of a literature review is to examine whether similar research studies have been done, and how this study fits into or complements the present literature (Maree, 2016: 28). In the review of the literature, the researcher performed a broad primary search through the online library services at the university. The databases consulted in conducting this literature review include EbscoHost, PubMed and Google Scholar, Mendeley and ResearchGate. The literature search included a number of keywords, such as 'needlestick injur*', 'sharp object injur*', 'health care provider", 'nurse' and 'survey'. This section will present literature related to the causes of SOIs and their risk of conducting blood borne infections. Knowledge and incidence and reporting of SOIs will also be presented in this chapter, as will the effects, prevention and management of SOIs.

2.2 Causes of SOIs worldwide

Sharp object injuries are the main source of trauma related to touching and dealing with patients (Gabriel, 2009: 41). The two most prevalent causes of SOIs worldwide are recapping of used needle and the dangerous collection and discarding of used sharps waste (WHO, 2003; Afridi et al., 2013: 85; Swe et al., 2014b: 121). The major activities causing SOIs are blood sampling, discarding of needles, handling waste, administering injections, handling dirty linen, and while transferring blood to the specimen container (Galougahi, 2010: 173; Norsayani & Hassim, 2003: 174). In a study conducted with 289 junior doctors in a regional Institute of Medical Sciences, Lamphelpat, Imphal, Manipur, India, most SOIs took place while withdrawing blood (33.3%), giving injection medications (16.6%), and suturing (27.3%) (Praveen et al., 2013: 152). As noted by Jahan (2005: 234), the most common cause of SOIs in hospital in Saudi Arabia during the 2-year period 2002 to 2003 were collision and recapping the needle, with 53.4% of SOIs occurring after a clinical procedure but before disposal of the sharp object. Work accidents happened not only due to the management of materials, such as needles and other sharp objects that have been in contact with blood or body fluids, but also due to sudden or unexpected movements by the patient during shots or a temporary lack of attention. However, even HCWs who may have performed the process many times may make one mistake which can cause an injury with a possibly serious outcome (Kebede et al., 2012: 1096; Alter, 2002: S95; Ciorlia & Zanetta, 2007: 232).

2.3 Risk for transmission of BBPs through SOIs

Students of nursing have a higher risk of exposure to clinical experiences of infections, because they may not have sufficient knowledge of the level of risk represented by a specific patient, or of technical skills and infection control events (Talas, 2009: 1394; Shiao et al., 2002: 200). Percutaneous contact to contaminated needlesticks and other sharp objects is an occupational threat to HCW that could cause mortality and morbidity from infections with BBPs (HIV, HBV, and HCV) (Rais & Jamil, 2013: 73). HCWs have a high risk of occupational contact with blood (Hossein, 2014: 2), while occupational exposure to a sharp object may include risk of a skin injury, which is a high-risk injury and the most common type during their work (Hashmi, 2012: 1; Hossein, 2014: 2). SOIs are a most significant problem for HCWs, as they multiply the risk of blood-borne infections and diseases. In fact, cases of spread of BBPs have been recognized for more than 50 pathogens, including HBV, HCV and HIV (Talas, 2009: 1394; Wang et al., 2003: 188; Ilhan et al., 2006: 564). As noted by Ali et al. (2009: 9) and Janjua et al. (2010: 1246), a high spread of HBV and HCV among general populations in Pakistan is likely to be caused by SOIs contaminated with BBPs (range 0.3-31.9%). In a worldwide study among HCWs carried out in 2000, infections with HCV, HBV, and HIV reached 39%, 37% and 4.4%, respectively, due to their job exposure to SOIs (Prüss-Üstün et al., 2005: 482).

2.4 Knowledge and incidence of SOIs

It has been noted that SOIs may cause substantial deadly blood-borne infection between HCWs, and are a threat to medical and nursing students while they are completing clinical learning in health care institutions (Beltrami et al., 2000: 386; CDC, 2008; Ilhan et al., 2006: 564; National Institute for Occupational Safety and Health, 2000; Smith & Leggat, 2005: 450; Talas, 2009: 1394; Wang et al., 2003: 188; Yang et al., 2007: 424; Swe et al., 2014a: 160). Exposure of HCWs to blood-borne infections often occurs through SOIs (Kurşun, 2014: 661; Beltrami et al., 2000: 386; CDC, 2008). A professional health study has revealed that some employee and job features are risks for work injuries (Oranye et al., 2016). Occupational injury is any damage to the body from an event in the work place (Pik, 2014: 7). An injury is considered by the Occupational Safety and Health Administration (OSHA) to be work related if an occasion or experience in the work place caused or contributed to the resulting disorder, and includes SOIs (Pik, 2014: 7).

Injuries related to work, vary in severity from minor, slight wounds and contusions to death. So, numerous cases may affect an individual's health, through short- or long-term pain, and similarly may affect their economic state through health costs and loss of income (Pik, 2014: 7; Dhaini, 2016: 28). HCWs have more exposure to work-related injuries such as SOIs than workers in most other fields (Dhaini, 2016: 23). Injuries caused via needles and sharp objects are very common in health care institutions worldwide (Devi Nirmala et al., 2014: 561). A

number of studies have documented SOIs among health care providers such as nurses and doctors, with reports from different countries, including Taiwan, Uganda, South Africa, the United Kingdom (UK), Malaysia, Ethiopia, and Saudi Arabia (Nsubuga & Jaakkola, 2005: 773; Jahan, 2005: 233; Yang et al., 2007: 424; Du Toit et al., 2009: 128; Kebede et al., 2012: 1094; Saia et al., 2010: 41; Swe et al., 2014a: 159). The SOI incidence varied in the different studies, and was reported as 14.9% in southeast Ethiopia (Bekele et al., 2015: 1) and as high as 66% in Saudi Arabia (Jahan, 2005: 233), with Saia et al. (2010: 41) reporting up to 100 000 incidents of SOIs per year in the UK. A study conducted in 434 nursing students in Turkey revealed that 83.9% of them had been exposed to SOIs (Kurşun, 2014: 661). Similarly, as noted by Janjua et al. (2010: 1244), 54% of 233 HCWs in Sindh Province in Pakistan had had at least one injury in the prior 6 months of the study. Another study conducted with 621 HCWs in an urban community in Mongolia noted that the occurrence of SOIs in the previous three months was estimated at 38.4%, and the frequency of incidence was 14.7% for one injury, 11% for two SOIs, and 12.6% for those that sustained SOIs three times or more in that period (Kakizaki et al., 2011: 187).

The occurrence of SOIs on the African continent is also considerable. As noted by Orji et al. (2002: 75), in a Nigerian teaching hospital, the commonest of occupational exposure to injury during work was through SOIs (75.6%), with an incidence of 44.3% reported in Gondar city, Ethiopia (Kebede et al., 2012: 1094). In a study conducted in 114 HCWs over a period of one year, from January to December 2003, in Durban, South Africa, only 19 (21%) respondents reported experiencing SOIs (Mosweu et al., 2005: 5). In a study of 300 HCWs in Ghana, 53.7% (160) of respondents reported SOIs (Kommogldomo, 2016: 6). It is undisputable that SOIs are common among HCWs, and as student nurses participate in health care delivery, they are equally exposed to them. It is crucial that SOIs are reported among HCWs, including nursing students, providing the opportunity to access post-exposure prophylaxis (PEP) and reduce the risk of exposure to BBPs.

2.5 Reporting trends in SOIs

The occurrences of SOIs is common in many places; however, despite the risk of infection and the possibility to start with management, many of the SOIs go unreported. For instance, in Ajman in the United Arab Emirates 60% of dental students did not report their SOIs (Jaber, 2011: 1), while 34% of European medical students did not report their SOIs (Salzer et al., 2011: 407). Many reasons are given by HCWs for not reporting SOIs (Bekele et al., 2015: 3). In his article on raising awareness and reducing the risk of SOIs, Trim (2004) found that respondents have various reasons for not reporting SOIs, and these included a lack of procedural knowledge, fear of a positive result, and the stigma associated with BBPs (Trim, 2004: 261). In a study by Du Toit et al. (2009: 128) in 112 South African doctors at the University of the

Free State, the reasons specified for the non-reporting of these occurrences were being too busy (58.1%), not thinking it was serious (48.8%), and not knowing the reporting procedure (7%), with some respondents indicating more than one reason. A study carried out in HCWs in Southeast Ethiopia showed that the prime reasons for not reporting SOIs were time constraints (35.1%), the fact that sharps which caused the wound were not used on any patient (27%), and lack of information that it should be reported (14.9%) (Bekele et al., 2015: 1). As noted by Salzer et al. (2011: 407) in 226 medical students in their last year of study in 11 European universities (4 from Germany, 3 from Austria, and 4 from the UK), nearly one-third were not acquainted with reporting procedures in cases of SOIs, and 45% felt that reporting an injury might impact on their studies, while 78% who had experienced SOIs were not conscious of the patient's HIV status. In Turkey the main reasons for not reporting an SOI among 201 nurses was that 33.3% were unaware of the reporting requirement or mechanism (Akyol, 2016: 2). Shah et al. (2018: 65), in a study of 370 nursing students in Karachi, Pakistan, found that about 155 (40%) reported the incident of SOI to a higher authority; the most common reasons for not reporting were lack of a reporting department (15.3%), workload (51.3%), and lack of knowledge (18.6%).

What is evident from the above authors is that in different countries worldwide there was documentation of non-reporting of needle-stick and SOIs by HCWs, and time constraints, reporting procedures and fear were the main reasons for not reporting the SOIs (Trim, 2004: 261; Du Toit et al., 2009: 128; Salzer et al., 2011: 407; Bekele et al., 2015: 1). The literature also showed that there is a high rate of occupational exposure to blood borne infection through needlestick or SOIs, with reporting and non-reporting of occupational exposure as well as common reasons for that well addressed in the literature (Salzer et al., 2011: 409; Nawafleh et al., 2017: 64; Shah et al., 2018: 68). These points form part of this study, and the researcher aims to discover whether the findings from this study will support those of previous international studies, or whether any differences will be found in comparison to nursing students at a university in the Western Cape. With the current situation of common occurrence of SOIs and non-reporting of such injuries, it is significant to note that such incidents affect the injured HCW at different levels – hence the need to explore that in the literature.

2.6 Effects of SOIs

The continued occurrence of SOIs among HCWs, and more specifically among nurses, is a cause for concern, as SOIs have been recognized to have an adverse effect on nurses. Furthermore, SOIs have a negative effect on the shortage of HCWs, and there are economic costs related to its continued occurrence.

2.6.1 Effects of SOIs on nurses

These days, with technical improvements in medication, use of invasive techniques and injections in patients has increased. As a result, nurses are exposed to a high risk of BBPs (Aggarwal et al., 2012: 45). Nurses' performance certainly impacts the general level of patient care in the hospital (Gao et al., 2012: 143). Studies have shown that being exposed to blood borne infectious diseases such as HIV, HBV and HCV, and SOIs can cause stress in nurses (Moayed et al., 2016: 5; Sohn et al., 2006: 478). This specific type of stress has a negative influence on the nurses and effects their home relations and those at work (Gupta et al., 2008: 143; Moayed et al., 2016: 5). In one study, stress of exposure to SOIs was classified as psychological symptoms, posttraumatic stress, anxiety, and depression among nurses (Green & Griffiths, 2013: 184). A study in two hospitals in Korea – at the university medical centre in Seoul and Ansan city – revealed that 71.1% of nurses described their stress and gloom levels as meaningfully raised after having an incident of SOI. In addition, nurses who had not been vaccinated against HBV showed a meaningfully higher level of anxiety (Sohn et al., 2006: 478). Also, as noted by Akbari et al. (2018: 2), in 1070 nurses in Iranian public hospitals with experiences of SOIs, these nurses experienced the highest level of stress during work after SOIs were experienced, on the night shift (42.3%), morning shift (30.2%), and afternoon shift (27.5%).

2.6.2 Effects of SOIs on the HCWs shortage

Stress and SOIs have been noted as some of the common reasons why HCWs leave their jobs (Pik, 2014: 11). As noted by Perhats et al. (2012: 542), the risk factors for sharp injury influence HCWs' decisions concerning whether or not to go back to their occupation or stay in their field, thus worsening staff lacks and delaying employment and holding efforts. These findings are disturbing, since the lack of HCWs has been frequently mentioned globally (Perhats et al., 2012: 542). As the WHO (2010a: 327) stated, while there is lack of HCWs in most locations of the world, it is even more serious in the developing world. In India, for instance, with a noted shortage of 2,4 million nurses, lack of nurses occurs at every level of the health care system (WHO, 2010a: 327).

It has also been noted in the USA that many hospitals are struggling with nurse shortages caused by SOIs (Buerhaus et al., 2007: 854). As stated by Leigh et al. (2008: 414), between 1992 and 2003 SOI stress led to the absenteeism of 903 nurses, doctors and employees. Also, 7% of the SOIs caused loss of more than 31 working days (Blenkharn & Odd, 2008: 281). Psychiatric illness subsequent to an SOI can also have secondary effects, including absence from work (Blenkharn & Odd, 2008: 281). Blenkharn and Odd (2008: 284), noted that out of 40 SOIs among medical waste managers, no seroconversions were logged, although two persons suffered incapacitating anxiety and stress complaint needful continued leave of

nonappearance with expert counselling and support; it also encouraged the notice of one person, who felt incapable of coming back to duties that involved medical waste. Although the shortage of HCWs or absenteeism from work after an SOI has been addressed in literature across the world, it was noted that there is limited information on absenteeism from work after an SOI in HCWs in the Southern African region.

2.6.3 Economic costs of work-related SOIs among HCWs

The continued occurrence of SOIs among HCWs overall and nurses in specific has the potential to increase costs. Absenteeism after SOIs at work imposes extensive costs on companies in terms of lower output, and rising workplace cover for insurance claims and financial reimbursement (Vecchio et al., 2011: 1068). Pik (2014: 10) stated that the costs of work that related to SOIs are significant, as high as $90 million annually in the USA for professional nurses alone. Drysdale (2013: 27), in British Columbia, Canada, noted that 13 348 claims first paid out in 2008 were for HCWs and social workers after an SOI. The general cost of claims paid in this area in 2008 after exposure to SOIs was $56,323,889 (Drysdale, 2013: 27). According to the OSHA in the USA, workers' recompense for losses and treatment result in a total annual expense of $2 billion for hospitals. The estimated cost of exchanging a nurse in the USA, including separation, employing, signing, and training, is $27,000 to $103,000 (OSHA, 2013). In the period 2002-2004, Northwest Texas Health Care System indicated that around 20 SOIs per year were caused by patient management activities. These injuries had an average direct cost of $27,402 per claim. Indirect costs to society were two to three times higher for an outlay of $54,804 to $82,206 per claim (Pik, 2014: 10). Indirect costs have an important influence on the level of patient care. Many specialists estimate that indirect costs are four to seven times higher than direct costs, especially after exposure to SOIs, and may result in decreased worker self-confidence, repeated employee training and hiring, use of other employees, medical management, incident reporting and augmented costs of employees' recompense cover, and of worker healthcare (Thepaksorn & Pongpanich, 2014: 68).

There is a lack of articles on nursing students and HCWs related to SOIs and their effects in southern Africa and Africa, such as the shortage of nurses and economic costs of work related to SOIs, which are therefore not being addressed.

2.7 Prevention of SOIs and their complications

Nurses have lengthy contact with patients and often perform functions that place them at augmented risk of blood-borne infections (Mill et al., 2014: 11; Sadoh et al., 2006: 724). Universal protection is a set of rules that provides simple prevention actions and controls and decreases the risk of transport of infectious diseases through exposure to blood and body

fluids from patients (Sadoh et al., 2006: 724). As recommended by the CDC, nurses and all HCWs should follow the universal precautions for prevention from occupational exposure to SOIs and body fluids, such as the use of gloves, mask, gowns, hand washing, no recapping of the needle, use of defensive eyewear, and safe discarding of sharp objects to protect the patients and HCWs from exposure to pathogens transported via blood (Alter et al., 1998; Sadoh et al., 2006: 11; Swe et al., 2014a: 161–162; Naidoo, 2010: 19). Appropriate hand washing is one of the important health protective plans for all HCWs (Askarian et al., 2011: 194). Hands should be washed by soap and water or cleaned using an alcohol-based, dry antiseptic hand cleanser between each patient interaction (Fahim et al., 2011: 246). Before being used for injections, syringes and needles must be sterile, and they must be disposable to reduce the risk of exposure to infectious diseases (Askarian et al., 2011: 194; Fahim et al., 2011: 230).

In 1981, McCormick and Maki initially defined the characteristics of SOIs among HCWs and outlined a sequence of prevention policies, as well as educational programmes, avoidance of recapping, and better use of needle disposal systems (Tuvadimbwa, 2005: 46; CDC, 2008; Kerepa, 2014: 67; Patel, 2018: 7). Also recommended by the WHO (2010b) is that nurses should avoid recapping needles. In the UK, standard precautions are to be applied to help in the prevention and management of SOIs where blood and body fluids are considered to contain infectious agents, and they recommend hand washing after each patient interaction and after interaction with blood or other body fluids, as well as the use of appropriate personal protective equipment (PPE) before contact with the patient, disposable gloves when working with blood or body fluids, using waterproof plasters on any cuts or scratches, and direct and safe discarding of sharps into suitable, puncture proof sharps containers (Bhargava et al., 2013: 556; Vaz et al., 2010: 134; Patel, 2018: 1).

As noted by Lemessa (2014: 23), most of the HCWs in teaching hospital in Addis Ababa, Ethiopia, reported using gloves and a sharps discarding container to reduce incidence of SOIs. Prevention of SOIs can be attained via stopping recapping of needles and the use of harmless needle devices and sharps collection boxes (Amira & Awobusuyi, 2014: 233; Lemessa, 2014: 23). Also noted by Blatchford (2000: 28) and Lewis et al. (2015: 489), initial reports of transmission of HBV happened in connection with dental procedures where the dentist or doctor did not wear gloves. One of the consequence of an SOI is transmission of HBV, and HBV vaccination is recommended for all HCWs, including nurses and student nurses (Holmberg et al., 2012: 4; Afridi et al., 2013: 90; Hossein, 2014: 6). However, a study conducted in HCWs in a teaching hospital in Addis Ababa found that only 24 out of 146 (16.8%) received HBV vaccination, and amongst those started on treatment only 18 (75%) received all three doses, four (16.9%) received two doses, and two (8.3%) received one dose (Lemessa, 2014:

23). The literature notes gaps in prevention measures among HCWs with regard to SOIs and their consequences, and investigating this phenomenon among nursing students in the Western Cape may provide insight into what still needs to be done while the nurses are in training.

2.8 Management of SOIs

After exposure to blood via SOIs, especially when a used needle is involved, it is recommended that one washes the wounded area with soap and water and squeezes the injured area to encourage bleeding, then starts the reporting procedure immediately (Henderson, 2012: 78; Mbaisi et al., 2013: 14; El-Hay, 2015: 29). It has been documented that some HCWs who sustain an SOI take no action. Noted in studies in HCWs is that they do a variety of activities following an SOI. Some immediately wash (Sharma et al., 2010: 74; Galougahi, 2010: 174; Koohestani et al., 2010: 60; Saini, 2011: 13; Swe et al., 2014a: 161; Chalya et al., 2015; Kumar, 2016: 313), while others first squeezed the injury site (Foster et al., 2010: 150; Ngene et al., 2014: 67; Nawafleh et al., 2017: 62; Goel et al., 2017: 3).

In 1997, the Canadian integrated protocol on better management of HCWs who have been exposed to BBPs was published. According to this protocol, the use of HBV vaccine is an effective method for preventing post-exposure HBV infections (Askarian et al., 2011: 194; Moloughney, 2001: 448). There seems to be limited literature about SOIs in South Africa, and specifically in the Western Cape. With the documented prevalence of SOIs, and bearing in mind that South Africa has the largest number of people living with HIV (Kalichman & Simbayi, 2003: 446), there is a need to establish the nursing students' knowledge and practices relating to SOIs at a university in the Western Cape Province, considering the high number of nurses who are being trained and who are involved in invasive procedures as part of their training.

2.9 Conceptual framework

This research used Haddon's matrix as a framework to guide the study, and locating this study within this framework permits a wider and more complete background coverage of the phenomenon of interest. Haddon's matrix is founded on an epidemiological model focusing on three phases, namely a pre-injury phase, injury phase, and post-injury phase. This approach recognizes that different factors occur in each phase, as illustrated in Figure 2.1 and further described in this section, and that any possible understanding and intervention related to the phenomenon should take these factors into consideration (Small et al., 2011: 3).

