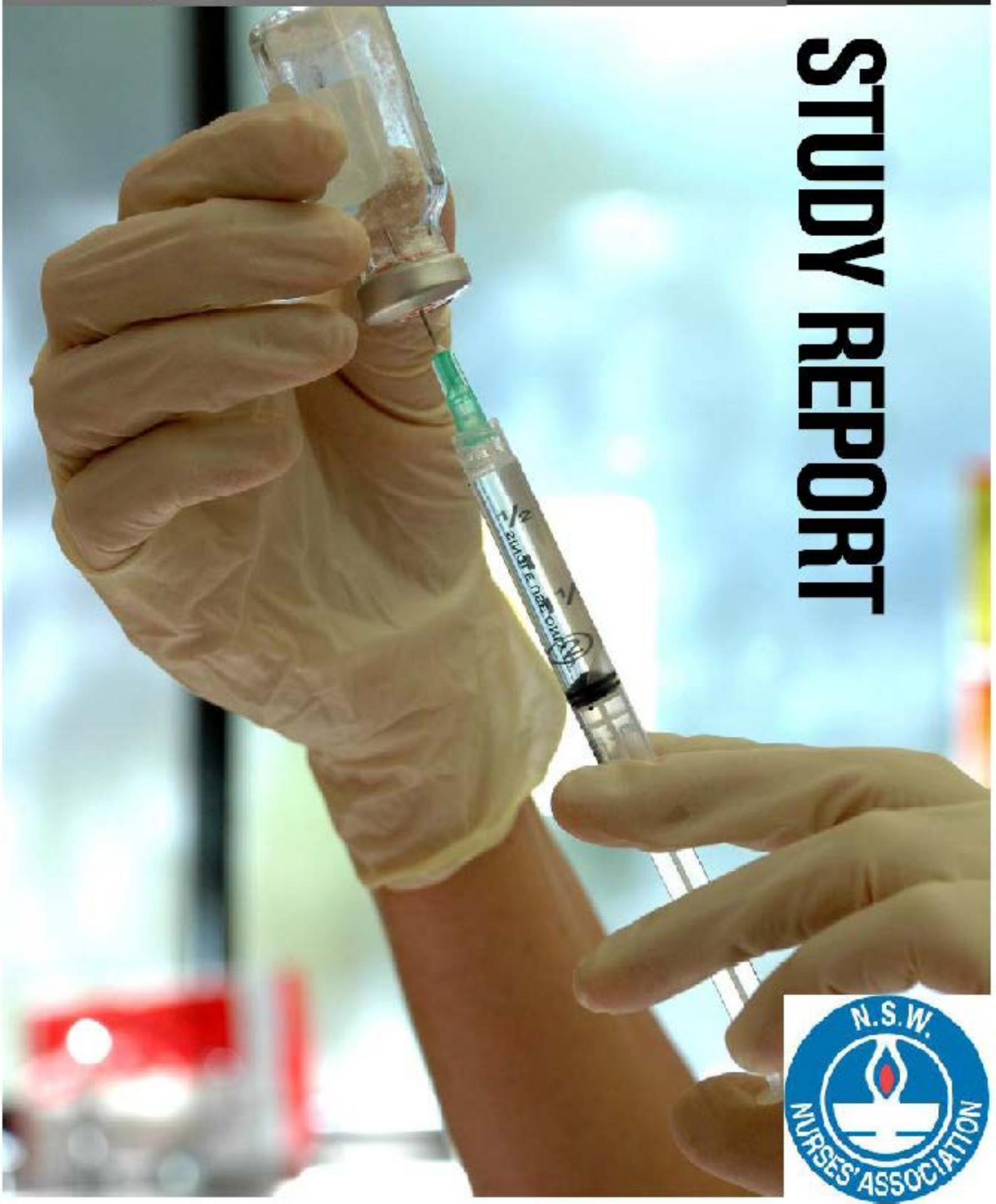
A cross sectional survey of sharps, including needlestick injuries among NSW nurses in 2007

THE UNIVERSITY OF NEWCASTLE AUSTRALIA



STUDY REPORT

N.S.W. NURSES' ASSOCIATION

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A CROSS SECTIONAL STUDY OF SHARPS INCLUDING NEEDLESTICK (SIN) INJURIES AMONG NSW NURSES IN 2007

STUDY REPORT

Authors

Chief Investigators

Ashley Kable, RN, Dip Teach Nurs Ed, Grad Dip Health Serv Man, PhD.

Maya Guest, BOHS, B Med Sci (Comm. Health (Hons)

Associate Investigators

Mary McLeod

Trish Butrej

Project Support

Patrick McElduff, Biostatistician

Daniel Barker, Statistician

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Executive Summary

Sharps-related incidents and injuries have been reported in the Australian context in individual hospital settings (1) (2). Other studies on this topic were conducted in NSW in 2006 on a sample of health care workers in the public sector (3) and by a survey of Australian Nursing Federation members in 2008 (4) about occupational exposures.

This cross sectional study has included participants from the private and aged care sectors, and disability and community nursing services and from rural and remote areas. These groups have not been well represented in other studies of Sharps including Needlestick (SIN) injury in Australia. The response rate in this study was low (18.5%) however, the participants constitute the largest sample of nurses (n=1301) reporting on SIN injury in a one year period in Australia in the last decade.

This study has been focused specifically on the nursing workforce in NSW; including nurses in public hospitals, private hospitals, aged care, disability services and community nursing services; and city, regional, rural and remote areas. Of the respondents, 56% were from the acute care (hospital) setting and 44% from community settings. Median hours per week providing patient care were 28 and 50% of respondents worked full time. Most participants had more than 10 years experience (86%). The largest group of respondents reporting their principal area of practice was aged care nurses. The proportion of respondents who reported that they normally handle sharps in their principal job was 77%.

The data in this report demonstrate the achievement of the proposed aims and objectives of this study including:

- Nurse reported incidence of sin injury in the past 12 months,

- Assessment of the perceptions of risk associated with a sin injury,

- Evaluation of the reporting and follow-up where a sin injury has occurred and routine adherence with follow-up procedures with recommended guidelines,

- Assessment of the provision of safety engineered devices (seds) in the workplace and the perception of nurses that sin injuries are prevented by the use of these devices,

- Identification of the existence of sharps safety programs to prevent the occurrence of sin injury in participants' place of employment,

- Evaluation of nurses perceptions of risk control measures by their employers for the prevention of sin injury in their workplace, and

- Comparisons of the data between the public and private sector employees; city, regional, rural and remote area nurses; public hospitals and private hospitals, aged-care facilities, disability services, and community nurses; and perspectives reported by managers and nurses.

The key results of this study include: 6.5% of nurses reported experiencing an SIN injury in the previous 12 months, and this was significantly higher in remote areas (16.4%). No significant differences in incidence were reported for principal areas of practice however, the highest rates were reported in emergency nursing (12%) and operating theatres (11%). Hepatitis B vaccination was reported to have been provided to 95% of participants. Ninety percent of nurses who sustained a SIN injury reported some or all of these incidents and 73% of injured nurses reported they were provided with adequate information and support following SIN injury. Safety engineered devices were reported to be available by 92% of participants and were significantly more available in the acute care sector (59% vs 42%); and 55% of respondents reported that nurses were involved in selecting and evaluating safety engineered devices. Recapping of non-safety needles was reported by 38% of participants. Only 39% reported routinely receiving sharps-related injury data and 32% reported attendance at sharps injury prevention training during the previous 12 months. Nurses perceptions of risk associated with SIN injury and prevention of transmission to secondary contacts were variable.

The data reported in this study indicate that sharps safety continues to be an important occupational health and safety issue for the nursing workforce and that some aspects of sharps safety prevention and responses to exposures may be appropriately observed. However, there is scope to improve some of these practices and to minimise the risk of SIN injuries and their associated hazards for nurses. The following recommendations are based on the results of this study.

Recommendations

1. Health care organisations should develop a culture of sharps safety and safe practices in high risk areas, particularly where Safety Engineered Devices (SEDs) cannot be substituted for items in current use.

2. Further research should be conducted to determine factors that contribute to the increased risk of SIN injury for nurses in remote areas.

3. Health care organisations should actively develop reporting processes and encourage reporting of SIN injuries.

4. Health care organisations should identify designated persons/departments as responsible for responding to sharps-related incidents because this is a critical component of post-exposure management.

5. Sharps safety training programs should be modified to address the perception that 'low risk' equals 'no risk' in the event of a SIN injury.

6. Sharps safety training programs should include activities recommended for the prevention of transmission of blood borne diseases to secondary contacts.

7. Health care organisations should vaccinate all nurses for hepatitis B.

8. Health care organisations should train and require nurses to use gloves during procedures where a potential exists for exposure to blood.

9. Sharps safety training programs should include information that recapping is an unsafe work practice. Other strategies may also be required to assist nurses to change this practice.

10. Health care organisations should follow-up all nurses who sustain SIN injuries and comply with the requirements for management of potentially exposed health workers.

11. Health care organisations should provide sharps injury prevention training programs and support nurses to attend them annually.

12. Health care organisations should routinely provide sharps injury data to staff.

13. Health care organisations should increase the availability of SEDs, particularly in the non-acute sector, because these devices can substantially reduce the incidence of SIN injury. Nurses should be involved in selecting and evaluating SEDs.

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1 Background

Sharps including needlestick (SIN) injuries represent a major hazard (physical, biological and psychological) in nursing practice. Nurses incur a significant proportion of all SIN injuries sustained by health-care staff, particularly from devices that have been previously used on patients (1, 5-9). Since 2000, two studies conducted in Australia in individual hospitals, one state-wide study on public sector health care workers in NSW and one study on a sample of nurses from the Australian Nursing Federation membership have been published (4, 10). The partners in this study were interested in determining whether there were differences in SIN injury of nurses in various geographic locations and workplace sectors and nurses' perceptions and experiences associated with SIN injury in the workplace.

2 Literature Review

Health Care Workers (HCWs) include those from a range of occupations working in public and private hospitals, aged and mental health care settings, medical and other health care services, residential care services and social assistance services (11). One of the most concerning hazards associated with this occupational group are sharps including needlestick (SIN) incidents. The resultant injuries can be described as piercing of the skin as a result of having contact with a sharp device including needles, during their preparation, use or disposal. They represent a major physical, biological and psychological hazard to HCWs. In addition to the physical injury at the puncture site, SIN incidents represent possible morbidity or mortality from exposure to blood borne viruses and the associated psychological distress such incidents cause, especially if the device has been used on an infected patient.