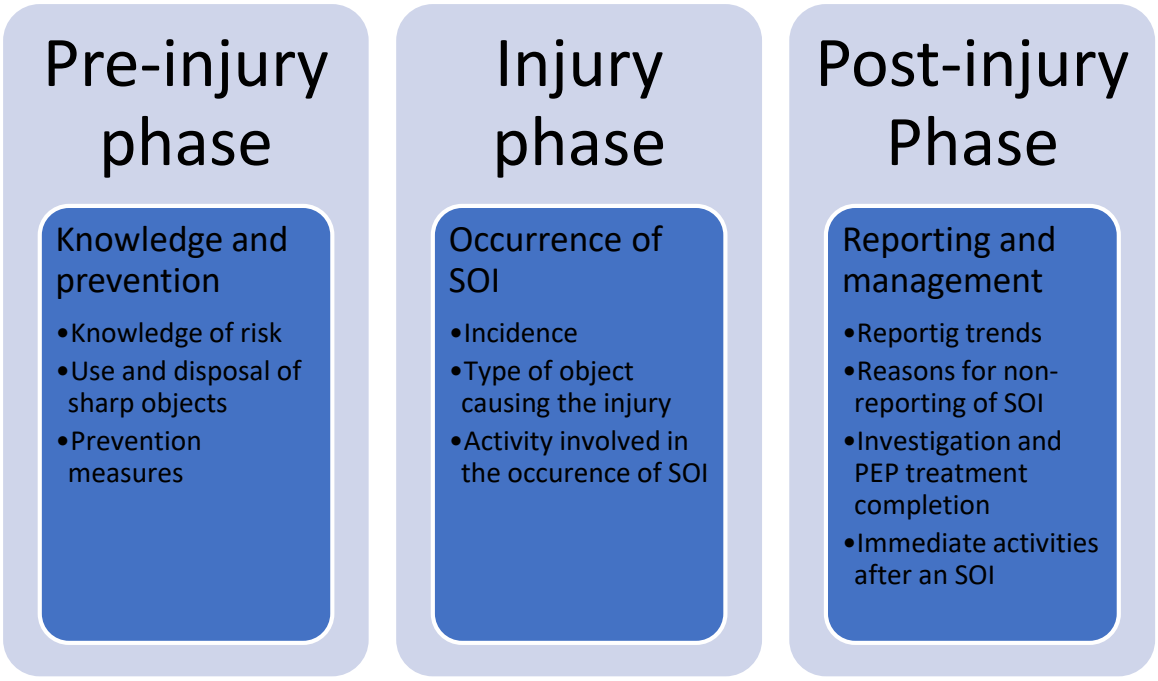

Figure 2.1 The framework: Haddon's matrix.

❖ **The pre-injury phase:** This phase relates to ensuring a safe setting, where nursing students could obtain the essential skills to handle, use and dispose of sharps with negligible risk of possible SOIs, and secondly to teach safer methods in this respect (Small et al., 2011: 2). In this study, this phase corresponds to objectives one and two, related to knowledge of the risk and prevention of SOIs.

Nursing students need to be knowledgeable about the risk of SOIs. For instance, the discarding of used syringes and needles has a major role in SOIs, and the skills to prevent injuries as a consequence of the improper disposal of syringes and needles are emphasized in the nursing programme in the School of Nursing. This emphasis takes place from the instant training in the administration of injections occurs, and is supported in related subjects such as microbiology, where infection control values are taught, for example, avoiding the recapping of a needle (Small et al., 2011: 2–3). This knowledge is crucial and fits this first phase of the framework, corresponding to the first objective of the study.

Safer methods include skills related to the administration of medications, and following established guidelines such as those of the WHO (2010b). These guidelines are easy to follow, and are applicable to nursing education concerning the disposal of used syringes and needles, the monitoring of injuries, safe workplaces, and provision for PEP (WHO, 2014a: 69). Adherence to these guidelines is crucial for the prevention of SOIs, which is an aspect related to this first phase of the framework. A safe injection is one that does not damage the receiver, does not expose the worker to any preventable risks, and does not cause waste that is unsafe

to the public. Unsafe injections can lead to transmission of BBPs with their related problems (WHO, 2010a: 327).

❖ **The injury phase:** In this study this phase emphasises mainly the occurrence of SOIs. The occurrence rate provides a suggestion of the extent of SOIs, and has the potential to provide guidance for any curriculum modifications and improvements (Uys & Gwele, 2005: 170). The injury phase also emphasises the specific form of sharp object causing the injury and increasing the risk of transmission of BBPs. This phase relates to the third objective of the study about the occurrence of SOIs.

Meyer and Van Niekerk (2008: 65) confirm that training courses and clinical practice play an important role in improving students' learning, which is vital to their future quality of care as professional nurses. Jerlock et al. (2003: 219) state that the students' exposure to the clinical work enhances their training in terms of basic and advanced nursing practice. Hoffman and Donaldson (2004: 448) indicate that students' exposure to clinical practice could lead to tension, which may increase the possibility of occurrence of SOIs. SOIs may occur as an outcome of risks in the environment, including having to take part in activities for which the nursing students have not yet been adequately trained, and/or lack of supervision during clinical learning (Zamani et al., 2007: 7). In their clinical practice, student nurses are involved in the healthcare process, including the performance of invasive procedures and the use of sharp objects, and these fit the injury phase section of the framework, and the third objective of the study.

❖ **The post-injury phase:** This phase focuses mainly on determining the reporting trends for cases of SOI, and management of injuries. Moreover, it is concerned with the use of treatment in the case of injury occurrence, and the availability of recommendations to the injured worker. In this study, this phase discusses the steps that could be taken to manage the occupational exposure to the risk of SOIs due to the blood or other body fluids. These steps include first aid, risk assessment information, reporting exposure to HBV, HCV and HIV via SOIs during clinical learning, and supplies of PEP (WHO, 2010b). The prophylaxis should be managed in as short a time after contact to the SOI as possible (WHO, 2014b: 15).

Most health care organizations have actions for reporting and recording SOIs and other percutaneous injuries in workers, and the team should evaluate whether these are sufficient for data collection and analysis, and define the data that can be used to measure improvements in injury reporting (CDC, 2008). This phase corresponds to objectives four and five on reporting trends and management after SOIs. The current study focused on Haddon's matrix and integrated this with a questionnaire to determine the nursing students' knowledge on SOIs, and their risk and management at one university in the Western Cape. Province.

2.10Summary

This chapter presented the literature review covering various aspects related to SOIs, and the conceptual framework. The literature notes that the occurrence of SOIs remains considerable worldwide and across the various categories of HCWs, but reporting trends remain low. The occurrence of SOIs has a number of negative effects, both for the injured person as well as the healthcare system and patient safety. There seems to be limited publications in the literature about SOIs in South Africa, and more specifically among student nurses in the Western Cape – hence the focus of this study.

The next chapter focus on the methodology of this quantitative study and how the researcher conducted this study.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

Chapter 2 provided an in-depth overview of the literature and the Haddon matrix used as the conceptual framework in our study. This chapter specifies the research approach, design and methods utilised during the study process. In this study, a quantitative research approach was selected to determine nursing students' knowledge and practices related to SOIs and their management at a university in the Western Cape Province. This research methodology chapter includes a discussion on the population, sampling, sample, data collection and data analysis, and highlights academic rigour and the specific ethical considerations as applied in this study.

3.2 Research paradigms

The term paradigm is derived from the Greek *paradeigma* meaning pattern, initially used by Thomas Kuhn (1962), cited by Vosloo (2014: 300) and Thomas (2010: 292), to denote a theoretical framework or method of thinking shared by a community of scientists, as a suitable model for examining problems and finding solutions. According to Kuhn (1977), cited in Thomas (2010: 292), a paradigm is a combined group of practical ideas, variables and difficulties linked with reliable methodology methods and tools. The paradigm is a way of observing normal phenomena that involves a set of philosophical expectations, and that direct one's method of inquiry (Polit & Beck, 2008: 15). According a paradigm is a combined group of practical ideas, variables and difficulties linked to reliable methodology and tools. General, a paradigm is best defined as full system of thinking (Morgan, 2007: 49). According to Thomas (2010: 292), research paradigms characteristically reflect our principles regarding the world we live in and want to live in. Based on this belief, Guba and Lincoln (1994: 108) differentiate positivist, post-positivist and postmodernist analysis, grouping postmodernism and post-structuralism within the critical model. Post-positivism is observed as an irregular form of the previous positivism, but they are both objectivist (Thomas, 2010: 293).

Similarly, Swanson and Holton (2005:19) classified research paradigms into three philosophical groups as positivism, interpretivism (constructivism) and critical postmodernism (critical theory), while practicality is understood as a link between positivism and post-positivism. Additionally, these three philosophical views are the popular paradigms in modern social, management, and organizational research (Thomas, 2010: 293). The key features of these three views, with the worldview, nature of knowledge followed, and different resources by which knowledge is produced and evaluated within each paradigm or worldview, are deliberated below.

3.2.1 Positivism

The classic positivist technical method refers to a general set of arranged, orderly actions used to obtain information (Polit & Beck, 2008: 16). According to French philosopher August Comte (1798-1857), the positivist paradigm of exploring social realism is based on philosophical ideas (Thomas, 2010: 294). A position such as this would allow the investigator to accept the part of an objective analyst, creating separate clarifications around those data that have been collected, in a seemingly value-free manner. For the same reason, positivists prefer an analytical clarification of quantifiable data (Thomas, 2010: 294). The positivist researcher maintains that one may adopt a distant, separate, neutral and non- interactive position (Morgan, 2007: 56; Guba & Lincoln, 2004: 20). The abstract thoughts of social association should, consequently, be connected to the exact measurements of the social world (Morgan, 2007: 56; Guba & Lincoln, 2004: 20). Positivism involves a belief that valid knowledge can only be produced on the foundation of direct observation using the senses; and this would include the ability to measure and record what would be seen as knowledge (Morgan, 2007: 56). Observation in this sense means accepting only observed indications as valid sign (Creswell, 2014: 7; Guba & Lincoln, 2004: 19–20; Morgan, 2007: 56). Valid signs are thus produced through the senses of sight, smell, touch, taste and hearing (Morgan, 2007: 56).

3.2.2 Post-positivism

The post-positivists have represented the old-style form of study, and these expectations hold true more for quantitative study than qualitative research (Creswell, 2014: 7). Post-positivism assumes that the world is objective (Swanson & Holton, 2005: 19; Morgan, 2007: 57). Therefore, post-positivist researchers generally follow truths in terms of relations among variables (Swanson & Holton, 2005: 19; Morgan, 2007: 57). They emphasis on quantitative methods to test and confirm suggestions (Creswell, 2014: 7; Swanson & Holton, 2005: 19; Morgan, 2007: 58; Thomas, 2010: 294).

Modern quantitative research is strongly influenced by the post-positivist paradigm (Coughlan & Cronin, 2017: 80), and is concerned with measurable objective outcomes. However, measurable outcomes in post-positivist research are only indicators of probable results, and not an indicator of proof (Coughlan & Cronin, 2017: 80). For example, when research indicates that there is a strong probability that SOI leads to transmission of BBPs, it is not stating that it will, only that there is a good chance that it will (Coughlan & Cronin, 2017: 80). In order to demonstrate this type of outcome, the ideal group to use would be the whole population; as this is virtually impossible, a typical sample from the people is the next best thing (Fawcett & Garity, 2009: 96). So quantitative reseach is interested in using statistics to study large numbers and what the probable answer to the research question will be (Coughlan & Cronin, 2017: 80).

Post-positivism provides the investigator with more objective measures for amassing data. The degree of honesty of the investigator could be a problem in this type of study. The question remains: Could the subjectivity in a post-positivistic study influence the data negatively? The answer will not certainly influence, because the researcher is considered a neutral person in such studies (Holzemer, 2010: 143). Ceolin et al. (2017: 7) believe that post-positivist study offers the social scientist the opportunity to carry out study on a small scale by using very original methodologies. In this study, the post-positivism paradigm was applied to determine nursing students' knowledge and practices related to SOI and its management at a university in the Western Cape Province of South Africa.

3.3 Research approach

In this study, fitting within the post-positivism paradigm adopted by the researcher, a quantitative research approach was adopted. This approach allows for numerical values collected from participants to be used for systematic processing that spans the steps from broad assumption to detailed methods of data collection, analysis and interpretation (Creswell, 2014: 3). According to Polit and Beck (2008: 16), quantitative research makes use of logical reasoning to generate forecasts that can be tested in real world situations. Furthermore, quantitative research uses a form of analysis to assess objective models through deductive reasoning, by investigating the relationships between variables (Creswell, 2014: 4). One of the advantages of quantitative research is that these variables, that may include large quantities of data, can be measured objectively so that changes over time can be noted; using statistical procedures provides clear results through analysis (Creswell, 2014: 4; Lapan & Quartaroli, 2009: 61). The aim of the current study was to determine nursing students' knowledge and practices related to SOI and its management at a university in the Western Cape Province of South Africa, and the data required for achievement of the research objectives need to provide some level of objectivity. Such data are numerical in nature. This fits the chosen quantitative approach for this study, and guided the choice of research design used.

3.4 Research design

In this study, a cross-sectional descriptive study was conducted among second-, third- and fourth-year nursing students at a high education institution in the Western Cape Province during the 2017 academic year. Cross-sectional designs aim to define the frequency of a particular characteristic, such as an exact experience, disease or any other health-related issue, in a clear population at a specific point in time (Burns & Grove, 2009: 241; Ausserhofer et al., 2012: 238). Use of a cross-sectional design is to examine a consequence, such as SOIs and contact with BBPs (Brockopp & Hastings-Tolsma, 2003: 258).

A descriptive study design was selected to gain more information regarding the characteristics within a particular field of research (Burns & Grove, 2009: 237). The descriptive research was conducted to describe and outline the characteristics of a phenomenon in real-life conditions, and used to generate new knowledge about concepts or topics on which limited or no research has been conducted (Burns & Grove, 2009: 45). Surveys cover all types of studies where a group of people are compared on two or more variables; some descriptive surveys look at a specific population, such as nursing students, to see whether their attitude toward some issue (such as SOIs) is related to their age or educational background (Wood & Ross-Kerr, 2011: 110). The cross-sectional descriptive design was used in the current study to describe the knowledge of nursing students with regard to their risk of SOIs, the occurrence of SOIs, and their reporting trends and management strategies in cases of an SOI.

3.5 Research setting

This research was conducted at a nursing department based at one university in the Western Cape Province. The university has a number of programmes, of which the basic nursing programme was one of the courses being offered. The nursing programme is offered for qualification as a professional nurse, following Regulation R425 of the South African Nursing Council (SANC) (SANC, 1985).

The selected nursing department had about 563 undergraduate nursing students at one of its campuses, who on completion of the programme will receive SANC registration with general nursing, community, psychiatry and midwifery specializations. The students completing the course at the nursing department used in this study complete the clinical component of their training at different public health institutions in the Western Cape. Considering that the selected institution had one of the highest numbers of basic degree nursing students in the Western Cape, information on their knowledge of SOIs, and the occurrence, reporting trends, risk, management and prevention of SOIs was needed, as this will provide an insight into the current situation regarding issues related to SOIs among nursing students.

3.6 Population, sampling strategy and sample size

3.6.1 Population

In research, the population is the group that could represent a research interest (Goddard & Melville, 2004: 34). Although it is sometimes possible to study an entire population, a group of individuals or other entities to which the findings are being generalized, most of the time a smaller representative group is used (Lapan & Quartaroli, 2009: 88). Researchers gather the data from the group and translate it into information to form the population parameters (Lapan & Quartaroli, 2009: 88). The total population for the study comprised nursing students, and the target population was made up of nursing students registered under the R425 nursing

programme at the particular institution in the Western Cape. There were about 563 students registered for the nursing programme at the selected institution, with 420 of them in their second to their fourth years of study in the 2017 academic year. The totals of nursing students per year level were as follows: 180 in their second year, 130 in their third year, and 110 in their fourth year of study.

3.6.2 Sampling strategy

As it is usually unnecessary to conduct a study with the whole population, it is crucial to devise a sampling plan. In the research process, the sampling component is critical and needs to be carefully thought out and clearly described; it involves selecting a group of people, events, behaviours, or other elements with which to conduct a study (Burns & Grove, 2009: 343). Sampling in research is when a smaller group is chosen from the greater group (population) to study; the findings in the small group are then generalised back to the people from which the sample was drawn (Van der Berg, 2009: 24).

In this study, a non-probability sampling technique was applied, more specifically quota sampling. Probability sampling in this instance requires the researcher to obtain a list of all of the students, and then randomly select the sample (Brink et al., 2012: 134). However, accessing the list of all students may require prior permission from them, which is not possible as it would violate students' right to privacy; hence the use of non-probability sampling. As stated previously, the target population was made up of 420 undergraduate nursing students who registered under the R425 nursing programme at the selected nursing department at a university in the Western Cape Province, who were in their second to fourth years of study. As the total of number of students may not be equally distributed across the three-year levels of study, this research used a quota sampling technique, which is discussed in more detail below.

3.6.2.1 Quota sampling technique

Non-probability quota sampling was conducted in this study. Quota sampling is one form of non-probability sampling that could be applied in quantitative research (Grove et al., 2013: 364). The purpose of quota sampling is to draw a sample that has the same characteristics as the whole population, taking into account the groupings in the population (Brink et al., 2012: 140). Quota sampling allows the researcher to control the number of sample subjects with the desired characteristics (Wood & Ross-Kerr, 2011: 142). The quota sample allows the researcher to gain information on the composition of the population (Brink et al., 2012: 140). Quota sampling uses a convenience sampling technique to ensure the inclusion of all subject types or strata in a population; this offers an improvement over simple convenience sampling, as it tends to decrease potential biases (Grove et al., 2013: 364; Wood & Ross-Kerr, 2011: 142). With this sampling method the researcher divided the population group into three

subgroups (strata), depending on their year of study (second year, third year, and four year). The sample was taken from each stratum as present in the population. Then quota sampling using the convenience technique was used to recruit individual respondents for the collection of data, with the aim of achieving the calculated sample size.

3.6.3 Calculation of sample size

The target population in the current study was 420 undergraduate nursing students. Confidence interval (CI) and confidence level were established once the total population was known, so the existing sample reflected the population (Van der Berg, 2009: 28). The Kadam and Bhalerao (2010: 55) formula was used by the researcher to calculate the sample size. The researcher used a confidence level of 95%, which represents how sure you could be that your results were a true reflection for the population, and a confidence interval of 4 as calculated using the sample size calculator from the Survey System website, which represents the range of the true value for the population (Kadam & Bhalerao, 2010: 55). Based on this, the sample size was estimated as 247 nursing students; in order to account for incomplete responses, the researcher used a sample of 252 respondents using non-probability quota sampling. Furthermore, the sample size was calculated manually using the following formula:

$$\frac{\frac{z^2 \times p(1-p)}{e^2}}{1+(\frac{z^2 \times p(1-p)}{e^2 N})} = \frac{\frac{(1.96)^2 \times 0.5(1-0.5)}{(0.04)^2}}{1+(\frac{(1.96)^2 \times 0.5(1-0.5)}{(0.04)^2 \times 420})} = \frac{600.25}{2.4291} = 247$$

whereby Z (standard normal deviation) =1.96, P (proportion) = 0.5, e (error margin or CI) = 0.04, and N (population) = 420.

3.6.4 Inclusion criteria

Inclusion criteria represent the characteristics which should be possessed to be part of the population (Burns & Grove, 2009: 345). The inclusion criteria of this study included nursing students registered for the 4-year nursing programme (R425) in the academic nursing programme at the selected university in the Western Cape Province, in from their second to fourth year of study in the 2017 academic year, and aged 18 years and older, to allow for the possibility of obtaining consent.

3.6.5 Exclusion criteria

Exclusion sampling criteria represent factors that can cause a component or an individual to be excluded from the population (Burns & Grove, 2009: 345). For the purpose of the study, any students who were not registered for the nursing programme (R425) were excluded, and first-year students were also excluded because they are not yet dealing with sharp objects during their training practice in the hospital (Zungu et al., 2008: 48; Van der Berg, 2009: 25). Also, those who were younger than 18 years were excluded, because one needs permission

and consent from their family for participation in this study, and many students do not stay with their family and thus it would have been difficult for the researcher to request and obtain parental consent. The researcher also excluded the nursing students that had participated in the pre-test pilot study. Nursing students in other programmes in the 2017 academic year were also excluded, as they were registered for additional qualifications and had already been practising and registered as practising nurses before starting the programme.

3.7 Recruitment and response rate

3.7.1 Recruitment of respondents

Appropriate recruitment of respondents for a research study is critical to the process (Curtis & Drennan, 2013: 113). The benefits of participating should be explained, without exaggerating or misleading (Polit & Beck, 2008: 287). When quantitative designs are used, the researcher must be able to recruit a large representative sample, so that they can generalise the findings to the wider population – which in this study will be nursing students (Curtis & Drennan, 2013: 113). Increasingly, health care researchers are utilising health care providers or faculty members to assist in recruiting large samples or groups with specific characteristics, such as nursing students (Curtis & Drennan, 2013: 113). In this study, staff of the School of Nursing assisted the researcher in recruiting the nursing students who met the inclusion criteria, by arranging for the researcher to address the students during class at the selected university in the Western Cape. This allowed the researcher to present information about the study to the nursing students in the absence of the lecturer, ask volunteers to participate in the study, and carry out the subsequent data collection. The lecturer allowed the researcher to come into the class towards the end of the session, and would leave the classroom to allow students decide whether to participate or not without any feeling of coercion. The researcher addressed the three-year levels separately, and this facilitated inclusion of respondents from the three year levels included in the study. In addition, the researcher reminded the students who had participated in the pilot study not to participate in the full study.

3.7.2 Response rate

The proportion of the selected sample that participates in the study is called the response rate (Bruce et al., 2008: 160). One obtains the response rate by dividing the amount of persons who submitted a finished survey (respondents) by the amount one tried to include based on the calculated sample size (Bruce et al., 2008: 224). Much research has been conducted on the issue of response rates, and there are several rules of thumb which are useful for maximizing them. Vogt et al. (2012: 19) noted that when the study is supported by a university, you may expect response rates higher than they would be if you contact possible respondents as an individual scholar. If the response rate is high, the hazard of nonresponse bias may be

insignificant. A response rate greater than 65% is often seen as sufficient for most determinations, but a lower response rate is common (Polit & Hungler, 2004: 366). Personal administration of questionnaires to individual respondents is another method, and personal interaction with respondents has a positive impact on response rates. Also, this allows investigators to help clarify specific items or the study purpose (Polit & Hungler, 2004: 366). The distribution of a questionnaire in the clinical setting is often cheap and efficient, and is likely to yield a high rate of completion (Polit & Hungler, 2004: 367). In this study, the investigator explained the purpose of the study to nursing students in the School of Nursing at a university in the Western Cape during data collection, and the response rate was over 84%. The calculated sample size was 247 and the researcher collected 252 out of 300 questionnaires handed out (see point 3.9). This was also an attempt to maximize the number of usable questionnaires, as receiving incomplete questionnaires is not uncommon in research. The researcher ensured the representation from the three year levels are maintained, by keeping record of number of respondents per year level as illustrated in the demographic information in chapter 4.

3.8 Instrument

The investigator developed a study form based on information from the literature and the researcher's experience with nursing students, as a technique that has previously been documented by Karadağ (2010: 130). Selecting an instrument to measure the variable in a study is a critical procedure in research (Burns & Grove, 2009: 419).

In this study, the questionnaire was developed and informed by various aspects that have previously been documented in the literature (El-Hay, 2015: 20; Kaur et al., 2014: 37; Prasuna et al., 2015: 432), and took about 15 minutes to complete. The questionnaire was divided into two parts in order to obtain data about the knowledge, risk, occurrence, prevention and management practices of nursing students in terms of SOIs, as explained below.

Part I consisted of the demographic features, allowing a description of the respondents. The demographic information collected included age, gender, year of study, marital status and religion.

Part II was developed to gather the knowledge regarding SOIs. The second part of the questionnaire covers the study objectives and the three phases presented in the Haddon's matrix framework, with 29 questions. For objectives one and two, corresponding to the pre-injury phase, there were 13 items related to knowledge of SOIs before, incidences, prevention and use of PPE. The third objective, matching the injury phase, was covered by six items that included the knowledge and incidence of SOIs, transmitted disease, causes, and one's feeling of risk regarding SOIs. Objectives four and five, that fit the post-injury phase, were covered by

10 items that covered knowledge related to direct response after SOIs. The investigator used the tick mark **(√)** scoring system for this questionnaire (see Appendix E).

3.8.1 Pre-test pilot study

In quantitative research it is advisable to conduct a pilot study to classify possible difficulties that could surface during the data collection (Brink et al., 2012: 57). This also provides the chance to pre-test the instrument for data collection, allowing the researcher to make adjustments should any flaws be identified (Brink et al., 2012: 57). So, the pilot study was done in August 2016 and February 2017 to define the reliability of the instrument. The researcher used Cronbach's alpha to establish the reliability of the modified questionnaire, which is discussed below.

The researcher chose a random sample of 30 nursing students and nurses. In 2016, only 20 of the 30 nurses consented to take part in the pilot study, and these were not part of the sample for the full study. The number of respondents for the pilot study was founded on the recommendations of Johanson and Brooks (2010: 399), of a sample size of at least 30 respondents for a pilot study. The research invited all the respondents to meeting room then he explained to them the purpose of the study and told them that they are free to withdraw from the study at any time. After that the researcher distributed the consent form and the questionnaire to the respondents, the respondents completed the questionnaires within 15 minutes and handed them back to the researcher on the same day of participation and they stated that the questionnaire was clear and easy to read. The researcher then calculated the Cronbach's alpha, which measures the internal reliability of the questions in the questionnaire, using the IBM Statistical Package for Social Sciences (SPSS) 24.0. The Cronbach's alpha was 0.64, which the researcher regarded as too low. Cronbach's alpha measures how well a set of items (or questions) relate to the same concept and is a measure of scale reliability.

After statistical consultation, it was recommended to the researcher that the number of statements that verified the knowledge and practice be increased, because it might not yet be sufficient for the software program to compute Cronbach's alpha exactly. The researcher then reviewed the questionnaire and carried out another pilot study in February 2017. This time the researcher again chose a random sample of 30 nursing students, with again only 20 consenting and completing the questionnaire. The research again invited all the respondents to meeting room then he explained to them the purpose of the study and told them that they are free to withdraw from the study at any time. After that the researcher distributed the consent form and the questionnaire to the respondents, the respondents completed the questionnaire within 15 minutes at the same time of participation and they told that the questionnaire was clear and easy to read. This time the Cronbach's alpha was 0.706, as seen in Table 3.2. The researcher decided to keep all of the items, because a Cronbach's alpha of 0.706 is acceptable

(Tavakol & Dennick, 2011: 54; Van der Berg, 2009: 35). The items covered issues like handling of a sharp object, and risk of transmission of blood-borne disease with management after exposure to injury, the availability of HBV vaccine, treatment after exposure to injury, and the use of protective equipment. These were all covered in the questionnaire in different forms, except for three items regarding the name and type of treatment obtained after an SOI. These questions were checking facts, and therefore could have been identified as not internally consistent by the software program.

3.9 Data collection process

The process of data collection is of critical importance to the success of a study (Lapan & Quartaroli, 2009: 148). The researcher collected all of the data himself. Data collection was done over a period of one month. In this study, the researcher explained the topic, objectives, and purpose of the study to respondents in the School of Nursing at a university in the Western Cape, for respondents to indicate their willingness to participate and sign the consent form. The researcher distributed about 300 consent forms to respondents from the second to fourth years of study; and 252 nursing students signed the consent form while 48 refused to sign and declined to participate.

After obtaining consent, questionnaires were administered to nursing students in their second to fourth years of study, registered for the 4-year nursing programme (R425) in the School of Nursing at a university in the Western Cape Province in 2017 (see Appendix E). The data were collected from students of one-year level at a time, and non-probability quota sampling was used. Group administration of questionnaires was applied. As noted by Maree (2016: 176), group administration is by handing out the questionnaires to respondents as a group, while the researcher waits for the respondents to complete the questionnaires individually. The researcher approached each group of students after permission was obtained from the institutional authorities and the lecturer. The purpose of the study and information about the study were given to all students in each group, and volunteers were asked to complete the questionnaires, ensuring that the representation from the three year levels is upheld. Data were obtained about the perceptions of nursing students as to whether or not they had experienced an SOI, what they did after the SOI, risk, management and preventive measures, fitting the framework of the study and covering the objectives which were set.

3.10 Data analysis

All data were collected, captured, coded, tabulated and undergo to statistical analysis. Statistical analysis was carried out using SPSS version 24 to relate the results to the sample, with consultation and support from a statistician (see Appendix B). Furthermore, Excel from Microsoft Office was used for data handling and graphic presentation of the data in the form of

bar or line graphs. Continuous quantitative data variables such as age were recoded into interval data for a more synthesized data analysis. Quantitative variables were described by presentation of frequency distributions, average, and standard deviation.

3.11 Academic rigour

A declaration of scientific rigour is essential in research. Irrespective of the research method, the most critical ethical responsibility in research is to describe the results of the study in the most dependable way possible (Daley, 2010: 56). Validity and reliability are two fundamental elements in the evaluation of a measurement instrument in a quantitative study (Tavakol & Dennick, 2011: 53).

3.11.1 Validity

Validity is a measure of the truth or correctness of a claim, and is a significant concern during the research process. It has been noted that the validity of questions is central to building an evidence base (Burns & Grove, 2009: 221). Validity of the instrument is the extent to which the questionnaire measures what it is supposed to measure (Van der Berg, 2009: 39; Brink, 2010: 169–167). Usually the researcher who develops the instrument bases the claim on a literature review (Brink, 2010: 168). According to Van der Berg (2009: 39), it is best to establish validity of the questionnaire before data collection. In order for the researcher to accomplish this, a pilot study was conducted, providing the opportunity to test the instrument. Face and content validity were established by presenting the questionnaire to nursing experts to establish if the questionnaire measured what it set out to. This fits what Maree (2016: 240) noted, that content and face validity can be established by experts in the field.

3.11.1.1 Content validity

Content validity is an estimate of how well the instrument represents the different components to be measured (Brink, 2010: 168). When one or more components are neglected, the researcher cannot really claim to be measuring whatever they are interested in (Brink, 2010: 168). The extent that test items are assessed as appropriate for a test is content validity (Lapan & Quartaroli, 2009: 46). Also, consultation with expert nurses and a statistician about the instrument helped to confirm content validity. The content validity of the instrument is indicated in Table 3.1, linking each question of the instrument with the study objectives and the phases of the framework used in this study.

Table 3.1 Content validity

Objective	Framework phase	Questionnaires
1. To determine nursing students' knowledge of risk of SOIs at a university in the Western Cape.	**Pre-injury phase**	Questions related to this phase and objective are: 15, 16, 18, 23, 24, 27, 28 and 29.
2. To determine nursing students' use of prevention measures before incident of an SOI at a university in the Western Cape.		Questions related to this phase and objective are: 17, 19, 20, 21, 22, 25, 27, 28 and 29.
3. To determine the occurrence of SOIs among nursing students at a university in the Western Cape.	**Injury phase**	Questions related to this phase and objective are: 1, 2, 3, 4 and 10
4. To determine the reporting trends in cases of SOIs in actual practice after an incident for nursing students at a university in the Western Cape.	**Post-injury phase**	Questions related to this phase and objective are: 6, 7 and 8.
5. To determine nursing students' awareness of the management practices after an SOI at a university in the Western Cape.		Questions related to this phase and objective are: 5, 9, 11, 12, 13, 14 and 26.

3.11.1.2 Face validity

Face validity is the most obvious kind of instrument validity (Brink et al., 2012: 168). In the 1960s and 1970s, the only type of validity that most studies addressed was referred to as face validity, which basically verified that the instrument looked as if it was valid to measure the concept it aimed to measure (Grove et al., 2013: 394). This procedure may be valuable in the instrument development procedure in relation to ensuring readability and clarity (Brink et al., 2012: 168). Face validity refers to whether the test looks valid to individuals who use and determine the test (Lapan & Quartaroli, 2009: 46). In this study, the researcher presented the questionnaire to expert nurses and was able to establish that the instrument measured what it was supposed to.

3.11.2 Reliability

Reliability refers to the repeatability, constancy and stability of a data collection instrument (Wood & Ross-Kerr, 2011: 184; De Vos et al., 2005: 162). This means that if a similar variable is measured in similar conditions, a reliable measurement technique will produce similar results (De Vos et al., 2005: 162). The technique of measuring variables must be reliable to reveal true differences (Burns & Grove, 2009: 222). A measure is a reliable measure if it gives a similar result each time under the same conditions or when the same issue is measured (Burns & Grove, 2009: 222). Basically, if it is reliable, you can be assured that all the items constituting the measure are reliable and that, if you were to use the measure again with the same persons, there would be a similar result (Lapan & Quartaroli, 2009: 62). In this study, test and retest reliability were carried out, and the correlation coefficient was measured from the results found

from the pilot study, the Cronbach's alpha coefficient was 0.706. In addition, with the assistance of a statistician Cronbach's alpha coefficient was calculated to determine the internal consistency of the instrument, and changes were made to the instrument, as recommended by Maree (2016: 239), that if a reliability of at least 0.6 is not obtained, adjustments should be made to the instruments. High- quality tests are important to evaluate the reliability of data completed in an examination or a research study, and this will confirm the stability or consistency of the instrument (Tavakol & Dennick, 2011: 53–54). As shown in Table 3.2, after making adjustments during the pilot study, the Cronbach's alpha coefficient was 0.706, which was acceptable for the study.

Table 3.2 Reliability of the instrument

Reliability statistics	
Cronbach's alpha	**N** of items
0.706	**68**

3.12 Ethical considerations

Ethical criteria are rules that provide direction for the choice of procedures and actions involved in directing research (Lapan & Quartaroli, 2009: 3). In this study, the proposal was submitted for ethics clearance to the Health and Wellness Sciences Research Ethics Committee, and it was approved under reference number: CPUT/HW-REC 2016/H25 (see Appendix A) and was renewed on an annual basis. In addition, the institution had been approached for support and permission was obtained to administer the study from the Head of Department of the School of Nursing (see Appendix B). The head of campus, the year level coordinator, and the lecturers of the different classes were contacted to request access to collect data from the students. Ethical decision making needs complex resolutions be made (De Vos et al., 2005: 68). The ethical principles were adhered to, these being autonomy, justice, beneficence, and non-maleficence, as described in the next section (Burns & Grove, 2009: 61).

3.12.1 Autonomy

Autonomy includes allowing each respondent to make an informed choice to participate or not, or to leave at any point in the research (Lapan & Quartaroli, 2009: 4). As a researcher, one treats respondents as independent agents by informing them about a proposed study and ensuring that they are able to voluntarily choose to participate or not. This was achieved by providing information to the prospective respondents, and asking them to voluntarily consent to participate, while informing them that participation in the study was not linked to their course

programme. On the day of administration of the anonymous questionnaire, the investigator gave each respondent a written clarification (see Appendix D) as well as a verbal explanation of what the study entailed, before he acquired written informed consent from respondents, as suggested by Sheryldene (2009: 10). The nursing students were told that taking part in this study was voluntary, and volunteers were invited to fill in the questionnaire. Respondents participated voluntarily and always had the ability to opt out of the research without any negative consequences, and they were all informed that they could leave at any time without any negative consequences (Lapan & Quartaroli, 2009: 96).

3.12.2 Confidentiality

Confidentiality refers to keeping member data or classifying information safe from exposure to any unauthorized person (Lapan & Quartaroli, 2009: 12). A key concern in survey research is confidentiality (Lapan & Quartaroli, 2009: 96; Brink, 2010: 51). This includes avoiding stealing of collected data (including capture of electronically transmitted data) and stopping unsuitable access by research helpers or others (Lapan & Quartaroli, 2009: 12). Another aspect to attend to is to ensure anonymity of the respondents, which means the respondent's identity cannot be linked with their individual responses, even by the investigator (Burns & Grove, 2009: 190). Respondents in the study were informed that data will stay confidential and be used for research purposes only. Confidentiality was maintained by using numerical codes rather than respondents' names in the questionnaire. As the investigator was conducting the research himself, he assured the respondents of the aforementioned (Van der Berg, 2009: 10). In this study, data were preserved in a locked cupboard that only the investigator had access to. Only the investigator, supervisor and statistician had access to the data from the study. All electronic data were password protected, and hard copies were kept in a locked cupboard, and will be saved for five (5) years after completion of the study, with only the supervisor and investigator having access to the cupboard. When the outcomes of the study are published, the respondents' and the institution's names will not be disclosed.

3.12.3 Justice

The principle of justice holds that human subjects should be treated fairly in all research (Burns & Grove, 2009: 188). Justice demands fair sharing of costs and benefits among persons and groups (Lapan & Quartaroli, 2009: 4). In this study, all students completing the second- to fourth-year nursing programme at the selected institution had equal opportunity to participate, and were all invited to participate, until the required sample size was achieved. There were no discriminatory practices in the selection of respondents. Those who did not want to participate were not forced to do so.

3.12.4 Beneficence and non-maleficence

The principle of beneficence underlies the determination of what good this study is going to do for anyone (Wood & Ross-Kerr, 2011: 214). It requires the investigator to do good, and especially to do no harm (Burns & Grove, 2009: 188). This is very important, and if there is any harm at all to the research respondent, the good must outweigh the harm (Wood & Ross-Kerr, 2011: 214). Although there was no personal benefit from participating in the study, the results of the study may be beneficial for the profession, as the nursing education institution may be able to use the outcomes of this study to enforce their strategies with regard to the management, prevention and reduction of SOIs.

The researcher ensured avoidance of harm and reduction of risks to research respondents, and attained a balance with regard to weighing of risks versus benefits (Wood & Ross-Kerr, 2011: 214). By adopting sound ethical principles and scientific approaches, the researcher protected the respondents from physical and psychological harm and mistreatment (Polit & Beck, 2014: 102). There were no known risks in this study, for example of physical harm to the students or victimization, and respondents voluntarily decided to participate; no respondent indicated any distress.

3.12.5 Privacy

Privacy is not only respect for confidentiality, although it implies this (Etzioni, 2010: 2). Privacy is an individual's right to regulate the time, degree, and general conditions under which individual information will be shared with or kept from others (Burns & Grove, 2009: 194–195). These data contain one's attitudes, politics, performances, ideas, and records (Burns & Grove, 2009: 195). This principle can be violated in a many ways, and investigators must keep in mind the importance of defending the privacy and identity of respondents, and of acting with consideration where the privacy of respondents is concerned (De Vos et al., 2005: 61). Data protection is both wider and more specific than the right to privacy (Etzioni, 2010: 2). Rules of privacy are whereby the identity and records of respondents in research are as far as possible kept private; no details about their identity are given without valid scientific and/or legal reasons, or without written consent from those concerned, or their representative, and after confirming that said contributor does not suffer from any form of adversity or stigmatization as a result of taking part in the research (Ananthakrishnan & Shanthi, 2017: 208). Written informed consent was received from the respondents (Appendix D) (Mbaisi et al., 2013: 24; Van der Berg, 2009: 10–11), and the researcher applied principles of privacy and protected respondents' data during data analysis. During data collection the lecturers were not in class, allowing student nurses to complete the questionnaires in privacy without an authority figure being present, and this was done as the students can be considered as a vulnerable population group and could be intimidated by their superiors being present. This provided free space for

the students to complete the questionnaire, as the researcher was an independent person who would not intimidate them.

3.13Limitations

Limitations are restrictions or problems in research that may reduce the generalizability of the findings (Burns & Grove, 2009: 41). Generally, when classifying limitations, the researcher must reflect the validity and reliability of all data collection methods, the generalizability of the sample to the population from which it was drawn, access to data, ethical problems, and the ability to control inessential factors in the environment and in respondents (De Vos et al., 2005: 118–119). Methodological limitations are weaknesses in the study design that could limit the credibility of the findings and restrict the population to which the findings can be generalized (Burns & Grove, 2009: 41). In this study, the investigator expects from the data collection methods will provide outcomes that reflect the true thinking of the population, if the respondents from the pilot study informed others about the questions in the questionnaire before the questionnaire was administered. It was planned to address this by making sure that the data collection was done finished in a short period of time, and by asking respondents not to talk about the questionnaire with other students. The study did not explore the respondents' views on SOIs among nursing students in depth, and restrictions in this study, leading to missing their information, absenteeism of some students on the specific days, inability of students to complete the questionnaire, and potential respondents declining to contribute to the study, may affect the representativeness of the collected data. Also, the researcher used only one health education institution; hence the outcomes of this study will not be representative of all nursing students.

3.14Summary

This chapter presented the research methodology and data collection approaches, reliability, validity, ethical considerations and limitations relevant to this study.

In the next chapter, the data analysis will be discussed in more detail and the findings will be presented by means of tables and graphs.

CHAPTER 4: PRESENTATION AND INTERPRETATION OF RESULTS

4.1 Introduction

In this chapter, the results of this study are presented, highlighting the link to the objectives of the study. The chapter presents analysis of the results of the 252 questionnaires collected in order to achieve the purpose of this study, which was to determine nursing students' knowledge and practices related to SOIs and is their management at a university in the Western Cape Province of South Africa.

The objectives of the study were:

- To determine nursing students' knowledge of risk of SOIs at a university in the Western Cape.
- To determine nursing students' use of prevention measures before the incident of an SOI at a university in the Western Cape.
- To determine the occurrence of SOIs among nursing students at a university in the Western Cape.
- To determine the reporting trends in cases of SOIs in actual practice after an incident among nursing students at a university in the Western Cape.
- To determine nursing students' awareness of management practices after SOIs at a university in the Western Cape.

In this chapter, the demographic information; respondents' knowledge of risk of SOIs; respondents' use of prevention measures before an incident of SOI; occurrence of SOIs among respondents; reporting trends in cases of SOIs in actual practice after an incident; and the respondents' awareness of the management practices after an SOI are discussed. Descriptive statistics, tables and figures are used to present the results.

A total of 252 questionnaires were collected from the undergraduate nursing students at a university in the Western Cape Province. Most of the questionnaires were completed in full, with a small number presenting missing data in some sections, which will be discussed. The researcher included all 252 questionnaires in the interpretation of the results, because the missing data did not affect the analysis.

4.2 Demographic information

4.2.1 Age, gender, year of study, marital status and religion of respondents

The average age of the respondents was 24 years (±SD=5, N=247), although five respondents did not indicate their age. The youngest respondents were 19 years old (n=14), while the oldest respondent was 46 years old. Most of the respondents (87% n=215) were between 19 and 27

years of age, as detailed in Table 4.1. This reflects the ages of the nursing students at a university in the Western Cape, which is supported by SANC statistics that reveal an average age of 23 years for nursing students (SANC, 2017a). As seen in Table 4.1, most of the respondents are female (83.7% n=211), with fewer males (15.9% n=40), and one transgender person (0.4% n=1).

Table 4.1 Age group, gender, year of study, marital status and religion of respondents

Variables	Categories	Frequency	Percentage
Age group (N= 247)	19–27	215	87.0
	28–36	20	8.1
	37–46	12	4.9
Gender	Male	40	15.9
	Female	211	83.7
	Transgender	1	0.4
Year of study	2nd year	72	28.6
	3rd year	87	34.5
	4th year	93	36.9
Marital status	Single	229	90.9
	Married	16	6.3
	Divorced	3	1.2
	In a relationship	4	1.6
Religion	Islam	9	3.6
	Christian	207	82.5
	Traditional African	31	12.4
	Not religious	3	1.2
	Jehovah's Witness	1	0.4

The statistics in Table 4.1 reflect the marital status of the respondents in the sample used for the study. The majority of the 252 respondents were single (90.9%, n=229), with only 6.3% (n=16) reporting being married, 1.2% (n=3) being divorced and another 1.6% (n=4) in a relationship.