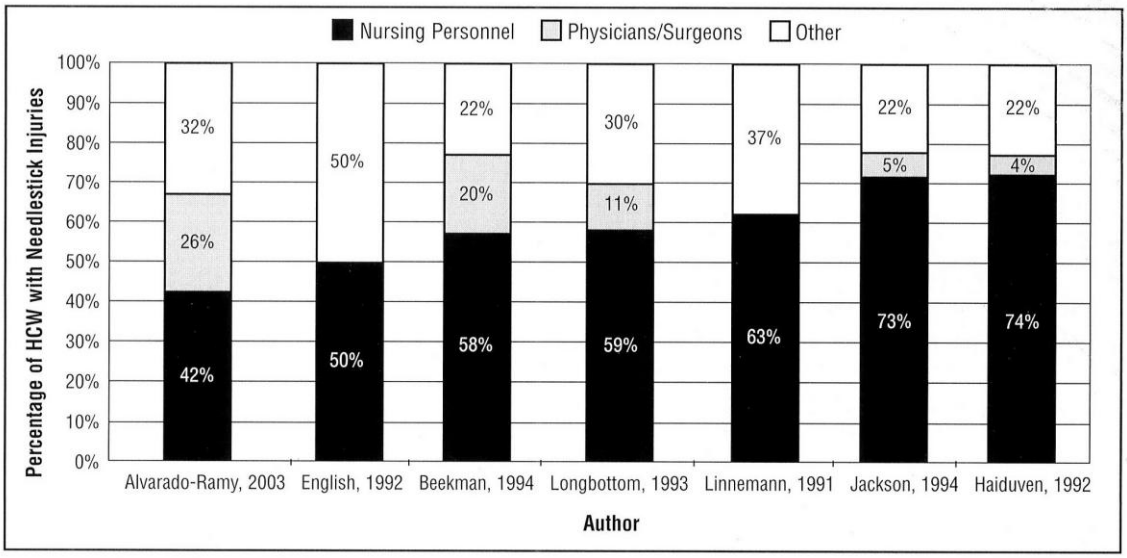
2.1 Risks to Nurses

Rate of Injuries to Nurses

Sharps-related injuries, particularly those contaminated with blood are of great concern to all HCWs, however, the rates vary between occupational groups. Studies conducted in Australia (1) and abroad (5) (12) (13) (14) have identified that nurses sustain the largest proportion of SIN injuries compared to other HCWs. A review of studies published between 1990 and 2004 reported estimates of the proportion of nurses experiencing needlestick injuries compared to other HCWs ranged between 42 – 74% of injuries (see Figure 1). The authors suggest "this is not surprising because the nursing staff have the most patient contact"(15), whilst Clarke et al. surmised it may be

due to changing hospital administrative practices which have resulted in nurses performing increased numbers of procedures requiring the use of sharps (7).

Figure 1: Incidence of needlestick injuries by occupational category (15)



Studies focusing on the prevalence of SIN injuries among nurses (only) have also been carried out. In the US a study undertaken by Aiken et al. (16), found that hospital nurses' risk of exposure to blood via a percutaneous injury is actually higher than institutional data would imply. The prospective and retrospective data from this study revealed that nurses sustain an average of 0.7 or 0.8 SIN injuries per year, or 3 to 4 every 5 years. A number of recent studies (Doebbeling (5), Watterson (6), Clarke (17) and Sohn (8)) reported that nurses incurred the highest proportion of total sharps injuries at rates between 40 to 55%. Interestingly, the study by Clarke (17) published in 2007 showed that nurses with fewer than 5 years of professional experience had a higher risk of sharps injuries. Data presented in the 2001 Uniform Needlestick and Sharp Object Injury Report cited in Shelton and Rosenthal (2004) reported a high incidence of sharps-related injury of nurses (43.6%)(13). A survey of British nurses by the Royal College of Nursing in 2006, reported that 9 in 10 nurses use needles or sharps, most report that there are procedures for dealing with sharps/needlestick injuries, and 7% of nurses had been injured by a sharp/needle in the last 12 months (18).

Australian Studies

A ten year prospective surveillance study of health care workers was conducted by Whitby and McLaws (1) in an 800-bed university tertiary referral hospital in Brisbane. Whitby and McLaws reported in 2002 that of the 1836 "dirty" needlestick injuries (NSI) reported, most were sustained in nursing (66%) and medical (17%) staff, with 63%

sustained before disposal. Hollow-bore injuries from hypodermic needles (83%) and winged butterfly needles (10%) were over-represented. The authors went on to conclude that the "introduction of self-retracting safety syringes and elimination of butterfly needles should reduce the current hollow-bore NSI by more than 70% and almost halve the total incidence of NSI" (1).

A study of percutaneous exposure incidents among Australian hospital staff by Smith et al (2005) conducted in a large hospital in North Queensland reported that nurses were the most commonly exposed (63.5%) (n=373 exposures) and 44.7% of nurse's exposures (n=237) were due to needlestick injuries and 44.3% of doctor's exposures (n=70) were due to sharps injuries. Hollow-bore needles were reported to have caused 67.6% of needlestick injuries (n=145) (19).

In 2006, Smith et al. (20) published results of a cross sectional survey of nurses (n=220) in a North Queensland hospital. The sharps-related injury rate in the previous year was 17.7% and the most common causative device was reported to be normal syringe needles, followed by insulin syringe needles, intra-venous needles or kits and blood collection needles. Half of the nurses' sharps-related events occurred beside the patient's bed and drawing up medication was the most common reason. Smith and Leggat (21) also conducted a study of the prevalence and nature of needlestick injuries among Australian nursing students finding that 14% of respondents had experienced an injury in the previous 12 months.

Recently, results of two other Australian studies have been published. *The Environmental Scan of Sharps Safety in the NSW Public Health System (2007)*, reported that seven percent of nurses (n=259) reported that they sustained sharps-related injuries during the previous two years in the public sector in NSW in 2007 (10). The Australian Safety and Compensation Council report: *Occupational Exposures of Australian Nurses (2008)* reported a sharps-related injury rate of 11% from participants (n=955) who were members of the Australian Nursing Federation in 2008 (4).

2.2 Characteristics of Injuries

Injuries by principal area of practice

While nursing is recognised as a high risk health care profession, the rate of SIN injury varies between practice areas. Although sharp devices can cause injuries anywhere within the healthcare environment, US data shows that 40% of injuries occur on inpatient units, particularly medical floors, intensive care units, and in operating rooms (22). Recent US studies have identified sometimes conflicting data regarding the risk

profile of nursing areas of practice. Operating theatre staff have been reported to sustain 33.3% of sharps-related injuries (23), and theatre nurses (n=88) have a reported relative risk of 1.11 (p=0.04) for SIN injuries compared with nurses working in other clinical areas (n=353) (24). Bilski (2005) reported results of a survey of 232 nurses who reported 130 needlestick injuries over a period of two years; and that the highest percentage of needlestick injuries occur in dialysis units (50%), intensive care units (45%), emergency medical care (38%), GP surgeries (36%), surgical wards and operating rooms (31%) and then non-surgical wards (21%)(25). Smith et al. reported that nurses working in the maternity/neonatal wards were only 0.3 times as likely to have experienced a SIN injury as their counterparts in the medical or surgical wards (2).

A cross sectional survey of nurses in four countries (n=34,318) by Clarke et al (2007) found that nurses practicing in anaesthesia, operating theatre, and recovery were twice as likely as nurses in other specialties, to experience a sharps-related injury (26), and paediatric, neonatal and mental health nurses had a significantly lower risk at one of the participating sites (n=11,516) (17).

Smith et al. (2) theorised about the causes of these differences and discussed that while previous researchers have listed prevalence by department and found different rates, very few conducted logistic regression analysis and adjusted for confounding variables. They suggest that demographic differences would exist between nurses who work in different hospital departments and more rigorous statistical analysis to adjust for confounding variables is required.

Devices Involved In Percutaneous Injuries

The type of device associated with SIN injuries has been a factor of interest in many studies. The range of sharp instruments typically used by nurses includes needles (butterfly needles, hypodermic, ordinary suture and atraumatic), intravenous giving sets, lancets, stitch cutters, trocars and stylets, surgical wire, scalpels and other surgical instruments. In addition to equipment used directly during patient care, metal and glass items represent a risk in laboratory settings.

A review of international literature conducted by NSW Health (2007) found that research consistently identified hollow bore needles attached to disposable syringes represented the greatest risk for SIN injuries (3). This is supported by Whitby and McLaws (1) who reported on 1,478 dirty NSI's, where 65% were associated with hollow bore needles. This is consistent with US data indicating that the variety of hollow bore instruments used are responsible for the majority of SIN injuries (22, 27, 28). The other

broad category of sharp instruments is solid and without a hollow profile designed to enable the transfer of fluids into and out of patients. Likewise, Dement et al (29) reported hypodermic needles and suture (needles) as the devices accounting for most percutaneous exposures (n=1,846), 30% and 29%, respectively.

Injuries by Nursing Procedure

The type of nursing procedure also contributes risk for SIN injury of nurses. A study by Jagger et al. (1988) demonstrated that devices requiring manipulation or disassembly after use (such as needles attached to IV tubing, winged steel needles, and IV catheter stylets) were associated with 5.3 times the rate of injury of disposable syringes (30).

The particular activity being undertaken when SIN injuries occur has been one of the factors of concern in many studies. The procedures reported to be associated with SIN injury are intramuscular and subcutaneous injections, applying sutures, phlebotomy/intravenous procedures and those requiring the use of scalpels/razors. Nsubuga and Jaakkola (2005) reported that almost 40% of SIN injuries (n=300) were related to administering injections (31), and in a study by Ilhan et al. (2006), 41% of respondents stated that performing an injection was the task being carried out when the injury (n=305) occurred (32). Research undertaken by the International Healthcare Worker Safety Research Centre found that injections were responsible for the greatest incidence of SIN injuries (13). Injections involve preparation and administration of the dose, as well as the disposal of used sharps and injury can occur at any stage of this procedure. In a study of 263 Korean nurses, Smith et al. (2006) found that most needlestick injuries occurred when opening an ampoule or vial (35%), disassembling needle kits (32%) and recapping needles (31%)(2); and in a study of 274 nursing students in Australia, that opening a needle cap was the most common causative event (34%), followed by opening an ampoule (26%) (21). Research undertaken within the Duke University Health System indicated that percutaneous exposures (n= 1,846) were most likely to occur during the use (52%) and disposal of sharps (43%) rather than in the preparation or assembly of devices (29). While the risk of SIN injuries associated with the preparation and delivery of injections and the use of a variety of other hollow bore needles are well recognised, the use of solid sharp equipment also represents a SIN injury hazard to HCWs. Recent US data from the Centres for Disease Control and Prevention (22), the Massachusetts Sharps Injury Surveillance System (27) and the EPINET Surveillance Program (28) indicate that approximately one third of all sharps injuries occur via the use of suture needles, scalpels, glass and other solid sharps (14). Research by Dement et al. (2004) recognised that while there has been a downward

trend in the numbers of hollow bore SIN injuries, this was not seen in the rates of suture needle injures (excepting blunt suture needles) where safety engineered protective devices were not available (29).