A total of 251 nursing student respondents indicated their religion, with only one respondent with missing information. As indicated in Table 4.1, most respondents (82.5%, n=207) were Christian, followed by traditional African religion followers (12.4%, n=31), those who followed Islam (3.6%, n=9), those who were not religious (1.2%, n=3), and one Jehovah's Witness (0.4%, n=1).

4.2.2 Respondents' gender and year of study

Although the distribution per year level was similar, the largest number of respondents were in their fourth year of study (36.9%, n=93), followed by third-year students (34.5%, n= 87) and second-year students (28.6%, n=72). As reflected in Table 4.2, there was a similar gender distribution for the three-year levels, with females forming the majority of student nurses in each year level.

Table 4.2 Gender and year of study of respondents

			Year of study			Total
			2nd year	3rd year	4th year	
Gender	**Male**	Count	14	14	12	40
		%	5.6	5.6	4.8	15.9
	Female	Count	58	73	80	211
		%	23.0	29.0	31.7	83.7
	Transgender	Count	0	0	1	1
		%	0.0	0.0	0.4	0.4
Total		Count	72	87	93	252
		%	28.6	34.5	36.9	100.0%

4.3 Respondents' knowledge of risk of SOIs

In this section of the report, information related to the pre-injury phase of the framework is presented, which relates to the first research objective of the study, that set out to determine the nursing students' knowledge of risk of SOIs at a university in the Western Cape.

4.3.1 Respondents' knowledge of risk of SOIs

To establish respondents' knowledge of risk of SOIs, the questions were presented in the form of binary responses. As illustrated in Table 4.3, of the 252 respondents, 75.8% (n=191) knew that needles should not be recapped after use, while almost a quarter of respondents (24.2%, n=61) did not know this. Most of the respondents (97.6%, n=246) considered SOIs as a risk for harm. All respondents knew that SOIs can result in transmission of diseases such as HIV, HPB and HPC.

Table 4.3 Respondents' knowledge of risk of SOIs

Statements		No		Yes	
		Count	%	Count	%
Needle should be recapped after use		191	75.8	61	24.2
SOIs are a risk for harm		6	2.4	246	97.6
SOIs can result in transmission of diseases e.g., HIV, HPB, HPC		0	0.0	252	100.0
Examples of SOIs.	Bite	209	82.9	43	17.1
	Splashes into mucous membrane	220	87.3	32	12.7
	Needle-stick via skin	8	3.2	244	96.8
	Scratches	206	81.7	46	18.3
	Scalpel injuries	112	44.4	140	55.6
	Scissor injuries	73	29.0	179	71.0
	Elevators injuries	244	96.8	8	3.2
	Stab with clean needle	109	43.3	143	56.7

Table 4.3 also indicates what the respondents consider to be examples of SOIs. Most respondents (96.8%, n=244) correctly identified needle-stick via skin as an example of an SOI, followed by 71% (n=179) identifying scissor injuries as an example of SOIs, with 56.7% (n=143) and 55.6% (n=140) identifying being pricked with a clean needle and scalpel injuries, respectively, as examples. However, other respondents poorly understood what constitutes an SOI, and 18.3% (n=46) considered scratches as an example, while 17.1% (n=43) considered bites, 12.7% (n=32) splashes into mucous membrane, and 3.2% (n=8) injury by elevators to be examples of SOIs.

4.3.2 Respondents' perceptions of risk of contracting BBPs during clinical learning

Figure 4.1 highlights respondents' feelings about risk of contracting BBPs such as HIV, HBV and HCV during clinical learning. Only 46.03% (n=116) agreed that there is a high risk, followed by 35.71% (n=90) who stated that while there is a high risk of contracting BBPs, they take all preventive measures. A further 13.89% (n=35) agreed that there is high risk but they take some preventive measures, whereas a very small percentage of respondents (3.57%, n=9) believed there is very little risk. Only 2 respondents (0.79%) never thought about the risk of contracting BBPs.

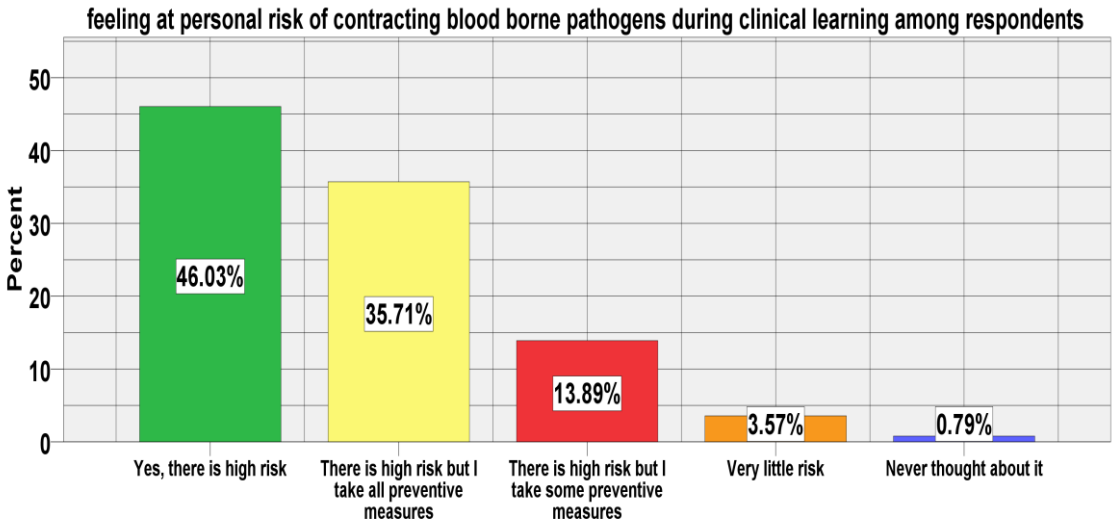

Figure 4.1 Views regarding personal risk of contracting blood-borne pathogens.

4.4 Respondents' use of prevention measures before incident of an SOI

This section provides results on respondents' prevention practices, in line with the second research objective of the study aimed at determining nursing students' use of prevention measures before the incident of an SOI at a university in the Western Cape. This still falls within the pre-injury phase of the framework used in this study. Prevention practices included obtaining vaccination against HBV, adherence to the universal precaution's guidelines, using PPE, and proper and safe disposal of needles. The majority of respondents (77.38%, n=195) indicated that their vaccinations against HBV remained incomplete, while only 15.87% (n=40) indicated having received full vaccination for HBV, and 6.75% (n=17) reported having had no vaccination against HBV, as illustrated in Figure 4.2.

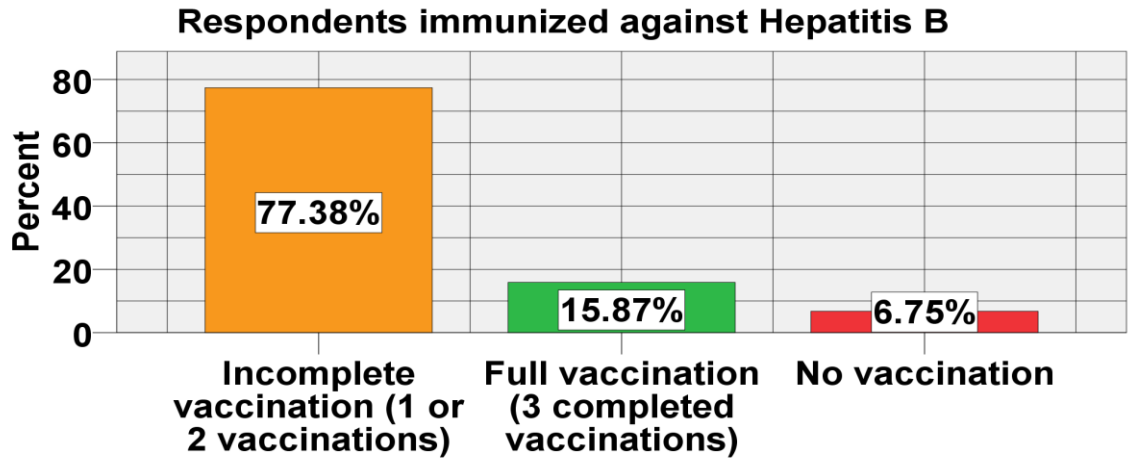

Figure 4.2 Vaccination against HBV among respondents.

4.4.1 Knowledge and practices of respondents regarding universal precautions

The majority of respondents (98%, n=247) knew that health institutions provide PPE, and 91.7% (n=231) had knowledge of the precautionary rules related to the prevention of blood-borne infections, while the remainder (8.3%, n=21) did not know, as illustrated in Table 4.4. Even though the majority of respondents knew that the facilities were responsible for providing PPE such as gowns, gloves, masks, eyewear and aprons, respondents still did not always wear double gloves, as recommended by the WHO and CDC (Alter et al., 1998: 19; WHO, 2009). When probed about the reasons for not wearing double gloves, the majority (72.2%, n=182) reported insufficient gloves at the facility as the main reason for not routinely doing so. More than a third (36.9%, n=93) of respondents indicated that the institution or facility prohibits double-gloving (see Table 4.4). Few other reasons for non-double gloving were provided in the study; for example, just under a quarter of respondents (23%, n=58) indicated that manipulating instruments when using double gloves was challenging, and 31 respondents (12.3%) cited an allergy to latex as a reason for not gloving. Another 10.3% (n=26) indicated that double-gloving results in hand tingling (see Table 4.4).

Table 4.4 Knowledge and practices of respondents regarding universal precautions

Statement		No		Yes	
		Count	%	Count	%
Have knowledge about the universal precaution guidelines related to prevention of blood-borne infections after SOIs		21	8.3	231	91.7
Have knowledge that health institutions provide PPE such as gowns, gloves, masks, aprons and eyewear		5	2.0	247	98.0
Reasons given by respondents who did not routinely wear double gloves	The facility does not have enough gloves	70	27.8	182	72.2
	The facility has enough gloves but cannot find a size that fits	199	79.0	53	21.0
	Inability to manipulate instruments when wearing double gloves	194	77.0	58	23.0
	Double-gloving changes the sensation, resulting in hand tingling	226	89.7	26	10.3
	Because of latex allergy	221	87.7	31	12.3
	The institution prohibits double-gloving	169	67.1	83	32.9
	Do not know	226	89.7	26	10.3

4.4.2 Respondents' use of PPE and needle disposal before an incident of an SOI

The study investigated respondents' use of PPE before an incident of an SOI (see Table 4.5). The questions were answered on a four-option Likert scale. Of the 252 respondents, the majority (65.5%, n=165) indicated ‘always’ using PPE for every action involving handling of blood and body fluid secretions. However, 22.6% (n=57) of respondents indicated 'usually’ using it, and the remainder (11.9% n=30) only ‘sometimes’ used PPE for actions involving handling of blood and body fluid secretions.

Table 4.5 Respondents' use of prevention measures before incident of an SOI

Statement	Always		Usually		Sometimes		Never	
	Count	%	Count	%	Count	%	Count	%
Respondent uses PPE for every activity involving handling of blood and body fluid secretions	165	65.5	57	22.6	30	11.9	0	0.0
After using the needle do you recap the needle before disposal?	39	15.5	16	6.3	28	11.1	169	67.1
After using a needle, I dispose of it in a sharp object container	223	88.5	13	5.2	10	4.0	6	2.4

Kommogldomo (2016: 58) and Franklin (2009: 29) highlight that the practice of universal precautions states that needles should never be recapped after use, and that health care institutions should provide sharp object disposal containers. Table 4.5 shows respondents’ practices with regard to needle recapping and disposal. Just over two-thirds (67.1%, n=169) of respondents indicated that they never recap the needle, as per good practice, while 15.5% (n=39) ‘always’ do recap the needle after use; 11.1% (n=28) and 6.3% (n=16) indicating doing so sometimes or usually, respectively.

In this study, the majority of respondents (88.5%, n=223) indicated that they ‘always’ use sharp object disposal containers, while a smaller portion of respondents did so to varying degrees, with 5.2% (n=13) ‘usually’, 4% (n=10) ‘sometimes’, and 2.4% (n=6) never using a sharp object disposal container.

In terms of where needles are placed after use when a sharp object container is not used, of the small portion (n=29) of respondents who indicated that they do not dispose of needles into sharp object containers, 8.33% (n=21; N=252) of respondents disposed of needles in a kidney

dish. However, 1.98% (n=5; N=252) indicated disposal in rubbish bin, and 1.19% (n=3; N=252) put the used needles into their pockets (see Figure 4.3).

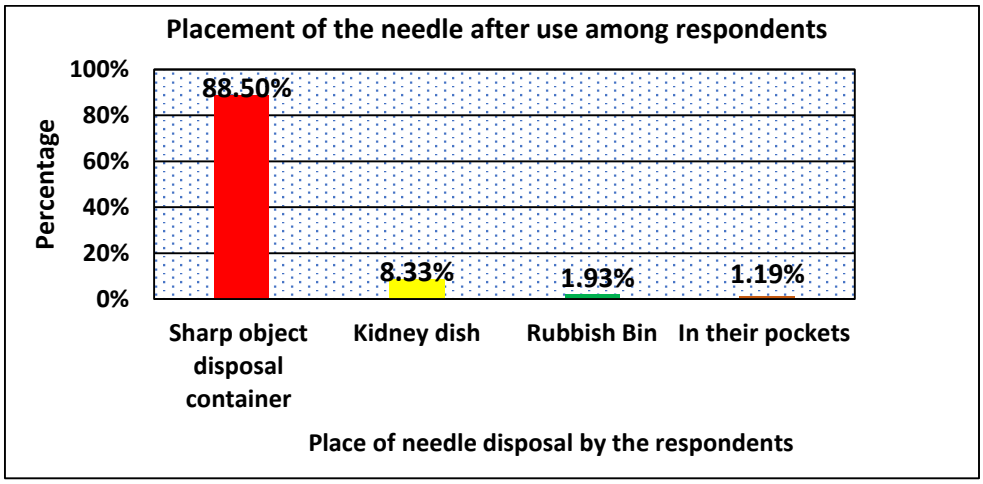

Figure 4.3 Respondents' indications of place of disposing of needles.

4.4.3 Respondents' reasons for not using PPE in activities involving the handling of blood and body fluid secretions

Respondents were asked about the reasons why they did not always use PPE in activities involving handling of blood and body fluid secretions. Of the 252 respondents, 87 (34.5%, n=87) respondents confirmed that they did not use PPE in all activities. Almost half of this group (49.4%, n=43; N=87) indicated unavailability of PPE at the institution (see Table 4.6). A further 21.8% (n=19; N=87) cited heavy workload as a reason, whereas 14.9% (n=13; N=87) did not see the need for PPE. Only 10.3% (n=9; N=87) regarded PPE as uncomfortable, whereas 3 respondents (3.4%, n=3; N=87) indicated not knowing about PPE (see Table 4.6).

Table 4.6 Respondents' reasons for not using PPE in activities

Respondents' reason for not always using PPE for every activity involving handling of blood and body fluid secretions	Frequency (N=87)	%
PPE not available at the institution	43	49.4
Heavy workload	19	21.8
I don't see the need for PPE	13	14.9
PPE is uncomfortable	9	10.3
Do not know	3	3.4

4.5 Occurrence of SOIs among respondents

This section presents information related to the reported occurrences of SOIs by the respondents, and is guided by the third research objective of the study and in line with the injury phase of the framework used. The relevant objective was to define the occurrence of SOIs among nursing students at a university in the Western Cape.

4.5.1 Occurrence of SOIs among respondents

Of the respondents in this study, 25% (n=63; N=252) reported having experienced an SOI event (see Figure 4.4). Similar to the gender distribution of the sample, of the 63 students that experienced an SOI, most were female (84.1%, n=53) and the remainder were male (15.9%, n=10).

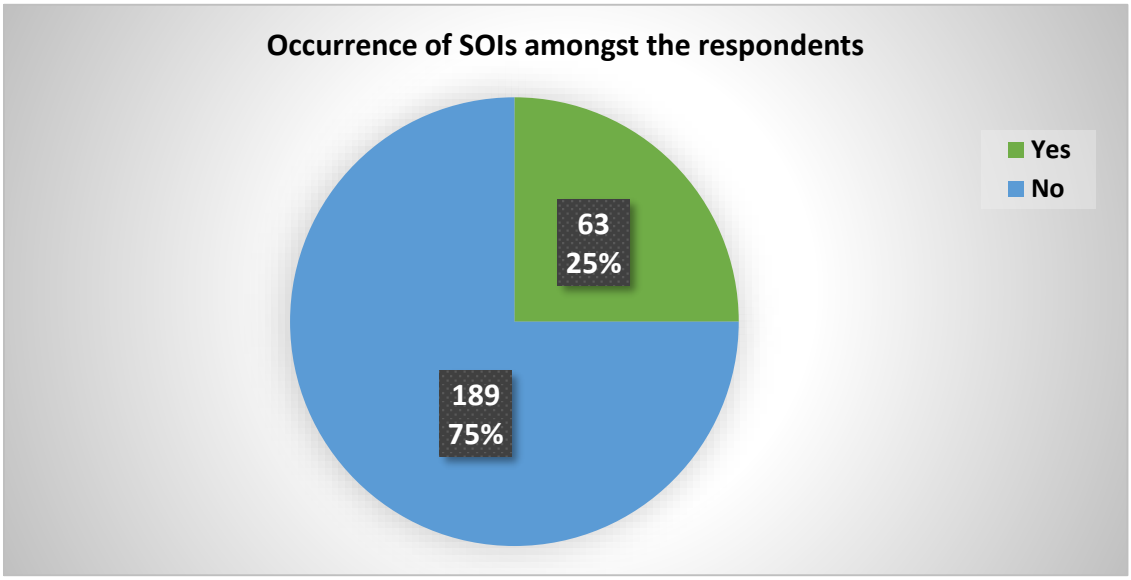

Figure 4.4 Report of occurrence of SOIs by respondents.

4.5.2 Exposure to SOIs across years of study and the number of SOI incidents

As seen in Table 4.7 (see below), there was a similar distribution in the occurrence of SOIs in the three years of study that were included, with the fourth-year students reporting a slightly higher percentage of 28% (n=26; N=93), with reports of 23.6% (n=17; N=72) and 23% (n=20; N=87) for the second- and third-year level students, respectively. No statistically significant differences were noted (p=0.7).

Table 4.7 Year of study of respondents with occurrences of SOIs

Year of study		Have you ever had an SOI?		Total
		No	Yes	
2nd year	Count	55	17	72
	%	76.4	23.6	100.0
3rd year	Count	67	20	87
	%	77.0	23.0	100.0
4th year	Count	67	26	93
	%	72.0	28.0	100.0

Of the 63 (25%; N= 252) respondents who indicated having had an SOI, the majority (73.02%, n=46; N=63) had experienced only one incident of SOI, while 17.46% (n=11; N=63) and 6.35% (n=4; N=63) reported having had two or three SOIs, respectively. Only one respondent (1.59%, n=1; N=63) indicated having had four SOIs, and one respondent also reported more than 10 incidents of SOIs (see Table 4.8 and Figure 4.5).

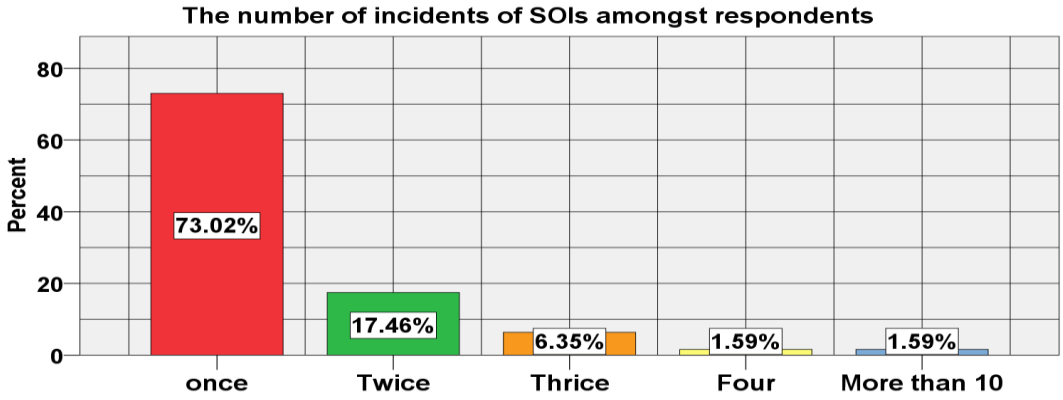

Figure 4.5 Respondents' number of times exposed to an SOI.

As illustrated in Table 4.8, The number of SOIs incidents per year level also shows that a single incident of SOI was more common in all year levels, with only one fourth year respondent indicating four incidents, and one third year respondent indicating more than ten incidents of SOIs.