Risks Following an Injury

Infection: Morbidity and Mortality

The greatest hazard presented by SIN injuries is the transmission of blood borne viruses (BBV) such as hepatitis B and C, and human immunodeficiency virus (HIV) (3, 33). Blood-borne infections may be transmitted occupationally through parenteral exposure, mucous membrane exposure and exposure through non-intact skin. Sharps injuries are primarily associated with occupational transmission of hepatitis B virus (HBV), hepatitis C virus (HCV), and HIV, but they may be implicated in the transmission of more than 20 other pathogens (14, 22). Following exposure, the virus can be transmitted to the practitioner if a sufficient amount of BBV enters the blood for infection to be established.

Data collected by the US Centers for Disease Control and Prevention in 2002 identified 57 cases where HCWs have contracted HIV with 27 of these cases being nursing staff. Further, there were 139 possible cases, defined as those where the HCW has contracted the disease in the absence of other known risk factors, with 35 of these being nursing staff (34). The infection rate for HCV is believed to be higher due to the nature of the virus. The availability of effective immunisation for HBV has resulted in seroconversion of this strain being very rare (3).

In a review of international sharps injuries' studies, Hanrahan and Reutter (1997) concluded that the greatest occupational risk for transmitting a blood-borne infection is by a penetrating sharps injury sustained from a contaminated sharp used on an infected person (35), with used hollow bore needles representing the greatest risk of transmission of blood borne disease (22, 27, 28, 33). Australian data indicate that greater than 80% of reported sharps injuries involve a contaminated needle (3). In addition, characteristics of the SIN incident can influence the risk of seroconversion where a patient infection is transferred to the practitioner. These factors include: a deep injury, visible blood on the device, high viral load status of the patient such as in newly infected patients or those in a terminal state, and the device being used to access an artery or vein (22, 36). In spite of the numbers of SIN incidents thought to occur, the rate of virus transmission from patient to practitioner remains low (3, 37). Table 1 provides seroconversion estimates from a number of jurisdictions.

Table 1: Likelihood of SIN injury resulting in seroconversion

Virus	United Kingdom 2001 (38)	United States 2000 (39)	New South Wales 2007 (3)
Hepatitis B (HBV)	1 in 3*	6%-30%	1.6% - 40%**
Hepatitis C (HCV)	1 in 30	1.8%	1.8% - 10%***
HIV	1 in 300	0.3%	0.1%-0.3%

* if source patient is 'e' antigen positive

** depending on HB eAg positive/HBV DNA > 10^4 viral equivalents/ml results

*** depending on RNA positive status

Psychological

The psychological impact of a SIN injury can range from mild anxiety to an incapacitating Post Traumatic Stress Disorder (PTSD). The emotional cost to the worker is not dependant entirely on the acquisition of disease. As a period of time must elapse before post-exposure follow-up can indicate disease status, uncertainty can lead to significant stress for the worker (14). The 1995 study by Reutter and Northcott qualitatively assessed (using a grounded theory approach) how nurses cope with the risk of acquiring HIV infection while caring for persons with AIDS (40). The study found that nurses' coping efforts after exposure were grouped into four categories: minimising the effect of exposure, reducing a sense of vulnerability, selective disclosure to others, and assigning meaning. Nurses reported minimizing the physical effects of exposure through measures such as 'bleeding' the needlestick injury and immersing the affected area in bleach solution. Nurses reduced their sense of vulnerability by assessing the possibility of harm, avoiding situations that aroused fear, and confronting the decision for HIV testing. Nurses limited their disclosure to co-workers to avoid rejection and to preserve professional self-esteem. Disclosure to significant others was influenced primarily by the support nurses perceived they would receive. Finally, nurses attempted to assign meaning to the exposure by determining why the incident occurred and by evaluating the implications it had on their lives. Gershon et al. (2000) undertook a qualitative survey (n=65) which included questions relating to the impact that an exposure incident had on their psychological well being and on their families. These exposed health care workers reported feelings of anxiety (53%), insomnia (18%), depression (13%), a loss of appetite (10%), sleepiness (10%) and frequently crying especially when they thought about the incident (10%) (41). Similarly, Lee et al. found that 42% of nurses in their study reported feeling anxious, depressed, or stressed, in the two weeks following a SIN injury (42). The 2006 case report by Worthington et al. further highlights the psychological effect of contaminated sharps injuries. Describing two cases where occupational exposure to HIV followed needlestick injuries, the

authors highlighted that the incidents resulted in the development of post-traumatic stress disorder (PTSD). Despite neither health care worker seroconverting to HIV positively, neither was able to return to work and both needed ongoing psychiatric care for PTSD (43).