Table 4.8 Number of times respondents were exposed to SOIs per year level

Number of SOI incidents		Year of study			Total
		2nd year	3rd year	4th year	
One	Count	11	14	21	46
	%	17.5	22.2	33.3	73.0
Two	Count	4	3	4	11
	%	6.3	4.8	6.3	17.5
Three	Count	2	2	0	4
	%	3.2	3.2	0.0	6.3
Four	Count	0	0	1	1
	%	0.0	0.0	1.6	1.6
More than 10	Count	0	1	0	1
	%	0.0	1.6	0.0	1.6
Total	Count	17	20	26	63
	%	27.0	31.7	41.3	100.0

4.5.3 Activities respondents were involved in during SOI occurrence

In this study, respondents reported being implicated in different activities at the time of the SOI incident, with 17 (27%, N=63) respondents reporting having had more than one incident of SOI. Administration of medication by injection was the activity most often reported as leading to the occurrence of SOIs, accounting for over three-quarters of the reported SOIs (76.2%, n=48; N=63). Just less than half of the respondents who had an SOI (44.4%, n=28; N=63) indicated that the SOI occurred during recapping of needles, while almost a quarter (23.8%, n=15; N=63) reported occurrence of SOIs while taking blood samples. Only four respondents (6.3%, n=4; N=63) reported occurrence of SOIs while removing stitches, and two (3.2% n=2; N=63) had an SOI during a suturing procedure, as illustrated in Figure 4.6. Individual respondents (n=8) each indicated that other activities associated with occurrence of SOIs were extraction of saline with a clean needle and testing for haemoglobin.

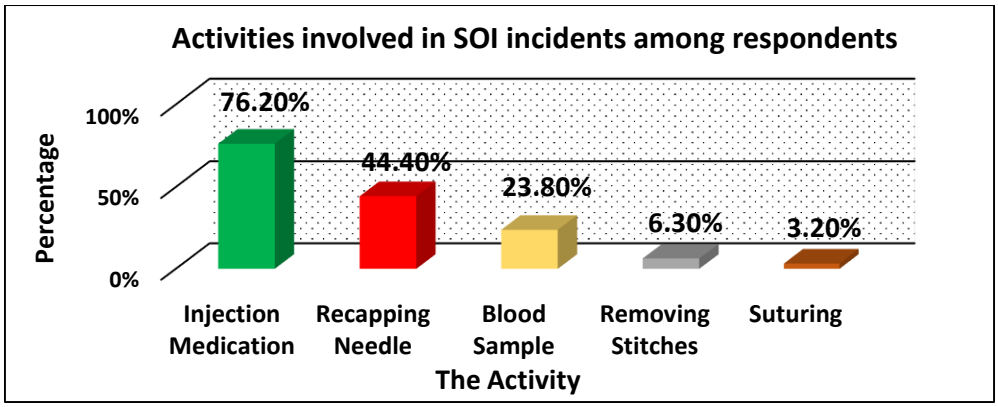

Figure 4.6 Respondents' activities leading to SOIs.

4.5.4 Instruments involved in SOI incidents among respondents

In terms of identifying the instruments that caused the SOI, as illustrated in Figure 4.7, most respondents indicated needles or hollow-bore needles (90.47%, n=57; N=63), followed by scissors (17.46%, n=11; N=63), and injection IV lines (12.69%, n=8; N=63), as well as placing a blade in a scalpel (7.93%, n=5; N=63). Individual respondents (n=5) each indicated that other instruments causing injury were glass material and a vial.

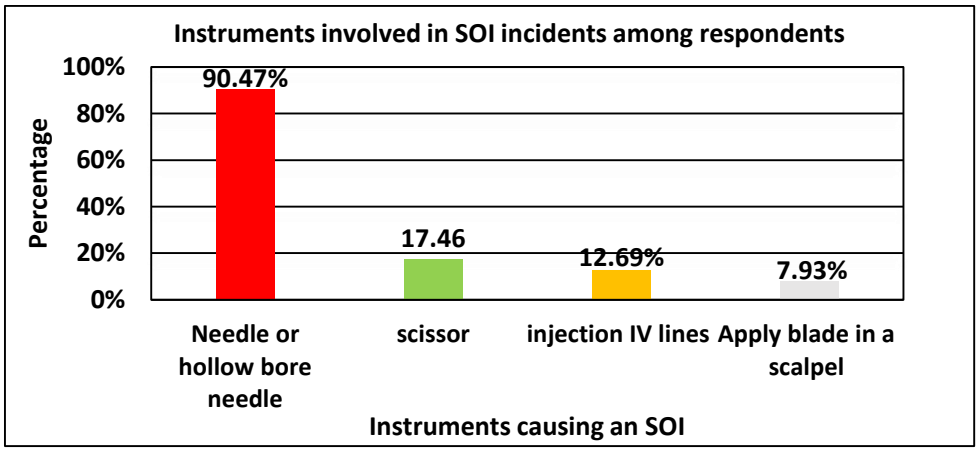

Figure 4.7 Instruments that caused injuries to the respondents (N=63).

4.5.5 Respondents' feelings after exposure to an SOI

This section relates to the feelings experienced by respondents after occurrence of SOIs and fits in with the injury phase in the Haddon matrix. Of the 63 respondents who had SOIs, 66.7% (n=42) experienced a feeling of fear after being exposed to SOIs, followed by anxiety (49.2%, n=31) as well as depression (23.8%, n=15). One (1.6%) stated that they hated the work and started being absent from it (see Figure 4.8). Individual respondents (n=8) each indicated other feelings after being exposed to an SOI, including indifference and irritation.

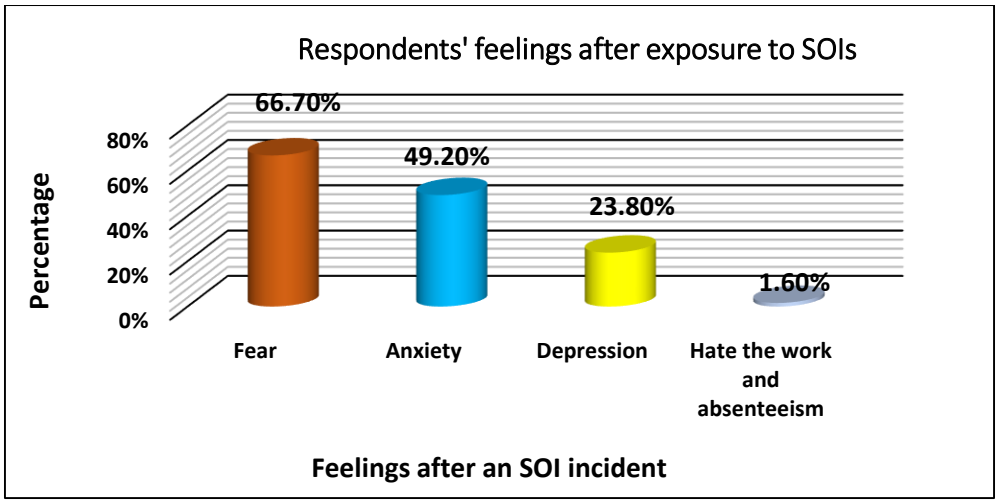

Figure 4.8 Respondents' feelings after exposure to an SOI (N=63).

4.6 Reporting trends of respondents after incident of SOI in actual practice

The occurrence of an SOI necessitates reporting the incident for further management and record keeping. This section presents information related to the trends in reporting of SOIs by respondents; it is linked to the fourth research objective of the study, and falls within the post-injury phase of the framework used.

4.6.1 Trends in reporting of SOI incidents by respondents

In terms of reporting an SOI, just two-thirds of respondents who had an SOI (66.67%, n=42; N=63) indicated that they reported it, while a third (33.33%, n=21; N=63) did not report it (see Figure 4.9). In terms of respondents who had the highest reporting rate, fourth-year students accounted for the majority (27%, n=17; N=63), followed by second-year students (20.6%, n=13; N=63) and lastly, third-year students (19%, n=12; N=63) (see Table 4.9). Females appear to be the highest reporters of SOI incidents (90.5%, n=38; N=42), followed by males (9.5%, n=4; N=42). However, this may be attributed to the fact that females accounted for 83.7% (n=211) of the total population (252), whereas males only accounted for 15.9% (n=40).

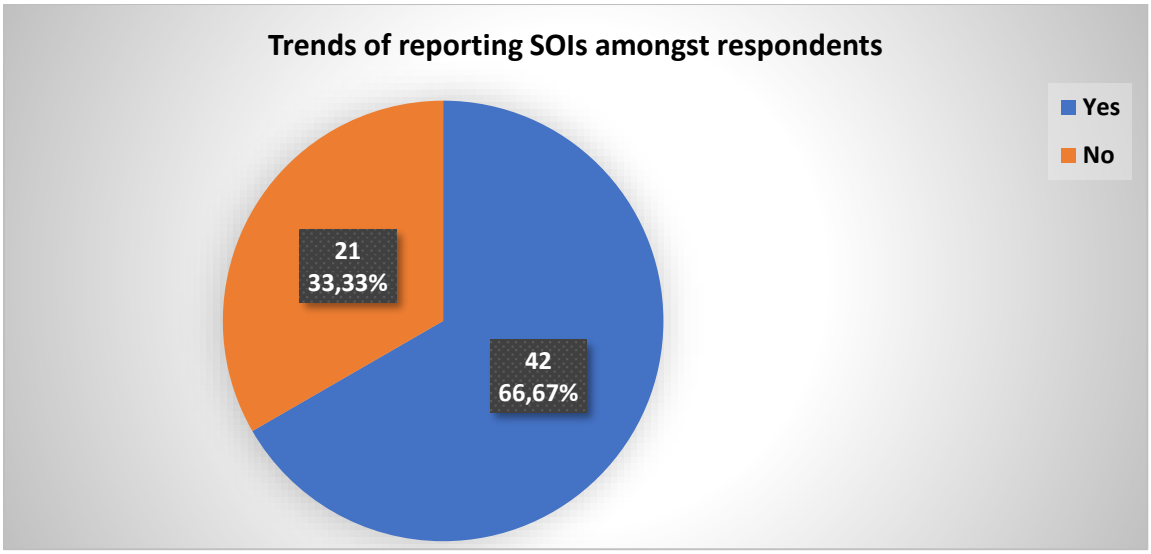

Figure 4.9 Reporting and non-reporting trends among respondents after an SOI incident (N=63).

4.6.2 Respondents' reporting trends across years of study

Table 4.9 highlights the trends in reporting and non-reporting of SOIs among respondents. A third of respondents (33.3%, n=21; N=63) did not report the SOI incident across the three years. The majority of those who confirmed not reporting the SOI incidents were fourth-year students (14.3%, n=9; N=63), followed by those in the third year of study (12.7%, n=8; N=63), with a minority of four respondents (6.3%, n=4; N=63) in the second year (see Table 4.9). The differences were not statistically significant (p=0.6)

Table 4.9 Year of study of respondents in reporting of SOI

Year of study		Did you report the injury to anyone?		Total
		No	Yes	
2nd year	Count	4	13	17
	%	6.3	20.6	27.0
3rd year	Count	8	12	20
	%	12.7	19.0	31.7
4th year	Count	9	17	26
	%	14.3	27.0	41.3
Total	Count	21	42	63
	%	33.3	66.7	100.0

4.6.3 Persons to whom the SOIs were reported

In terms of who the SOIs are reported to, more than half (59.52%, n=25; N=42) of the respondents reported to the Professional Nurse (PN) in charge (see Figure 4.10), while some (19.05%, n=8; N=42) confirmed reporting to fellow students. Only four respondents (9.52%, n=4; N=42), reported SOIs to the clinical supervisor, whereas two (4.76%) reported to the teacher. Another two (4.76%) indicated reporting to the manager and mentor of the community health centre, and only one respondent (2.38%) reported it to the matron of the hospital.

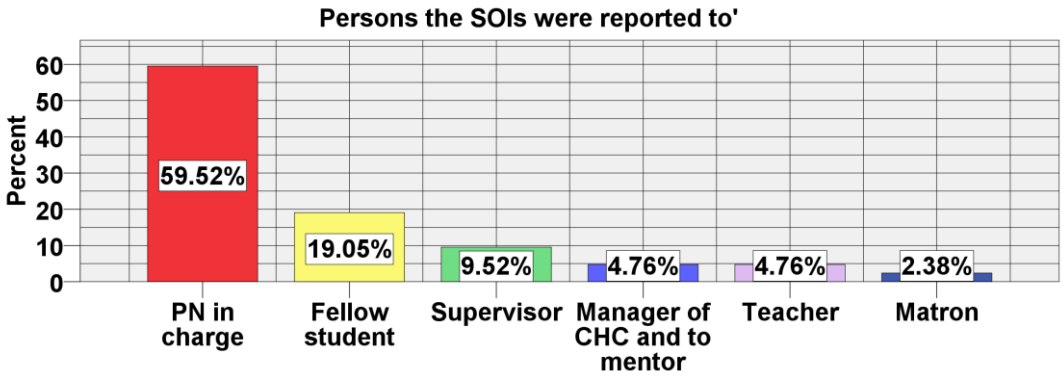

Figure 4.10 Persons who received the reports of an SOI (N=42).

4.6.4 Reasons for not reporting SOI incidents

In terms of reasons for not reporting an SOI incident, 15 (71.43%) out of 21 respondents who did not report the SOI incident believed that there was little to no risk involved in not reporting it, while two respondents (9.52%; N=21) cited fear of job loss and being too busy as reasons. Only one respondent (4.76%) stated absence of a reporting system at the facility as a reason and another one gave fear of stigma as the reason (see Figure 4.11).

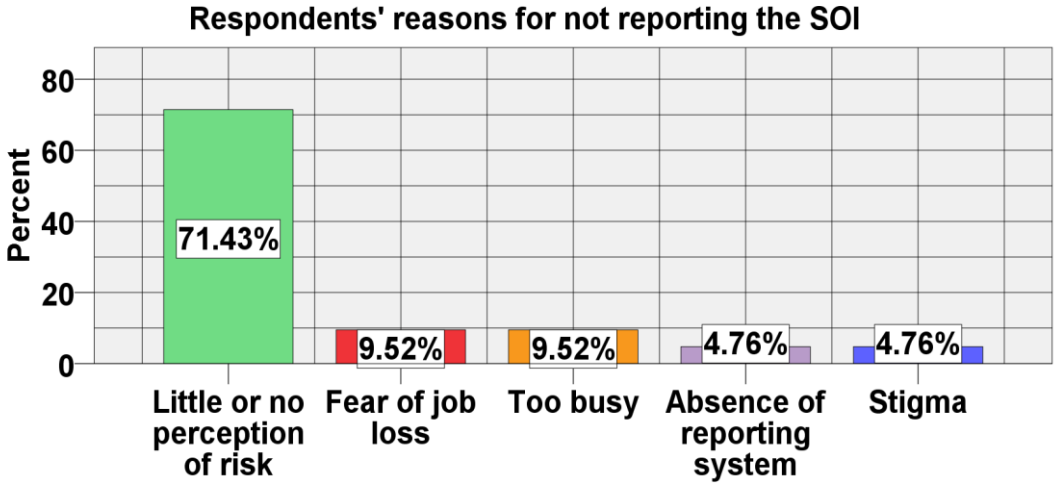

Figure 4.11 Respondents' reasons for non-reporting of SOI (N=21).

4.7 Respondents' awareness of the management practices after an SOI

In this section of the study, information related to the post-injury phase of the framework is presented. This relates to the fifth research objective of the study, which focuses on nursing students' awareness of the management practices after an SOI at a university in the Western Cape.

4.7.1 Respondents' actions post-SOI

Respondents were asked to indicate their immediate actions following an SOI, and most respondents (66.7%, n=42; N=63) indicated squeezing the puncture site, whereas 63.5% (n=40; N=63) immediately washed the injury with soap and water. Fifteen respondents (23.8%, n=15; N=63) cleaned the area with antiseptic, while only five respondents (7.9%, n=5; N=63) did nothing after an SOI (see Figure 4.12).

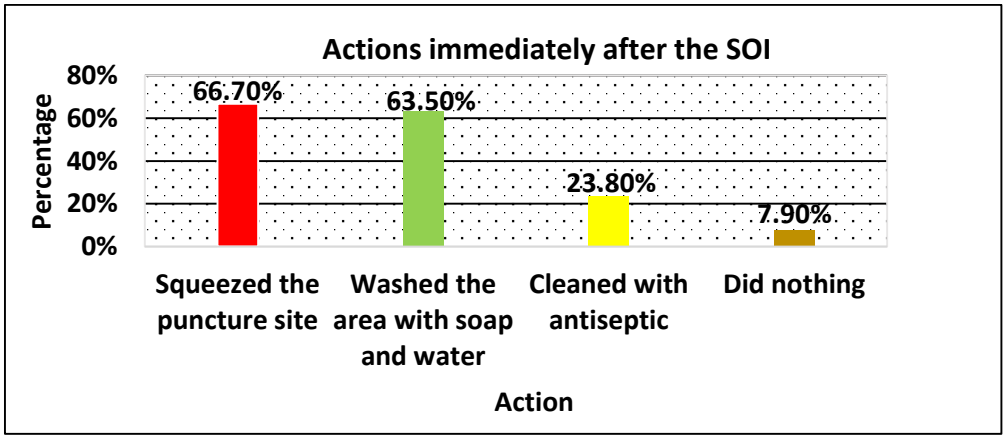

Figure 4.12 Respondents' actions immediately after an SOI (N=63).

4.7.2 Blood tests after the SOI

One of the activities to be undertaken following an SOI is for the injured person to go for blood tests. Of the 42 respondents that reported having had an SOI, just over half (52.4%, n=22; N=42) reported having blood tests done after the SOI, while the remainder (47.6%, n=20; N=42) indicated not doing blood tests (see Figure 4.13). This means that just less than half of the respondents who reported the SOI did not go for blood testing, thus placing their lives at risk – in addition to the 21 respondents who did not even report the SOI incident. That translates into 65% (n=41, N=63) of the respondents who had an SOI that did not have their blood tested for further management.

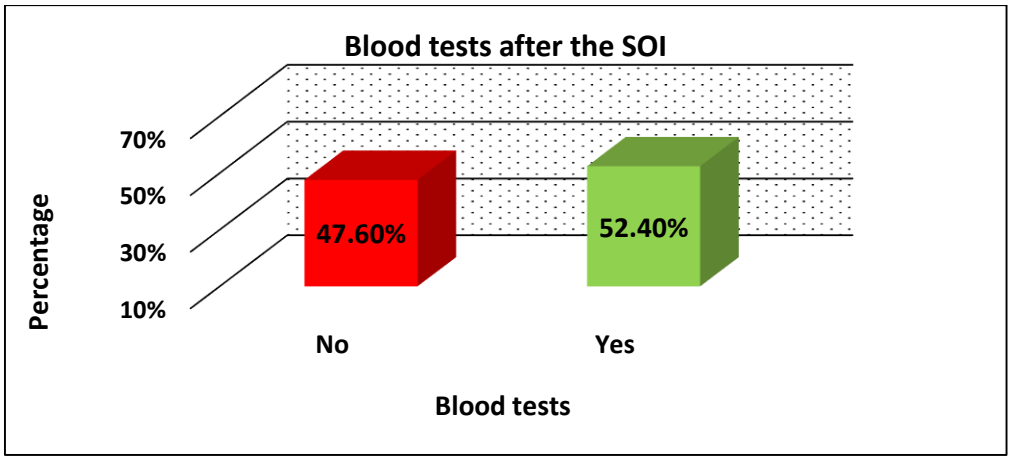

Figure 4.13 Blood tests performed after the SOI (N=42).

4.7.3 Blood tests after SOI, per year of study

In terms of year of study, the results showed that mainly fourth-year students (54.5%, n=12; N=22) went for blood tests, followed by second-year students (27.3%, n=6; N=22) and then third-year students (18.2%, n=4; N=22) (see Figure 4.14). Although this may indicate that the second and third-year students may not be fully aware of the importance of blood testing after an SOI incident, no significant differences were noted (p=0.1).

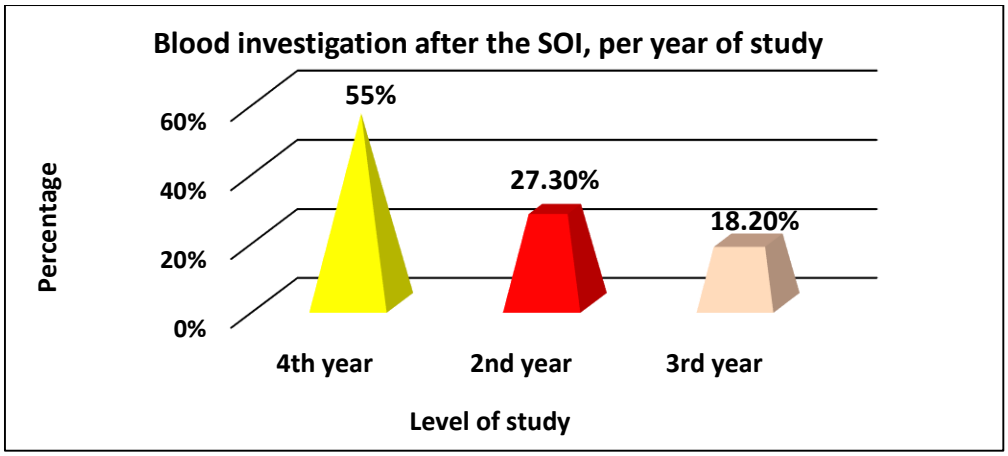

Figure 4.14 Blood tests after the SOI, per year of study (N=22).

4.7.4 Accessing PEP after an SOI

Post-exposure prophylaxis (PEP) refers to taking antiretroviral treatment after being potentially exposed to HIV, in order to prevent becoming infected with HIV. Of the 63 respondents who experienced an SOI, only a quarter of this group accessed the PEP (25.40%, n=16; N=63), whereas the majority (74.60%, n=47; N=63) indicated not accessing PEP following an SOI incident (see Figure 4.15). As illustrated in Figure 4.9, only 42 respondents (66.7%, n=42; N=63) confirmed reporting the SOI occurrence. This means that only 38% (n=16; N=42) of those who reported the SOI incident had access to PEP and the remainder did not, as illustrated in Figure 4.15.

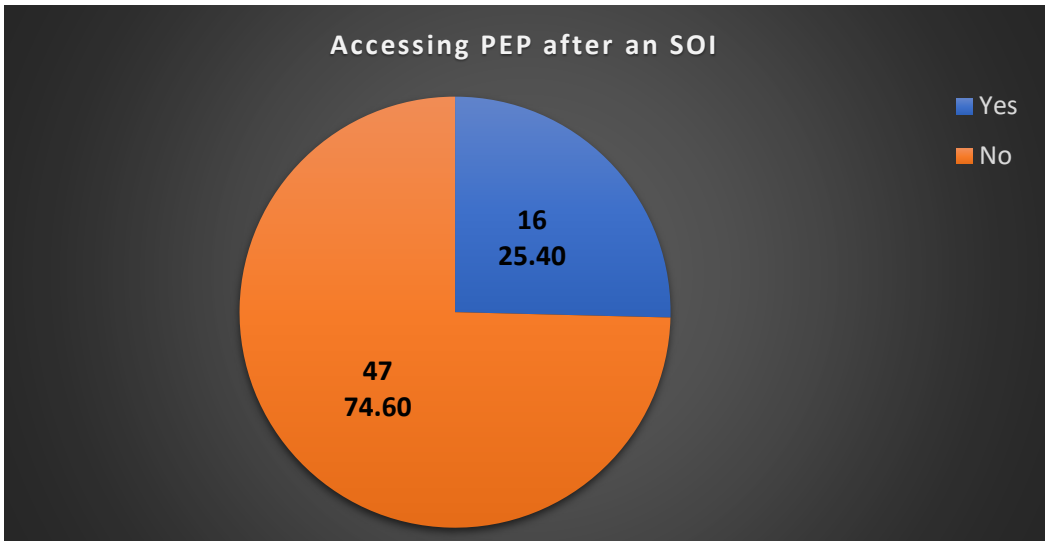

Figure 4.15 Respondents who accessed PEP after an SOI (N=63).

4.7.5 Reasons for not receiving PEP after SOI occurrence

The main reasons given for not accessing PEP were noted as fear of side effects of PEP (38.29%, n=18; N=47), and being too busy (31.91%, n=15; N=47), while a few indicated that they forgot to do so (29.78%, n=14; N=47) (see Table 4.10). The majority of respondents (87.5%, n=14; N= 16) who indicated access to PEP (N=16) confirmed receiving antiretrovirals for HIV, whereas 6.28% (n=1; N=16) received PEP for HPB. Only 6.28% (n=1; N=16) indicated access to Neurontin, and it was noted that 93.75 % (n=15; N=16) did not complete the PEP (see Table 4.10).

Table 4.10 Types of PEP and reasons for receiving and not receiving PEP

Variables	Categories	Frequency	Percentage
Type of PEP among respondents	28 days' course of antiretrovirals	14	87.5
	PEP for Hepatitis	1	6.25
	Neurontin	1	6.25
Completion of the PEP among respondents	No	15	93.75
	Yes	1	6.25
Respondents' reasons for not getting the PEP	Too busy	15	31.91
	Forgot	14	29.78
	Fear of treatment side effects	18	38.29

4.7.6 Respondents' ranking of activities after SOI exposure

In terms of order of activities following SOI exposure, the majority (69.4%, n=168; N=242) of respondents indicated squeezing the puncture site as the first activity, while (55.1%, n=135; N=245) ranked washing the area with soap and water as the second action after SOI exposure. Third ranking among respondents (58.4%, n=142; N=243) was cleaning the injury site with antiseptic, with 59.6% (n=149; N=250) ranking the reporting procedure as the fourth action. Going for blood tests was ranked as the last action (68%) (see Table 4.11).

Table 4.11 Ranking of respondents' order of activities of management

Order of activity following an SOI	1st activity	2nd activity	3rd activity	4th activity	Last activity	N
Squeeze the puncture site	**168** **69.4%**	40 16.5%	19 7.9%	6 2.5%	9 3.7%	242
Wash the area with soap and water	59 24.1%	**135** **55.1%**	29 11.8%	17 6.9%	5 9%	245
Clean the injury site with antiseptic	4 1.6%	45 18.5%	**142** **58.4%**	27 11.1%	25 10.3%	243
Start reporting procedure	14 5.6%	21 8.4%	38 15.2%	**149** **59.6%**	28 11.2%	250
Go for blood tests	4 1.6%	8 3.2%	20 8.1%	47 19 %	**169** **68%**	248

4.8 Summary

This chapter highlighted the findings of the study and was arranged according to the objectives. The results showed that respondents had some knowledge about SOI occurrence and the importance of PPE, but the majority of respondents indicated that protective equipment was sometimes insufficient at their facility. Institutional management plays a role in the use of PPE among respondents, and this was noted from 93 (36.9%) respondents who stated that they were not allowed to double glove at the facilities. The results also showed that respondents knew that sharp objects should be disposed of in a sharp object discarding container. However, a significant number (21, 8.3%) of respondents disposed of needles in a kidney dish.

In terms of frequency of SOI occurrence, the results showed that the majority of the 63 respondents who reported an SOI incident had at least one SOI, and that the most common activity involving SOI occurrence was administration of medication via injection, with the most common instrument involved in SOIs being needles or hollow-bore needles. In terms of trends in reporting of SOIs by respondents, over two-thirds of those who had an SOI incident confirmed reporting it; however, the remaining third did not. This means that one-third of SOI incidents are not reported. Furthermore, only a quarter of the respondents who confirmed experiencing an SOI gained access to PEP, leaving the majority of respondents without access to PEP.

Those who reported an SOI indicated that the first person that they informed was the PN. However, students preferred reporting to fellow students over their supervisors, teacher, managers and matrons. This means that management may not be aware of the rate of SOI

incidence at their health institutions and facilities. Reasons cited for not reporting the SOI included fear of being disciplined or dismissal. In terms of actions following an SOI, the majority indicated that they squeezed the puncture site. As for blood testing after SOI occurrence, over half confirmed doing blood tests, but the rest did not undergo these tests. Blood testing was mainly performed by fourth-year students, which means that that second- and third-year students may not be aware of the importance of blood testing after an SOI incident.

A discussion of these major findings follows in Chapter 5.

CHAPTER 5: DISCUSSION

5.1 Introduction

The previous chapter reported the key results of the study which were relevant to the objectives, and was guided by the conceptual framework used in this research. This chapter covers the interpretation and discussion of findings on the demographics of the respondents; respondents' knowledge of risk of SOIs; respondents' use of prevention measures before an incident of SOI; occurrence of SOIs among respondents; reporting trends in cases of SOIs in actual practice after an incident; and the respondents' awareness of management practices after an SOI.

The chapter is presented following a similar pattern to the previous chapter, and the interpretation and discussion are presented in terms of addressing the research objectives of the study. Links will be made to provide a comparison between the different aspects related to SOIs as covered in the study.

For ease of reference, the research objectives are listed below:

i. To determine nursing students' knowledge of risk of SOIs at a university in the Western Cape.
ii. To determine nursing students' use of prevention measures before an incident of an SOI at a university in the Western Cape.
iii. To determine the occurrence of SOIs among nursing students at a university in the Western Cape.
iv. To determine the reporting trends in cases of SOIs in actual practice after an incident among nursing students at a university in the Western Cape.
v. To determine the nursing students' awareness of the management practices after an SOI at a university in the Western Cape.

5.2 Characteristics of the study respondents

Three hundred (300) self-administered questionnaires were handed out to potential respondents, and 252 of them were returned. Most of the respondents were female (83.7%) and a minority (15.9%) were male. Similar proportions with regard to gender distribution in the nursing profession have been reported in the literature. For example, Singh et al. (2015: 231) reported by among 165 nursing students in Kathmandu University Hospital Dhulikhel, Kavre, Nepal, that the majority (86.1%) were female and the minority (13.9%) were male. A study conducted in Mauritius reported that over half (59.8%) of the nursing students were female and less than half (40.2%) were male (Subratty & Moussa, 2007: 315). This distribution of more females than males is expected when reviewing the statistics on students registered for the

R425 programme as regulated by the SANC as well as all nurses on the SANC register, and the nursing profession has traditionally been predominantly occupied by females, as reflected in the SANC statistics (SANC, 2017b). According to SANC (2017b) registration statistics, females students accounted for the majority of registrations (3046), followed by males students (289).

It is to be noted that, with the availability of more opportunities provided to women, more young women are entering the workplace annually (Barrett et al., 2011: 33–34). In this study, most of the respondents indicated their marital status as single (90.9%), and most were Christian (207, 82.5%). The fact that the majority of respondents were still young accounts for the high proportion of single respondents, and since Christianity is one of the predominant religions in South Africa, the same proportion is reflected in the sample in this study (Onadeko et al., 2017: 195).

Similar to the gender distribution, the age distribution of the sample used in this study is similar to that reflected in the SANC statistics on student nurses, which showed that the average age of nursing students was 28 years (SANC, 2018). A study by Laishram et al. (2013: 258) on the prevalence of SOIs among nurses in a tertiary care hospital reported that the over a third (38.8%) of nurses represented the age group 31-40 years. All respondents provided information on their age, and the majority of respondents (83.7%) were between the ages of 19 and 27 years, while 20 respondents were between the ages of 28 and 36 years. Only 12 respondents were between the ages of 37 and 46 years.

Similarly, other studies that investigated SOIs during practice found the main age group in nursing, dental and medical students in Pakistan, Saudi Arabia, Gauteng in South Africa, India, Brazil and Namibia to be the same as in this study, at 19-27 years (Amukugo et al., 2018: 5; Shah et al., 2018: 67; Prasuna et al., 2015: 439; El-Hay, 2015: 22; Souza-Borge s et al., 2014: 158; Tawil, 2013: 2469; Zungu et al., 2008: 48). The average age of nursing students was 24 years in studies by Amukugo et al. (2018: 5) and Tawil (2013: 2467), the same as in this study.

5.3 Respondents' knowledge of risk of SOIs

This section provides a discussion of respondents' knowledge of risk of SOIs and their knowledge of sharp objects. Knowledge of the risk of SOIs is directly related to how HCWs and nursing students would perform during clinical practice (Mbaisi et al., 2013: 11). For example, results from this study showed that almost a quarter (24.2%) of respondents did not know that they should not recap needles after use.

All of the respondents knew that SOIs can result in transmission of blood borne disease such as HIV, HBV and HCV infections. In the present study, the majority (97.6%, n=246) of nursing students considered SOIs as a risk for harm. Similarly, a study among HCWs in North India

reported that all respondents were aware of the risk for harm and that SOIs result in possible transmission of blood-borne infections (Kaur et al., 2014: 34).

Respondents' knowledge about identifying sharp objects was also established in this study. Sharps and needle-stick injuries are wounds caused by medical instruments such as needles, scalpels, blades and scissors (Arafa et al., 2016: 120). These instruments can accidentally puncture or cut the skin and cause small wounds in the skin, and may lead to the transmission of BBPs (Afridi et al., 2013: 90; Mbaisi et al., 2013: 11). Identification and knowledge of what constitutes an SOI is important for preventive strategies, so that HCWs and nursing students are aware of the risks they are exposed to. Most exposures in HCW are caused by percutaneous injuries with sharp objects contaminated with blood or body fluids, such as scalpels, needles, lancets and cracked glass (Prüss-Üstün et al., 2005: 482). Such events increase the risk of exposure to blood and body fluids, which has been noted as a significant occupational risk in the nursing profession (Powers et al., 2016: 4)

Results from this study showed that the majority (96.8%) of respondents correctly identified needle-stick injury via skin as an example of an SOI, followed by over two- thirds (71.0%) who indicated scissor injuries; more than half (56.7%) indicated stab with clean needle and scalpel (55.6%) as SOIs. This shows that respondents had a fairly good understanding of what constituted an SOI.

However, the results also indicate that there are still some gaps in the knowledge of the respondents, as some (17.1%) considered bites as SOIs, whereas 18.3% considered scratches as SOIs, which is contrary to what constitutes an SOI. Similar results were found in a study conducted among 230 dental students in a college of dentistry in Ajman, United Arab Emirates, where only 67% of students correctly defined an SOI, and almost half (49%) considered a bite to be an SOI (Jaber, 2011: 4).

5.4 Respondents' perception of risk of contracting BBPs during clinical learning

Knowledge of the risk of SOIs is important in clinical practice, as it often informs the manner in which respondents' practice (Fayaz et al., 2014: 536; Holla et al., 2014: 103; Singh et al., 2015: 231; Suliman et al., 2018: 26). The most often performed actions with risk of SOIs are intramuscular injection, taking blood samples, or during IV cannulation, and frequently replacing the cap on a previously used needle (Kebede et al., 2012: 1096). Minor sharp injury also has the risk of transmitting over 20 pathogens, such as HBV, HCV, and HIV/AIDS (WHO, 2016). Amukugo et al. (2018: 6) noted that nursing students in the clinical setting are at high risk of SOIs due to their relative inexperience of invasive actions; hence it is crucial that they are able to correctly identify their risk of SOI, which would facilitate implementation of prevention measures.

This study's results show that less than half of the respondents had a good understanding of the high risk of contracting BBPs during clinical learning. Similar results were found by Nophale (2009: 190), who also reported that just more than half (53%) of nursing students were aware of the occupational risk of contracting BBPs. Lemessa (2014: 18) reported that less than a quarter (22.7%) of students perceived a high risk of contracting BBPs.

Swe et al. (2014b: 126) also confirmed that over two-thirds (68.3%) of HCWs supposed themselves to be at very high risk of harm from acquiring HIV infection during their medical career. Similar findings that contact with needles may cause immense risks of contamination and blood borne diseases have been reported in other studies (Guglielmi et al., 2005: 257; Nawafleh et al., 2017: 67). However, a study in Pakistan conducted among 417 nursing students reported that a fair amount (22%) did not know the diseases can be transmitted by a contaminated needle (Aslam et al., 2010: 151).

A study by Onadeko et al. (2017: 194) conducted among HCWs in a university college hospital in Ibadan, Nigeria, showed that similar to this study, 40% of respondents reported a high occupational risk of contracting HIV infection. Gupta et al. (2008: 142) also reported that despite the occupational risk of contracting HIV among interns in India, just over half (55%) of them used preventive measures, whereas in this study only 35.7% indicated taking all preventative measures, with 13.9% taking some preventative measures. In contrast, Raghavendra and Viveki (2016: 3382) concluded in their study that the majority (82%) of medical interns perceived a high risk of occupational exposure to BBPs such as HIV.

5.5 Respondents' use of prevention measures before the incident of an SOI

Our study shows that despite knowledge of the occupational risk of contracting BBPs, nursing students did not take all preventive measures such as vaccinations, with less than one fifth reporting taking just some preventive measures. This may allude to the fact that there is a misalignment between awareness of the risk of contracting BBPs and the use of preventive measures to reduce that risk.

This study shows that only a few (15.87%) of the nursing students received complete vaccinations before the SOI incident; the majority (77.38%) had incomplete (either one or two out of three) vaccinations. All the respondents had completed their first year of training as nursing students, and were supposed to have completed the HBV vaccinations in their first year. Similar reports about low vaccination practices were reported by Arafa et al. (2016: 120), who focused on nurses' practice of control measures against BBPs and infection. Their results showed that only two-thirds (66%) had been vaccinated against HBV, while a third (34%) were still unvaccinated and prone to infection (Arafa et al., 2016: 120).

Engelbrecht et al. (2015: 23–28), also conducted a survey in the Free State (South Africa), and reported that less than a fifth (19.1%) of nursing students did not take preventive measures before the incident of an SOI, and were therefore not adequately protected against HBV. Similarly, a study in Turkey reported that the majority (87%) of students did not take preventive measures such as complete vaccination against HBV (Ozer & Bektas, 2012: 2). This becomes concerning, as many other authors have reported similar results (Norsayani & Hassim, 2003: 147–175; Franklin, 2009: 65; Sonkar et al., 2013: 4189; Lemessa, 2014: 5–19).

The risk of transmission of infection from those who are infected to non-immune people through an SOI has been estimated to be between 0.23% and 0.35% for HIV, between 5% to 10% for HCV, and 6% to 30% for HBV (WHO, 2014b: 19; Das et al., 2011: 88; Ali et al., 2009: 4). The results of this study show that an alarmingly low number of nursing students, nationally and globally, are not taking preventive measures such as full vaccinations against HBV and are consequently, exposed to the risk of contracting BBPs.

In addition to vaccination, the use of PPE is one of the preventative measures. The WHO (2014d: 1557–1558) recommends that PPE should protect the mucosae from contaminated droplets and fluids, to assure the safety of the patient and HCWs and prevent transmission to others. Gloves, face covers, protective footwear, gowns or coveralls, and head covers are also considered essential to prevent transmission of infections to HCWs (WHO, 2014d: 1557). PPE is considered the most observable control used to prevent transmission, but “is effective only if applied together with other controls including facilities for barrier nursing and work organization, water and sanitation, hand hygiene, and waste management” (WHO, 2014d: 1557).

Our study showed that the use of PPE by nursing students was not consistent for all respondents. More than two-thirds of the respondents (65.5%) indicated that they ‘always’ used PPE, while up to 22.6% 'usually’ used it for every action involving blood handling. Similar results were found among HCWs and nursing students at War Memorial Hospital in Kenya, where almost two-thirds (60%) of respondents made use of PPE (Mbaisi et al., 2013: 45). Similarly, a study conducted among HCWs and nursing students in Nigeria showed that just less than two-thirds (63%) of respondents always used PPE, while more than half (56%) had never worn goggles for actions involving blood handling (Sadoh et al., 2006: 722). Similarly, Powers et al. (2016:5) noted that only 17.4% of their 231 respondents who were nurses indicated full compliance with all nine aspects of standard precautions.

These results from literature support the findings of this study in terms of inconsistent use of PPE among HCWs and nursing students. PPE use among nursing students in this study was low and inconsistent. The inconsistent use of PPE increases the risk to participants, as non-use of PPE removes the additional protective barrier. Our study showed that according to the

majority (72.2%) of respondents, the main reason for not routinely wearing double gloves was insufficient gloves at the facility. Thus, facilities are lacking in their responsibility to provide gloves to nursing students. Secondary reasons included the prohibition of double gloving at facilities (36.9%), and inability to manipulate instruments (23%) when wearing double gloves. A similar study conducted among medical, nursing, midwifery and dental students at the university teaching hospitals of Shiraz in Iran also reported on students' reasons for not routinely wearing double gloves. More than half (52.3%) of these students reported unavailability of PPE, while 43.2% reported inability to manipulate instruments when using double gloves (Askarian & Malekmakan, 2006: 229). In a similar study conducted among 483 HCWs in northern Ethiopia, only 50 (10.4%) respondents reported that they 'always' wore gloves, gown, mask, and goggles during procedures that needed PPE, and that the major reasons for poor use of PPEs like gloves, gowns and goggles was shortage of supply at the institution (Gebresilassie et al., 2014: 288). All health care institutions should provide the resources required for safe practice, as this would ensure a safe and more conducive work and learning environment for the student nurse and all other HCWs.

In terms of sensations experienced when wearing double gloves, various published studies show that a high percentage (50%–74%) of medical and dental students did not use the double-gloving technique. The major reasons for this were noted as inadequate facilities (40.6%), inability to manipulate instruments (26%) and a decrease in hand sensation (19.3%), such as tingling and numbness (Lukianskyte et al., 2012: 8). Similarly, Al-Dabbas and Abu-Rmeileh (2012: 702) reported that over half (53%) of HCWs did not use the double-gloving technique because they believed that doing so decreased hand sensation (31.6%), and 25.7% felt that it does not increase protection against infection .

In 1991 the OSHA in the USA prohibited the recapping of needles after their use (Kebede et al., 2012: 1096). However, according to the literature this practice remains an important source of SOIs, and this is worrying (Joukar et al., 2018: 386; Gebresilassie et al., 2014: 289; Souza-Borges et al., 2014: 161; Sadoh et al., 2006: 724; Askarian & Malekmakan, 2006: 230). Recapping needles before disposal is a dangerous practice. If recapping is necessary, then tongs, a recapping device or one-hand scoop method should be employed to recap the needle (Joukar et al., 2018: 382). Recapping needles before disposal may cause the holder to miss the cap, and result in subsequent stabbing. The needle could also pierce the cap, leading to stabbing, or a poorly designed cap may be dislodged from the recapped needle and also result in stabbing (Joukar et al., 2018: 382). Hence, the majority of SOIs occur during the recapping and disposing of needles, and whilst handling trash (Joukar et al., 2018: 386; Gebresilassie et al., 2014: 289; Souza-Borges et al., 2014: 161). A study conducted in Nigeria also reflected that less than a third (31.6%) of HCWs admitted to always recapping used needles, while the

percentage who never recapped used needles was higher than our study (76.4%) (Sadoh et al., 2006: 724). Also, another study conducted at the university teaching hospitals of Shiraz in Iran showed even fewer students (11.6%) who never recapped needles after use (Askarian & Malekmakan, 2006: 230).

In this study, the results indicate that a meaningful number of respondents (24.2%) engage in recapping of needles after use. This study shows that even if 75.8% (191) indicated that a needle should not be recapped, just over two-thirds of respondents (67.1%) applied this in practice and never recap after using needles. Just under one-fifth (15.5%) indicated ‘always' recapping needles before disposal, and the remaining respondents (6.3%) indicated usually and 11.1% indicated ‘sometimes’ doing so. This shows that almost a third of respondents engage in unsafe needle disposal practices, but that the majority were following safety precautions in terms of not recapping. Similarly, a study in 137 medical students in Palestinian Territory showed that 19.4% sometimes or rarely practised recapping the needle before disposing of it in a container, and only 9% never recap the needle before disposal in a sharp objects container (Al-Dabbas & Abu-Rmeileh, 2012: 702).