2.3 Perceptions of Risk Associated with SIN Injury

HCW perceptions of risk associated with a SIN injury may influence their response to these incidents, reporting practices and adoption of preventive strategies in the clinical context. Tabak et al. (2006) (44) examined doctors (n=68), nurses (n=87) and auxiliary staff (n=27) perceptions of risk of contracting a disease by means of a needlestick injury. Using a scale from one (low risk) to six (high risk), overall, staff rated their susceptibility of contracting a disease as moderate or higher. Specifically, nurses gave a rating of 4.67 for perceived susceptibility and 3.88 for the severity of contractible disease, which was higher than that of doctors (4.65 and 3.64 respectively). Auxiliary staff however rated severity of contractible disease higher (4.84) than both nurses and doctors. Other studies however have found that HCWs perceive their risk as much lower. In a study of 100 HCWs reporting accidental exposures by Cockcroft and Oakley (45), the perception of HIV risk was considered none or low by 84% of HCWs, while for hepatitis B the risk was considered to be none or low by 66% of HCWs. Lum et al. (46) surveyed needlestick injuries in country general practice and found that three-quarters of respondents (n=367), including nurses, perceived their risk of contracting a blood borne disease as low, however significantly more nurses rated medium/high risk compared to general practitioners ($p = 0.001$).

Knowledge of the risk of viral transmission appears to be better for HIV than HBV. In a study on contamination incidents among doctors and midwives, Burke and Madan (47) found that 69% of midwives underestimated the risk of contracting hepatitis B from a needlestick and 36% underestimated the risk of contracting HIV. Cockcroft and Oakley (45) found that more HCWs correctly identified the risk of HIV transmission (34%) than the risk of hepatitis B transmission (17%) prior to the provision of information. In addition, they noted that knowledge about HIV and HBV transmission did not differ between those who had previously reported an incident and those who were reporting for the first time. Lum et al. (46) found that only about 30% of HCWs indicated the correct transmission rates from needlestick injury for HBV, HCV, and HIV.

Knowledge has been found to be low regarding viral transmission from some sources. Knight and Bodsworth (48) surveyed nurses (n=192) in a teaching hospital and found childbirth and sexual intercourse were correctly associated with HBV transmission

(69% and 93% of nurses respectively). However, incorrect associations were also reported: eating contaminated food (25%), and contact with urine and faeces without gloves (87%).

2.4 Prevention Guidelines and Policies

The recommended approach to prevention of transmission of BBV in health care settings is adoption of Universal Precautions. These precautions (derived from CDC recommendations) include using gloves and personal protective equipment, washing hands if contaminated, not recapping needles and placing all sharp objects in puncture resistant containers for disposal as close as possible to their use (46). Adherence to universal precautions is fundamental and needs to be emphasised (24). However, as compliance is variable, interventions to improve compliance should relate to the knowledge and practice of practitioners, as well as equipment and service design. In addition, sharps-related safety interventions may include prevention strategies such as developing a safety culture; eliminating the use of sharps wherever possible; facilitating sharps injury reporting to improve surveillance of data; selecting, implementing and evaluating the impact of safety engineered sharps devices; promoting safe work practices; and educating and training healthcare workers (49, 50).

In New South Wales, the *Policy and Guidelines for Prevention of Sharps Injuries in the Public Health System* was revised in June 2007. The policy is a reference for developing sharps injury prevention programs (50). In addition, the *NSW Health Infection Control Policy (2007)* contains guidelines for safe handling, use and disposal of sharps (51).

Management of HCWs Exposures Associated with SIN injury

Due to the risk of exposure to blood borne viruses from SIN injury, it is important that appropriate responses are undertaken to ensure the most effective treatment is implemented. An urgent risk assessment (including determination of significance of an exposure and blood testing of the HCW and source patient) should be made to determine what further action to take and whether post-exposure prophylaxis (PEP) is required; and information about the risk of blood borne disease and PEP, counselling and psychological support should be made available to any employee who experiences a SIN injury. According to the CDC's post exposure guidelines, when an injury is reported, several tests should be conducted, including HIV, HBV and HCV anti-body tests. When the source patient is known, tests are also performed on them as soon as possible (52). Following a risk assessment, PEP and immunisation should be provided if required (38, 53).

Some studies have reported a lack of post exposure policies. Lum et al. (46) found that only half of the practices in their study had a policy related to the follow-up of SIN injury and that the follow-up procedures varied considerably. Similarly, Phipps et al. (24) reported that none of the three hospitals in their study had an official post-exposure protocol to assist nurses in receiving appropriate post-exposure care, or for monitoring injury occurrences.

Even when policies are in place, the adherence to follow-up procedures varies. Lum found that most participants said they washed the site and documented the injury, however only about one-third of the participants reported they tested their own or the patient's blood and 5% reported they did nothing (46). Lee et al. (42) found that of 110 nurses who had experienced a SIN injury, only 22 (20%) received care in their employee health department. Another seven (6%) visited their primary care physician and 10 (9%) underwent emotional or infectious disease counselling.

More promising levels of follow-up treatment were reported by Pettit et al. (54), with 104 (92%) of employees who experienced a SIN injury seeking follow-up treatment. Of these, 103 received local wound care, 36 received tetanus/diphtheria vaccine, 14 received hepatitis B vaccine, 9 received hepatitis B immunoglobulin, and 12 received zidovudine.