This risky practice appears to be common among nurses, nursing students and HCWs, as recorded in the literature. For instance, Lee and Ismail (2005: 39) reported similar findings, where one-third of the SOIs were related to recapping after needle use. Similar results were reported by Beyera and Chercos (2015: 4), where almost a third (32%) of nursing students recapped needles after use. Similarly, Norsayani and Hassim (2003: 177) and Radha and Khan (2012: 593) showed rates 24% to 67.4% of HCWs who practised recapping after needle use, respectively. Muralidhar et al. (2010: 408) also reported that the practice of recapping needles after use was still prevalent among HCWs and nursing students (66.3%). The results of Ghasemzadeh et al. (2015: 323) were consistent with these, with 67.4% of nursing students recapping needles after use. This unsafe practice is very worrying as it compromises the safety of these nurses due to the increased risk of exposure to BBPs.

Not only should needles not be recapped, they should be disposed of appropriately. The WHO (2014c: 11) outlined guidelines for safe waste management, where sharp objects (e.g. needles, syringes, glass items) and pipes that have been in interaction with blood or body fluids should be placed inside puncture resistant waste bottles (as described above). These should be situated as close as practical to the patient care area where the substances are used, and similarly so in workrooms.

Our study shows that a fair number of respondents complied with safe waste management practices, with the majority (88.5%) reporting that they 'always' used sharp object containers to dispose of needles. This reflects their knowledge and awareness of correct disposal practices. However, 8.33% disposed of needles in a kidney dish (see Figure 4.3). Our study

shows a better awareness of proper sharp object disposal as opposed to the studies of Hashemipour and Sadeghi (2008: 73) and Askarian and Malekmakan (2006: 230), where only just over a third of nursing students (38.7% and 35.6%, respectively) reported always using sharp object containers to dispose of needles.

Similar results have been reported for other health science students; for example, Al-Dabbas and Abu-Rmeileh (2012: 702) reported that most medical students (87%) reported that they always used sharp object containers to dispose of needles. This shows that our respondents have better practices of safe needle disposal.

Our study shows that PPE use remains low, fitting the previous results by Powers et al. (2016:4), indicating low levels of compliance to standard precautions. Some of the identified barriers to use include unavailability of PPE at the facility and heavy workloads. The main reason, as indicated by just less than half of respondents (49.4%), was unavailability of PPE at the facility; this was followed by less than a quarter (21.8%) of respondents who reported heavy workload as a reason for not always using PPE when engaged in activities involving blood handling. These results show that administration at the facilities is lacking in their duty and responsibility to provide nursing students with the necessary protective equipment. This practice jeopardises the safety of both patient and clinician. Furthermore, heavy workloads allude to the fact that nursing students are overburdened with too much work (Tuvadimbwa, 2005: 5; Peng et al., 2008: 139; Bhardwaj et al., 2014: 8; Akbari et al., 2018: 3). As a result, they may not have enough time or may simply be too exhausted to take the necessary precautions and use PPE when handling blood.

Similar results were reported by a study conducted among HCWs and nursing students in tertiary care hospitals in South India, showing that PPE was not readily available to HCWs during an emergency situation (Punia et al., 2014: 3). Medical students in Singapore did not always wear PPE due to heavy workloads during clinical training in the hospital (Seng et al., 2013: 499).

5.6 Occurrence of SOIs among respondents

This study revealed that only a quarter (25%) of students had been exposed to SOIs; the remaining majority (75%) reported non-exposure to SOIs during their years of study. Unlike the findings of this study, Nawafleh et al. (2017: 62–64), reported a higher percentage (46%) of SOI occurrence among nursing students, with an increased incidence among these students in the second year (94%) of study. Similarly, Salmanzadeh et al. (2016: 417) showed that the highest frequency of SOIs was observed among medical staff (79.7%). Other studies by Ghasemzadeh et al. (2015: 321), Zungu et al. (2008: 48) and Swe et al. (2014b: 124) showed

rates of reported SOI incidence of 16% to 39.3% among nursing students, and 19.9% in medical students.

A study in North India showed that almost two-thirds (63%) of students had at least one percutaneous injury, with an increased amount of injured nurses through their secondary year of study (Nawafleh et al., 2017: 61). Similar results were reported in dental undergraduate students in Ajman by Jaber (2011: 7), who concluded that SOI incidence was higher among fourth-year students (60.3%), followed by fifth-year students (39.7%). A study conducted in Turkey reported SOI prevalence as 31.4% in the first year, 44.4% in the second year, 39.4% in the third year, and 18.6% in the fourth year of study (Ozer & Bektas, 2012: 3800). This reflects a fairly low incidence of SOI among respondents, and may be attributed to safe needle disposal practices documented in this study.

Exposure to SOIs across years of study is low in this study, with the majority of students (73.02%) reporting experiencing only one SOI, less than a fifth (17.46%) reporting two SOIs, 6.35% reporting three incidents, only one respondent each noting four exposures and more than ten SOIs. A study in 279 student nurses from the their second- to fourth-year levels of study in Jordan showed that over half (54.8%) reported having one incident of SOI, 21.9% reported having two incidents, and 23.3% reported having three or more incidents of SOI during clinical study (Suliman et al., 2018: 26). Results from a study conducted by Askarian and Malekmakan (2006: 228–229) in Shiraz university teaching hospitals in Iran indicate that over a quarter (27.8%) of medical students reported being exposed to SOI once, followed by 18.8% who reported two exposures, 13.5% who reported three, and 39.9% who reported more than three.

In a study by Prasuna et al. (2015: 432) in 83 nursing students in India, 39.8% (n=33) reported experiencing SOIs: 66.7% (n=22) of these were exposed to an SOI once, 21.2% (n=7) twice, and 12.1% (n=4) three times. The results of the study by Balouchi et al. (2015: DC14) in 200 HCWs showed that only 72 respondents (36%) had no history of SOIs, whereas the others (128, 64%) reported having experienced occurrences of SOIs through the past year; 39% (n=78) reported one occurrence of an SOI, 17% (n=34) reported two to three occurrences, and 4% (n=8) reported four to five and more than five occurrences of SOIs.

Results from this study found that the nursing students were exposed to SOIs fewer times than reported in other studies in the literature. The number of SOI incidents is fairly low, which may be reflective of safe practices and adequate knowledge of students about handling sharp objects.

In terms of activities respondents were involved in when the SOIs took place, over three-quarters (76.2%) of the 63 respondents who experienced an SOI in this study indicated that

they usually occurred after injection of medication, followed by 44.4% who indicated that they occurred while recapping a needle (see Figure 4.6). Almost a quarter (23.8%) of respondents indicated that the SOIs occurred during blood sampling procedures. These results are similar to those of Rakhshani et al. (2013: 87), who showed that the most common activities that led to SOIs were injection of medication and blood samples, which had frequencies of 56.4% and 28.6% respectively.

Similar studies among nurses and student nurses showed that injection of medication was the most common activity involved in SOI occurrence (Afridi et al., 2013: 85; Oluwatosin et al., 2016: 31; Nawafleh et al., 2017: 61–62; Saravanan et al., 2018: 73), followed by recapping a needle (Oluwatosin et al., 2016: 31; Saravanan et al., 2018: 73). Similar studies supported our findings showing recapping of needles to be a major contributor to SOIs, with incidences ranging from 32% to 66% (Manzoor et al., 2010: 174; Lukianskyte et al., 2012: 7; Kaur et al., 2014: 32; Jaybhaye et al., 2014: 51; Rajput et al., 2016: 18).

Goniewicz et al. (2012: 526) confirmed that the commonest medical activities resulting in SOIs was recapping of used needles (30%), then intramuscular injection of medication (22%), with taking of blood samples and IV cannulation both offering an equal risk (20%). Correspondingly, Hadaway (2012: 527), Abdulmahdi (2014: 27) and the Canadian Centre for Occupational Health and Safety (2016) proved that recapping used needles can be considered the single most common cause of SOIs, and can account for 25% to 30% of all SOIs among HCWs and nursing students.

Many studies indicate recapping as the most common activity involved when SOIs occur, as opposed to this study, which indicated that injection of medication was the main associated activity (76.2%). This means that nursing students in this study may not have adequate knowledge related to injection procedures. In order to remedy this problem, the guidelines proposed by the WHO and NIOSH should be followed, which is reiterated in the recommendations.

In terms of instruments involved in SOI incidents among respondents, the majority (90.47%) of respondents who had an SOI in this study indicated that hollow bore needles (the type used for giving injections or withdrawing blood) were the most common instruments involved in SOI incidents, followed by scissors (17.46%). This is consistent with the activities involved when SOIs occurred in this study, being administration of injections and recapping of needles. Similar findings were reported by Radha and Khan (2012: 589), who reported that most (63.8%) nurses indicated hollow bore needles as the most common instrument in SOI incidents, followed by 44% who reported that scissors were accountable for SOIs. Other studies reported hollow bore needles as accounting for the majority of SOIs, with rates documented as 82.9% (Amira & Awobusuyi, 2014: 228) and 92% (Kaur et al., 2014: 34). Similarly, a study conducted

among HCWs in Nigeria concluded that the most common cause of SOIs was hollow-bore needles (68.5%), followed by suture needles (10.6%) (Oluwatosin et al., 2016: 32).

Students and HCWs may experience a range of feelings after an SOI incident. Our study shows that more than two thirds (66.7%) of respondents reported feeling fearful after exposure to an SOI, with just less than half (49.2%) reporting experiencing anxiety. Less than a quarter (23.8%) of the respondents who had an SOI reported feeling depression, while only a small percentage (1.6%) reported hating work and staying absent from it.

Oluwatosin et al. (2016: 32) reported similar statistics where HCWs felt anxiety and stress following the incident, with 89% becoming fearful after experiencing an SOI. Similarly, in a study conducted among dental students at a dental training site in KwaZulu-Natal (South Africa), results indicated that a quarter (25%) of respondents reported that anxiety was the most common emotion experienced after an SOI (Moodley & Naidoo, 2015: 337). Similar findings were reported by Suliman et al. (2018: 24), who indicated that some nursing students exposed to SOIs expressed that they found the incidents traumatic, and developed feelings of fear, anxiety, and depression. Furthermore, Sohn et al. (2006: 478) noted that HCWs who were exposed to SOIs exhibited higher levels of anxiety, which intimates that a history of prior exposure could pose a risk for additional SOIs.

5.7 Trends in reporting by respondents after SOI incident in actual practice

Sharp object injuries are still considered one of the greatest occupational hazards for HCWs, and expose them to health risks (WHO, 2014d: 1557). The WHO states that amongst the 35 million HCWs worldwide, about 3 million receive and experience SOIs contaminated with BBPs each year, 2 million of those are exposed to HBV, 0.9 million to HCV and 170 000 to HIV (CDC, 2013). However, due to severe underreporting of such incidents, the exact number and prevalence are unknown and undocumented. This makes it difficult to determine and understand the actual severity of SOIs among HCWs (CDC, 2013).

Of the 63 respondents in our study who experienced SOIs, two-thirds (66.67%) of this group confirmed reporting an SOI during clinical training. This result is similar to that of a study conducted by De Castro et al. (2009: 149) in the Philippines, which indicated that three-quarters (75%) of nurses and students reported SOIs. There was a high rate of reporting SOIs in this study, which is in agreement steady with prior reports (Lee & Ismail, 2005: 33; Memishwty et al., 2002: 234; Tully et al., 2006: 465; Wilburn, 2004: 452; Amira & Awobusuyi, 2014: 231). However, Amini et al. (2015: 25) performed a study on SOIs among nurses in a teaching hospital in Tehran, and noted that only half (50.2%) of the SOIs had been reported. Low reporting trends have also been documented by Jahangiri et al. (2016: 74), who noted that almost 39.8% of SOIs were reported by HCWs. Similarly, a study by the NIOSH has shown

that underreporting of SOIs ranged between 40% and 75% among HCWs and nursing students (Amira & Awobusuyi, 2014: 231).

In our study, SOI reporting rates were lower among third-year students (19%) than among second-year (20.6%) and fourth-year students (27%). Similar results were found by Talas (2009: 1399), with a reporting rate of SOIs of 29.6%, and lower reporting among second- and fourth-year students.

In this study, more than half (59.5%) of the respondents reported the occurrence of SOIs to the PN in charge, followed by 19.05% who reported to fellow students and a small percentage (9.5%) who reported to the supervisor. Similarly, Talas (2009: 1394) showed that less than half (43.9%) of nursing students reported SOIs to the PN. In an additional study conducted in a public teaching hospital in Negri Sembilan, Malaysia, 71 cases of SOIs occurred, where 18 were reported to the sister in charge of the ward (PN) (Lee & Ismail, 2005: 36). Also, as noted by Koohestani et al. (2010: 60), after exposed to SOIs only 36% of respondents reported it to the supervisor or PN in charge. This study shows that reporting trends were fairly good among nursing students, with the majority reporting SOIs to the PN; however, a small percentage reported to the supervisor.

Although HCWs and nursing students are conscious of the benefits and importance of early reporting, a culture of silence continues. It is therefore important to understand the exact reasons for underreporting. Failing to report an SOI is a serious problem, and prevents wounded HCWs from receiving PEP against HIV, which has been found to be 80% effective against contracting HIV (Mbaisi et al., 2013: 60). In this study, despite 97.6% and 100% of respondents indicating that they know that SOIs are a risk for harm and can result in the transmission of diseases, respectively, a third (33.3%) of those who were exposed to SOIs did not report them to anyone. The main reason (71.43%) for not reporting was ‘little or no perception of risk’. This may be indicative of nursing students in this study not being fully conscious of the importance of reporting and of how SOIs impact on their safety and the health of the patients. A similar study by Jaber (2011: 7) among medical students also showed that three-quarters (75%) did not report SOIs due to a low perceived risk. Another study in middle Europe also indicated that reasons for lack of reporting were little or no perception of risk by HCWs (Wicker, Ludwig et al., 2008: 489).

This is a source of major concern, as not reporting SOIs exposes students to significant risk of potentially acquiring a serious infection and ensuing chronic infectious disease. Secondary reasons for not reporting were ‘fear of job loss’ (9.52%) and being ‘too busy’ (9.52%), despite the fact that these are students who are not in job placement. The absence of a reporting system and stigma were also cited as among the reasons for not reporting. Similar reasons for not reporting were noted in another study, including low perceived risk, inadequacy of reporting

system, busy schedule, poor reporting procedures, and concern about confidentiality (Prasuna et al., 2015: 432). In a study carried out in a school of nursing and midwifery in Arak, Iran; the main reason for lack of reporting was the personal judgement of students concerning the low risk of transmission of blood borne infection through the injured site (Koohestani et al., 2010: 60).

5.8 Respondents' awareness of management practices after an SOI here

Bleeding or squeezing the puncture site has been cited by the WHO as the first action taken immediately after experiencing an SOI, while washing the area site using water and soap is the second action (WHO, 2014a: 73). The third action is cleaning the injury site with antiseptic followed by the reporting procedure as the fourth action and blood testing (Smith et al., 2001: 645–646; WHO, 2003; Jayanth et al., 2009: 44; Marshall & Ruedy, 2011: 26; Mtasiwa, 2009: 66; WHO, 2014a: 73; Swe et al., 2014a: 124; Jahangiri et al., 2016: 74). In this study, most respondents displayed the correct management practices in terms of the first action to be taken after an SOI. Two-thirds (66.7%) of the respondents squeezed the puncture site immediately, followed by cleaning the area using water and soap (63.5%), and then cleaning with antiseptic (23.8%); a small percentage did nothing (7.9%). These results show that nursing students in this study followed the correct procedures after an SOI incident.

Similar results are noted by Nawafleh et al. (2017: 62) among Jordanian nursing students from the second to fourth years of study. Less than a third (31%) squeezed the puncture site, whereas 13% washed the injury site using water and soap, and 11% cleaned the area with antiseptic, while some (16%) did nothing. Similarly, studies by Kaur et al. (2014: 35), Koohestani et al. (2010: 60) and Galougahi (2010: 174) indicated that the first step immediately after an SOI contaminated with blood is to squeeze the puncture site (5.7%), followed by washing the injury site using water and soap (5.6%). A study by Amira and Awobusuyi (2014: 231) reported that the most common action taken post-injury was washing the site using water and soap . Aslam et al. (2010: 152) also noted that the first action of management practices was to squeeze the puncture site (87%), washing with water (9%), and washing with disinfectant (4%).

This study shows that over two-thirds (69.4%) of respondents squeezed the puncture site as the first activity after SOI exposure, while washing the area with soap and water (55.1%) ranked as the second action. More than half (58.4%) ranked cleaning the injury site with antiseptic as the third action, with starting the reporting procedure fourth (59.6%), and the last action after an SOI being to go for blood tests (68%). Similar results were reported by Ross and Furrows (2014: 28), who gave squeezing the puncture site, followed by thoroughly washing the injured area under running water with soap, and reporting the incident to the safety officer for appropriate PEP as the order of activity following an SOI.

After experiencing an SOI one is supposed to go for blood test investigations. Our study shows that just over half of the respondents who reported an SOI (52.4%, n=22; N=42) underwent blood tests thereafter, and only a quarter of those who sustained an SOI (25.4%, n=16; N=63) accessed PEP, with three-quarters (74.60%, n=47; N=63) of respondents not accessing PEP following an SOI. This is a concern, as students who sustain an SOI need to be managed appropriately and provided with timeous prophylaxis treatment.

This concern is also noted in other countries, as similar results were reported by Prasuna et al. (2015: 430), who conducted a study among nursing students in an Indian nursing college. The study reported that only 15% of nursing students had undergone blood tests, and almost three-quarters (72.7%) did not access PEP after SOIs (Prasuna et al., 2015: 430). Similarly, a study among 162 undergraduate nursing students in Jordan also showed that the majority (83%) of respondents did not undergo any blood tests after an SOI (Nawafleh et al., 2017: 62). This does not apply only in nursing students, as a study conducted among HCWs in Maharashtra, India, also showed that less than half (40%) did not undergo any blood testing after an SOI, and only 20% took PEP as an immediate response to an SOI (Rajput et al., 2016: 18). Suliman et al. (2018: 25) also reported that most respondents (90%) did not undergo any blood tests, while Saravanan et al. (2018: 76) concluded that over a third (35%) didn't do blood tests after an SOI, and 27.5% received PEP after an SOI. Results from this study showed a higher rate of nursing students not accessing PEP.

The main reasons for not receiving PEP after occurrence of an SOI was fear of PEP side effects (38.29%), and being too busy (31.91%). Some respondents indicated that they forgot to get PEP (29.78%). Similar to the results of this study, Raghavendra and Viveki (2016: 3380) reported that the main reason for not accessing PEP was fear of adverse effects from HIV drugs, while in a study by Mbaisi (2013: 60–61) this reason was reported by more than half (59%) of the nursing students. This finding is similar to that of Beyera and Chercos (2015: 5), who reported that only a quarter (25.3%) of HCWs received PEP, this remarkably low rate of PEP use among HCWs being due to fear of side effects. Wakibi et al. (2011: 44) also reported that over a third (38%) of nursing students cited being too busy and forgetting as main reasons for missing PEP. Muralidhar et al. (2010: 408) have revealed that PEP practices for SOIs are insufficient among HCWs and nursing students, and our results verify this, with a very worrying situation of only one respondent finishing the prescribed PEP out of the 63 that had an SOI. Such a situation increases the risk of student nurses to be infected with BBP, which puts their lives at risk.

5.9 Summary

SOIs and the associated biological hazards are one of the most significant problems facing HCWs, and even more so inexperienced nursing students who have just entered the workplace

or started clinical practice. Findings show that steps are taken in system to reduce the risks of SOIs among nursing students. Furthermore, findings show that nursing students and medical students in general need to be educated about ways to prevent and reduce SOIs, and about the significant risk of contracting BBPs. Health facilities are exposing nursing students to SOIs by not providing them with the necessary protective equipment and prohibiting practices such as double-gloving, which are compliant with standard universal precautions. Avoiding needle recapping and proper disposal of sharps seem to be most important preventive steps, as well as proper handling of needles (especially hollow-bore needles) when administering medication. Access to PEP after exposure was low due to fear of side effects. Therefore, improving current vaccinations may also be of great importance in this regard, in order to ensure patient and clinician safety. In terms of reporting trends, findings from this study indicated good reporting practices among nursing students, which were much higher than those associated with international studies.

The purpose of this study was to determine nursing students' knowledge and practices related to SOIs and their management at a university in the Western Cape Province of South Africa. The following chapter provides the conclusion to the study and the recommendations, reflections, limitations and contributions of the research.

CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This section will deal with summary of conclusions and recommendations drawn from the study which set out to determine nursing students' knowledge and practices related to SOIs and their management at a university in the Western Cape Province. This section of the study will also make some recommendations for new areas for nursing students, for health institutions, for nursing education institutions, and for further research.

6.2 Conclusions

This study concludes that there was a low occurrence of SOIs among nursing students at a university in the Western Cape Province (N=252; n=63) in comparison to what is documented in literature. Despite the low occurrence, it remains a concern, as this is an avoidable event that has serious implications to the physical and psychological wellbeing of the injured person. The main activities that respondents were involved in when the SOI occurred were administration of medication and recapping of needles. The commonest type of devices involved in SOIs were consistent with the activity involved during the occurrence of the SOIs, and were noted to be hollow-bore needles, and scissors. After being exposed to SOIs most respondents felt fear, anxiety and depression, and these affect the psychological wellbeing of the nursing students.

Furthermore, this study exposed that the while the nursing students were adequately aware of SOIs and preventive measures, application of this knowledge in their practical training was poor. For example, although all participants knew that SOIs expose them to transmission of infectious diseases such as HIV, HBV, and HCV during clinical learning, some respondents did not report the SOIs. Also, up to 67.1% of respondents indicated that they recapped needles, while 75.8% knew that needles should not be recapped. This highlights the gap between knowledge and practice.

As for the use of PPE. this study showed some of the nursing students sometimes used PPE for every activity involving handling of blood and body fluid secretions – but not always. The main reasons why they only used PPE sometimes were heavy workload and PPE not being available at the institution. Also, the majority of them did not routinely wear double gloves, and the reason given for this was that the facility does not have enough gloves. Most nursing students had incomplete vaccinations against HBV, which puts them at risk of HBV transmission. Therefore, educational programmes are needed by the respondents, not only to prepare them with enough knowledge of universal precautions before exposure to SOIs, but also with information on management after exposure to SOIs, across the years of study.

Furthermore, the rate of accessing PEP after an SOI in these respondents was very low (25.40%), and the main reasons for not accessing PEP were noted as fear of side effects, being too busy, and just forgetting to do so. This was also highly linked to the reporting, as the rate of those who did not report the SOI was one-third of the respondents who sustained an SOI (33.33%). The main reasons for non-reporting of SOIs was little to no perception of risk, fear of job loss, and being too busy. Respondents had a good awareness and practice with regard to the immediate action after an SOI, although, the following actions were not always completed, as a smaller percentage of those who had an SOI had any blood test done, and access to PEP, with only one person completing the provided PEP medication dose. Taking into consideration the findings of this study, further recommendations are needed.

6.3 Recommendations

The following recommendations are made based on the findings of this study.

6.3.1 Recommendations for nursing students

The researcher recommends encouraging nursing students to use all preventive measures available in practice for blood-borne infection control, such as gowns, gloves, masks, aprons and eyewear during clinical learning.

All nursing students who are in training and spend time in a health care institution should have completed vaccination against HBV, in order to reduce fear, anxiety, and depression after exposure to an SOI, as the vaccine will provide immunity in case of injury. There should also be clear procedures on access to HIV PEP, and these students should be encouraged to access PEP after being potentially exposed to HIV, in order to prevent HIV infection among nursing students and HCWs, and very important, students should obtain sufficient support to be able to complete the provided PEP.

The researcher recommends increasing the awareness of nursing students at a university in the Western Cape province about the risk of contact with SOIs and the value of reporting the incidence of such injuries, whatever the reasons, and not to fear job loss. This can be achieved through an awareness programme and instructional classes on how to deal with SOIs, before they start invasive procedures on patients and working with blood.

Our results highlight that reporting of SOIs needs to be strengthened among nursing students at a university in the Western Cape province. Augmented reporting rates may be attained through improved education, chiefly for young students who may not yet be conscious of the authorized reporting procedures or the sequelae of contaminated SOIs when they arrive at the school of nursing, and start training in hospital.

6.3.2 Recommendations for health institutions

The researcher recommends using specialist health professionals to perform invasive activities such as drawing blood and intramuscular or subcutaneous injections of medication during clinical learning in the school and hospital, to further investigation and ensure continuity of avoiding the incidence of SOIs in nursing students. The introduction of retractable needles would help in reducing the incidence of SOIs, as it will also eliminate the needle recapping practice which is one of the activities that contributes to continued occurrence of SOIs. Management styles that are more supportive and less punitive would facilitate more transparency and supportive environment, with the potential to reduce the fear of reporting the SOIs by the student nurses and other HCWs.

The researcher also recommends a review of the management, prevention policy and universal precautions with protection measures used and international recommendations that relate to the incidence of SOIs that was instituted by the WHO and NIOSH for HCWs and nursing students (WHO, 2003: 2; WHO, 2001: 68; WHO, 2014a: 73; American Nurses Association, 2002: 11; NIOSH, 2000). To defend themselves and their co-workers, students should be conscious of the risks linked to SOIs and should use safety devices and better-quality work practices. It is recommended that the following be strictly adhered to:

- Provide immediate management care to exposure site after an SOI:
  - ✓ Let the wound bleed freely or squeeze puncture site.
  - ✓ Wash wound area and skin with soap and water.
  - ✓ Clean the injury site with antiseptic.
  - ✓ Used the reporting system procedure in your workplace.
  - ✓ Get blood tested immediately and confidentially for HIV, HBV, and HCV infections.
  - ✓ Do not put on a dressing.
  - ✓ Do not suck wound site.
- Ensure provision of PEP or treatment in agreement with CDC guidelines when the source patient is unidentified or tests positive for:
  - ✓ HIV: Start prophylaxis within 72 hours of the experience (WHO, 2014b: 17; CDC, 2017).
  - ✓ Hepatitis B: If vaccinated before, there is no need for treatment, but if not vaccinated, get hepatitis B immune globulin and start hepatitis vaccine series.
  - ✓ Hepatitis C: No treatment is suggested, but you may need to consult a specialist expert about new PEP.

- Enforce the application of universal precautions and implementation during practices that include the following interventions:
    - ✓ PPE, such as wearing gloves, a mask, eye protection, and a gown, should be used for interaction with blood and body fluids.
    - ✓ Always avoid recapping the needle after use in an injection and before disposing of it in a sharp object container.

6.3.3 Recommendations for nursing education institutions

More clinical learning and training on using strategies for safe handling and discarding is advised, before starting any technique using needles, and disposal of used needles in a fitting sharp object disposal container.

The researcher recommends that officials in the education institution provide PPE to students during their clinical education training in laboratories or educational hospitals. This is because most of the reasons the nursing students gave for not using equipment such as gowns, gloves, masks, aprons, and eyewear, and wearing double gloves for every activity involving handling of blood and body fluid secretions, were that PPE was not available at the institution, the facility did not have enough gloves, and the institutions prohibited the use of double gloves.

The researcher advises that education institutions and hospitals provide information on the reporting system for SOIs and the preparation of the report on an SOI during the training. Nursing education institutions need to provide support services that reinforce trust and confidence, and this will provide more opportunity to students to report the SOI within an appropriate time period to be able to start PEP, even if the incident gets reported to the nurse educator. Also, preparation programmes through annual conferences which report the presentation of injuries caused by sharp objects and development of such programmes will contribute to reducing the risk of SOIs, and consequently the risk of transmission of blood-borne diseases by SOIs.

6.3.4 Recommendations for further research

This study identified the following areas for further research:

i. Further studies can be done on the SOI rate in nursing students at all universities in the Western Cape Province and also the number of unreported cases of students with SOIs. Further research can be continued with because this is a perennial problem in the nursing schools and hospitals.

ii. Further studies are needed to determine the effect of SOIs in nursing students in South Africa. In addition, to the effect, the studies can evaluate interventions to strengthen adherence to universal precautions, eliminate SOIs and provide a more supportive system for students to be able to report any incident.

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Appendix A: Letter of approval of proposal

Cape Peninsula University of Technology

HEALTH AND WELLNESS SCIENCES RESEARCH ETHICS COMMITTEE (HW-REC)
Registration Number NHREC: REC- 230408-014

P.O. Box 1906 • Bellville 7535 South Africa
Symphony Road Bellville 7535
Tel: +27 21 959 6917
Email: sethn@cput.ac.za

5 December 2018
REC Approval Reference No:
CPUT/HW-REC 2016/H25

Faculty of Health and Wellness Sciences – Nursing Department

Dear Mr Ramadan Amer

Re: APPLICATION TO THE HW-REC FOR ETHICS CLEARANCE

Approval was granted by the Health and Wellness Sciences-REC on 15 September 2016 to Mr Amer for ethical clearance. This approval is for research activities related to student research in the Department of Nursing Science at this Institution.

TITLE: Nursing students' knowledge and practices related to sharp objects injury and management at a university in the Western Cape Province

Supervisor: Dr Modeste

Comment:

Data collection permission is required and has been obtained.

Approval will not extend beyond 6 December 2019. An extension should be applied for 6 weeks before this expiry date should data collection and use/analysis of data, information and/or samples for this study continue beyond this date.

The investigator(s) should understand the ethical conditions under which they are authorized to carry out this study and they should be compliant to these conditions. It is required that the investigator(s) complete an **annual progress report** that should be submitted to the HWS-REC in December of that particular year, for the HWS-REC to be kept informed of the progress and of any problems you may have encountered.

Kind Regards

Dr Navindhra Naidoo
Chairperson – Research Ethics Committee
Faculty of Health and Wellness Sciences

Appendix B: Internal ethics of the Western Cape College of Nursing grants

Western Cape Government
Health

DIRECTORATE: WESTERN CAPE COLLEGE OF NURSING
Theresa.Bock@westerncape.gov.za
Enquiries: Dr T M Bock
Tel: 083 602 7097
021 940 4567
Date: 2017/02/03

Mr R Amer
M Tech Candidate
CPUT: Health and Wellness faculty
Bellville

RE: RESEARCH CLEARANCE

Your research titled: *"Nursing students' knowledge and practices related to sharp objects injury and management at a university in the Western Cape Province."* refers.

The Internal Ethics committee of the WCCN grants you the necessary permission to contact the relevant Campus Heads to make arrangements for your data collection. The contact details are as follows:
Metro West Campus, Mrs B Rafferty, tel. 021 684 1211
Boland Overberg Campus (Worcester), Ms L Strauss, tel. 023 347 0732
Southern Cape Karoo Campus (George), Mrs r Byrnes, tel. 044 803 1711

We wish you success in this study.
Sincerely

METRO-EAST CAMPUS
OF WCCN T.M BOCK
021 940 4567

Dr T.M Bock

Deputy Director: Head of Campus WCCN: Metro East

HOD Psychiatry

Acting Chair WCCN Research Ethics Committee

Phone: 021 940 4567: 021 940 4543 (fax)
Stikland Hospital De la Haye Road, Bellville, 7530

Appendix C: Consultation and supporting letter from the statistician

Cape Peninsula
University of Technology

To whom it may concern:

RAMADAN KHALIFA AMER (Student Number 216152127) – MTech Nursing

The statistical analysis of the data in this research project required by the student was done using SPSS 24, under my supervision.

My function was to assist the student in the statistical analysis

Corrie Uys, D Tech (Informatics); M.Sc (Statistics)
Centre for Postgraduate Studies
Cape Peninsula University of Technology

Appendix D: Research information sheet and Informed consent

Title: - **Nursing students' knowledge and practices related to sharp objects injury and management at a university in the Western Cape Province**

Principal Investigator: **Ramadan Amer**

Co-investigator/supervisor: **Dr RR Marie Modeste**

E-mail: - ramadanamer19@gmail.com

Health and Wellness Sciences Research Ethics Committee

Address: 7A Mount View Agulhas Loevenstein Bellville.

Contact Number: **0715669081**

Dear Participant,

I am a postgraduate student of Cape Peninsula University of Technology. I am writing to invite you to take part in a study to determine of nursing students' knowledge and practices related to sharp objects injury and management at a university in the Western Cape Province. Kindly spend a few minutes to read the information given here, which will describe the details of this project. You can ask me any questions about this project that you do not fully understand. It is very important that you are fully satisfied and that you clearly understand what this research involves and how you could be involved. Also, your participation is entirely voluntary and you are free to decline to participate. There would not be any negative effects, if you refuse to participate. You are also free to withdraw from the study at any point, even if you do initially agree to take part. Participation in this study is not linked to your study program.

This study has been approved by the Research Ethics Committee at Cape University of Technology and will be conducted according to the ethical guidelines and principles of the international Declaration of Helsinki.

What this research study is about

The purpose of this is a study to determine nursing students' knowledge and practices related to sharp objects injury and management at a university in the Western Cape Province.

For the purpose of this study, sharp objects injuries refers to injuries that are percutaneous injuries into the body of a health care provider during the performance of his or her duties in

the clinical practice, caused by hollow-bore or sharp instruments, including but not limited to, needles, suturing needles, scalpels, lancets and contaminated broken glass.

Why you have been invited to participate

Since you are a nursing student, you have extensive knowledge about the subject being researched in this study. This is so, as nursing students, like other health care providers are exposed to occupational hazards such as sharp object injuries due to a number of reasons. Nursing students face a great risk of exposure to blood-borne infections by pathogens such as HIV, Hepatitis B viruses, and Hepatitis C while performing their clinical activities in the hospitals. As a student nurse, you have valuable information to contribute to the understanding of nursing students' knowledge of SOI, risk and management for the nursing student's in the Western Cape.

What your responsibilities will be

If you agree to participate, after signing the consent, you will be asked to complete a questionnaire which will take about 15 minutes.

Will you benefit from taking part in this research?

Although there is no personal benefit for you from participating in the study, the results of the study may be beneficial for the profession, as the nursing education institution may be able to use the outcomes of this study to fill the gap and provide more support to enhance implementation of strategies with regard to the prevention and reduction as well as management of sharp object injuries.

Are there any risks involved in taking part in this research?

There are no known physical risks from participating in the study, and the researcher will make effort to avoid harm. In case you are emotionally distressed or experience any emotional discomfort, you are encouraged to report to me the researcher, Mr R Amer, and you will be referred to the counselling unit of the University for counselling and support. In Bellville, the counselling unit is located in the building of the library extension ground flour and here is their contact **+27 21 959 6182**. Your name, contact details and identities will be kept confidential.

Will you be paid to take part in this study and are there any costs involved?

There is no financial reward in participating in this study and no direct cost to you.

You are invited to ask me any question you may have on the study for further clarification.

DECLARATION BY PARTICIPANT:

I declare that:

I have read this information and consent form and that it is written in a language with which I am fluent and comfortable with.

I have had a chance to ask questions and all my questions have been sufficiently answered.

I understand that taking part in this study is voluntary and I have not been forced to take part.

I may choose to withdraw from the study at any time and will not be penalized or prejudiced in any way.

I may be asked to leave the study before it has finished if the researcher feels it is in my best interests, or if I do not follow the study plan as agreed to.

I also consent that my information may be:

- Used and kept for future research studies ☐
- Used and discarded ☐

Signed at (place)……On (date) …..…. …..…..…..…….. 201….

Signature of participant……. Signature of witness…….

DECLARATION BY THE INVESTIGATOR

I, …… declares that, the information in this document to has been explained to

(Name of Participant) ……..…

I encouraged the participant to ask questions and provided adequate time to answer them.

I am satisfied that the participant adequately understands all aspects of the research, as discussed above

Signed at (place)……. On (date) ……201….

Signature of investigator……. Signature of witness…….

Appendix E: Questionnaire

Cape Peninsula University of Technology

Health and wellness sciences at Faculty

Department of Nursing sciences

Private Bag X 124 BELLVILLE 7530 South Africa

Telephone: (021) 9134145 cell phone: (071) 5669081

Questionnaire on Nursing students' knowledge and practices related to sharp objects injury and management at a university in the Western Cape Province

(Demographic Data Questionnaires)

N	**<u>Part I:</u> Please tick ☑ appropriate answers all questions.**			
1	What is your age in years? (Your last birthday) _____			
2	My gender is	Male		
		female		
		Other – Specify……		
3	Year of study	1st year		
		2nd year		
		3rd year		
		4th year		
4	Marital status	Single		
		Married		
		Divorced		
		Widower/ Widow		
		Other – Specify ……		
5	What is your religion?	Islam		
		Hindu		
		Christian		
		Traditional African		
		Other: Specify ……		

(Structure Data Questionnaires)

N	Part II: Please tick ☑ appropriate answers all questions;
1	Have you ever had a sharp object injury? ☐ Yes. ☐ No.
2	**If** your answer is **YES** to question **1**, How many times did you have a sharp object injury? ☐ Once. ☐ Twice. ☐ Thrice. ☐ Specify the number…….
3	**If** your answer is **YES** to question **1**, What were the activities you were involved in when you had a sharp object injury? **(Please, you may select more than one).** ☐ Recapping needle ☐ Suturing ☐ Removing stitches ☐ Blood sample ☐ Injection medication ☐ Other activities – specify……
4	**If** your answer is **YES** to question **1**, What was the instrument that caused the injuries? **(Please, you may select more than one).** ☐ Needle or Hollow-bore needle. ☐ Scissors. ☐ Apply blade in Scalpel. ☐ Injection IV line. ☐ Other procedures. – specify……..
5	**If** your answer is **YES** to question **1**, What did you do right after the sharp object injury? **(You may choose more than 1).** ☐ Washed the area with soap and water. ☐ Clean with antiseptic. ☐ Squeezed the puncture site.

	☐ Did nothing ☐ Other – Specify ……...
6	**If** you have had a sharp object injury. Did you report the injury to anyone? ☐ Yes. ☐ No.
7	**If** your answer is **YES** to question **6**, Who did you report to? ☐ Teacher ☐ Supervisor ☐ PN in charge ☐ Follow student ☐ Other – Specify……
8	**If** your answer is **No** to question **6**, Why did you not report? ☐ Too busy. ☐ Forgotten. ☐ No reporting system. ☐ Fear of job. ☐ Stigma. ☐ Little or no perception of risk. ☐ Other reason - specify ……...
9	**If** your answer is **YES** to question **1**, Did you go for blood investigation or tests after the sharp object injury? ☐ Yes. ☐ No.
10	**If** your answer is **YES** to question **1**, What was your feeling after exposed to sharp object injury? **(You may choose more than 1).** ☐ Depression ☐ Anxiety ☐ Fear

	☐ Hate the work and absenteeism ☐ Other specify……
11	**If** your answer is **YES** to question **1**, Did you get any treatment after the sharp object injury? ☐ Yes. ☐ No.
12	**If** your answer is **YES** to question **11**, What type of treatment did you get? ……
13	**If** your answer is **YES** to question **11**, Did you complete the treatment? ☐ Yes ☐ No
14	**If** your answer is **NO** to question **11**, Why did you not get the treatment? ☐ Too busy. ☐ Forgotten. ☐ Fear from treatment side effects. ☐ Other specify…….
15	Should needle be recapped after use? ☐ Yes. ☐ No.
16	Do you consider sharp object injuries as risk for harm? ☐ Yes. ☐ No. ☐ Do not know.
17	Do you know about the universal precaution guidelines related to prevention of blood-borne infections after a sharp object injury? ☐ Yes. ☐ No.
18	Do you know that sharp object injuries can result in transmission of blood-borne disease e.g., HIV, Hepatitis B, Hepatitis C?

	☐ Yes. ☐ No.
19	Are you immunized against Hepatitis B? ☐ Full vaccination (3 completed vaccinations). ☐ Incomplete vaccination **(1 or 2 vaccinations).** ☐ No vaccination**.** ☐ Don't know.
20	Do you know that the health institutions provide Personal Protective Equipment such as i.e., Gown, Gloves, Mask, Aprons and eyewear? ☐ Yes. ☐ No.
21	Do you use Personal Protective Equipment for every activity involving handling of blood and body fluid secretions? ☐ Always. ☐ Usually ☐ Sometimes. ☐ Never.
22	**If** your answer is **Usually**, **Sometimes or Never** to question **21**, What is the reason for not using Personal Protective Equipment for every activity involving handling of blood and body fluid secretions? ☐ I don't see the need for Personal Protective Equipment ☐ Heavy workload. ☐ Personal Protective Equipment is uncomfortable. ☐ Personal Protective Equipment not available at the institution ☐ Do not know. ☐ Other – specify ……
23	Do you feel that you are at personal risk of contracting blood-borne infection such as HIV, Hepatitis B, and Hepatitis C in the clinical setting where you complete your clinical learning? ☐ Yes, there is high risk. ☐ There is high risk, but I take all preventive measures. ☐ There is high risk, but I take some preventive measures. ☐ Very little risk.

	☐ Risk is non-existent. ☐ Never thought about it
24	Which of the following do you consider to be examples of sharp injuries? **(You may select more than one).** ☐ Bites ☐ Splashes into mucous membrane ☐ Needle-stick via skin ☐ Scratches ☐ Scalpel injuries ☐ Scissors injuries ☐ Elevators injuries ☐ Stab with clean needle ☐ Other - specify …….
25	What is the reason given by students who did not routinely wear double gloves? **(You may select more than one).** ☐ The facility does not have enough gloves ☐ The facility has enough gloves but cannot find a size that fits. ☐ Inability to manipulate instruments when wearing double gloves. ☐ Double gloving changes the sensation resulting in hand tingling. ☐ Because of latex allergy ☐ The institution prohibits double gloving ☐ Don't know ☐ Other – specify ……..
26	What will you do if you had a sharp object injury? Arrange the list in order of priority from **1** to **5.** 1 is the very first thing you will do, and 5 is the last activity you will do. ☐ Start reporting procedure. ☐ Wash the area with soap and water. ☐ Go for blood tests. ☐ Clean the injury site with antiseptic. ☐ Squeeze the puncture site

	☐ Don't know ☐ Other - specify: …….
27	After using the needle do you recap the needle before disposing in the sharp object? ☐ Always ☐ Usually ☐ Sometimes ☐ Never
28	After using a needle, I dispose the used needle in a sharp object container ☐ Always ☐ Usually ☐ Sometimes ☐ Never
29	If you answered **Sometimes, Usually or Never** on question **28,** where do you place the needle after using it? ☐ Kidney dish ☐ In my pocket ☐ On the patient locker ☐ Other – Specify …….