Even when follow-up precautions are taken, the transmission of HCV, HBV or HIV cannot always be prevented using current technology (Gerberding & Henderson 1992 cited in Hanrahan 1997) (35). The NSW Health policy directive *HIV, Hepatitis B and Hepatitis C - Management of Health Care Workers Potentially Exposed (2005)* (53) is the current guideline for NSW nurses.

Reporting of Injuries

Researchers agree that published rates under-represent the true rate of SIN injury (15) (1) and where passive surveillance data are used, reported rates are lower due to under-reporting by staff (2, 5, 15, 48). In a survey of 285 HCWs, Lee and Noor Hassim found that 59% of staff who sustained a needlestick injury did not report the injury (42), while Doebbeling et al. (5) surveyed 3,223 HCWs and found that one-third of percutaneous injuries were unreported or not formally documented. For nurses in particular, studies have found that the rates for not reporting of injuries may range from 32.4% (55) to 41% (20), 70% (48), 73.6% (42) and up to 81% (Heald & Ransohoff 1990 cited in Lee et al 2005) (15).

Reporting rates vary between professional groups and nurses have been shown to have higher rates of reporting. Doebbeling et al (2003) found that percutaneous injuries were unreported by 62% of physicians and 27% of nurses (5). Whitby and McLaws (1) noted a statistically significant improvement in not reporting injuries by nurses over a 10 year period from 64% initially to 14%-24%. Cutter and Jordan (55) in a survey of 200 theatre and delivery suite staff found that only 53% of surgeons reported their injuries, compared to 91% of nurses and midwives; and Burke and Madan (47) surveyed 384 doctors and 293 midwives and found that midwives had significantly higher reporting rates (46%) compared to doctors (9%). In NSW, sharps injuries are voluntarily reported and resultant data are considered to represent under-reporting of these occupational exposures (3).

Reasons for Not Reporting/Reporting SIN incidents

There are a variety of reasons for not reporting that have been identified by previous studies: Not thinking it was important enough (68% of 318 respondents) (24), believing the exposure did not constitute a risk (75% of 120 respondents (48)), (95% of 81 incidents (42)); and not considering the patient as at high risk of having a blood borne infection (86% of 36 respondents) (55), and these reasons suggest that the injury was considered to be minor. Considering the injury to be minor accounted for 32% (21) and 7% (20) of under reporting in two studies. However, both Smith and Leggett (21) and Smith et al. (20) reported the most common reason was because the instrument was unused (42% of 38 respondents and 27% of 43 events respectively). Lee and Noor Hassim found the following reasons from 42 participants: source thought not to be infectious (31%), incident was not important (22%), worried about future consequences (17%), did not know who to report to (10%), too complicated and too many forms to fill out when reporting (10%), or embarrassed (7%) (42). These authors also discussed the view that HCW may not report needlestick injuries due to fear about the effect on their practice if they contract infectious disease and the information becomes public. Smith and Leggat (21) also reported that 16% of 38 respondents did not report because they were too embarrassed and 5% were worried about getting into trouble (21).

A lack of time also influenced whether injuries were reported (53% of 34 respondents) (55). Time constraints and perceptions that an injury or source was low risk have consistently been reported in the literature (3) as reasons for not reporting sharps-related injuries.

Nsubuga and Jaakola (31) found that a high proportion of nurses (75% of 526 respondents) were not aware of a hospital policy on needlestick injuries in a study conducted in Africa. A lack of knowledge on hospital policy could be a contributing factor to the rates of under-reporting.

Compliance with Guidelines

Even though safety guidelines and universal precautions have been developed, compliance varies and injuries still occur. One study investigating the uptake of guidelines of health care workers employed in operating theatres (n=200), found that safety behaviour is modified depending on the likelihood of a patient having a blood-borne disease (55). This study revealed that only three out of 200 (1.5%) respondents (one surgeon and two midwives), would adopt all seven theatre-specific measures for all patients, while the remaining 197 were selective about which individual safety measures to use (55).

Improved use of standard precautions has also been reported. Doebbeling et al. (5) reported that 67% of 2,417 nurses routinely wore gloves while performing invasive procedures and 55% of 2,168 registered nurses reported recapping needles after use. Among HCWs, Lee and Noor Hassim (42) determined that the mean score for practice of universal precautions was around 35, with a range of 23 to 40, and Doebbeling found that compliance with precautions varied from 29% and 70% for all HCWs.

The importance of following universal precautions was demonstrated by Lee and Noor Hassim (42). They found a significant linear relationship between episodes of needlestick injuries and scores for practice of universal precautions ($p = 0.012$), meaning that the higher the score for practice of precautions, the lower the number of needlestick injuries. Another precaution with high compliance rates is vaccination for hepatitis B (HBV). Smith et al. (19) reported that 92.8% of all staff in their study had been fully vaccinated for HBV.

Aiken et al. (1997) found that nurses who sometimes or often recapped needles were 1.4 times more likely to report an injury during the prospective part of the study than those who never recapped; 2.2 times more likely to retrospectively report an injury in the previous month and 1.8 times more likely to report ever being injured (16).

In addition to the guidelines and policies for post-exposure management of SIN injuries described above, the following policy directives (described below) are current for the NSW Public Health System. Public Health Organisations are responsible for offering a course of HBV vaccination to HCWs whose work practices place them at risk, staff

should be aware of whom to contact for advice concerning occupational exposures, reporting systems must be established and advice should be provided about measures to prevent possible secondary transmission during the window period including: not donating plasma, blood, body tissue, breast milk or sperm; adopting safe sex practices (eg condoms); seeking expert advice about pregnancy and/or breastfeeding and modification of work practices involving exposure prone procedures (*NSW Health. HIV, Hepatitis B and Hepatitis C – Management of Health Care Workers Potentially Exposed 2005*) (53).

Sharps injury prevention program requirements are described in the document *Sharps Injuries – Prevention in the NSW Public Health System (2007).* These programs should include development of a safety culture in health care organisations, communication of sharps injury data, sharps safety education and training, hazard assessment, appropriate representation on product evaluation committees, consideration of use of Safety Engineered Devices (SEDs), point of use location of sharps disposal containers, adoption of risk control measures – including use of Personal Protective Equipment (PPE), reporting systems for sharps injuries and appropriate post exposure management policies (50).

The *NSW Health Infection Control Policy (2007)* also contains guidelines for safe handling, use and disposal of sharps (51). These guidelines include requirements to use gloves where HCWs are potentially exposed to blood and/or body substances (particularly for peri operative and invasive procedures, venepuncture or finger or heel stick), no re-sheathing of non-reusable sharps and disposal of sharps in puncture resistant containers.

2.5 Safety Engineered Devices (SEDs)

Sharps-related hazards have been recognized for many years and prompted the development of a number of Safety Engineered Sharps Devices. The General Purpose Standing Committee in 2004 conducted an inquiry into serious injury and death in the workplace but refrained from recommending widespread use of safety engineered devices (specifically retractable needles) due to lack of data regarding cost benefit analyses of these devices. During this inquiry, the NSW Nurses' Association recommended that the OH&S Regulation 2001 "be amended so that the requirement to provide safe equipment clearly includes equipment designed to eliminate or reduce the risk of injuries from sharp medical instruments and devices"(56). The NSW Nurses' Association also has a policy on occupational health and safety that is consistent with the NSW legislation.

The Sharps Safety Project was conducted in 2006 by NSW Health Department and WorkCover NSW as a result of the General Purpose Standing Committee No.1 Inquiry into Serious Injury and Death in the Workplace. This multi-focused enquiry included a review of sharps use in the healthcare industry. Recommendation 13 of the report from that Inquiry required NSW Health, in conjunction with WorkCover NSW, to undertake a further study of the costs and benefits of introducing retractable needles across the NSW health system. This project was charged with developing a policy framework to minimise and where possible and reasonably practicable, eliminate risks associated with the use of medical sharps in NSW public health organisations.

In 2001 the US OSHA legislation was amended to require the use of engineering controls (safer needle devices) to prevent exposure to blood borne pathogens (57) and this reflects the availability of improved devices, emphasises advances in medical technology and reminds employers to use readily available technology in their health and safety programs. In the Australian context, in the *NSW Health policy directive: Sharps Injuries – prevention in the NSW public health system (2007)*, the usefulness of safety-engineered sharps devices is recognised and organisations are encouraged to consider their use where practicable and clinically appropriate (50). Whitby and McLaws concluded in their study that the "introduction of self-retracting safety syringes and elimination of butterfly needles should reduce the current hollow-bore NSI by more than 70% and almost halve the total incidence of NSI" (1). Other studies have reported reduction rates of 61% (in a controlled trial by Orenstein et al) (58), between 23-85% (Heald & Ransohoff and Resnic & Noerdlinger) cited in Lee & Noor Hassim (59) and between 62-88% (CDC, 1997; Jagger, 1996) cited in Wilburn (57).

A review of studies investigating the efficacy of safety-engineered devices found that the reduction in percutaneous injury rates was between 22% and 100% (60). However, this reduction may have also been a result of the training and education the health care workers received on the use of the devices, rather than from the devices alone (60). Orenstein et al. (58) found the overall rate of NSI was reduced by 61% after protective devices were introduced. However, they were unable to confidently attribute the decline to the introduction of safety devices. For phlebotomy procedures, the use of the bluntable phlebotomy needle and the phlebotomy needle with recapping sheath reduced percutaneous injury rates by 76% and 66%, respectively (49).

Characteristics of safety devices considered to be desirable include: the device is needleless, the device requires no activation, the user can easily tell whether the safety feature is activated, and the device performs reliably and is safe and effective for

patient care. While some of these characteristics may not be feasible in all situations, they serve as a guideline for device design and selection (61).

Even though most studies have concluded that reductions in SIN injuries have occurred due to the introduction of safety devices (29), results have been variable and some limitations of the safer devices have been identified. Dement et al. (29) found that some safety devices had to be activated by the user and the method of activation was not intuitive. In some cases the safety feature cannot be activated until after the needle is removed from the patient (61). In 40 out of 55 (73%) injuries reported by Lee et al., the safety feature was not activated and was only partially activated in 7 (13%) of them. In addition, respondents reported that in 2 of the cases, the safety feature malfunctioned (42). Another limitation is the type of safety device that can be produced to replace current devices. For example, hollow bore needles cannot be eliminated or produced in a blunt form (62), therefore a safer form of this needle seems unlikely. Understanding the factors that contribute to the effectiveness of these devices will maximise prevention effectiveness and components of prevention planning.

An expert panel was used to estimate the proportion of reported incidents (n=952) that could have been prevented by safety device use, as well as guideline adherence and guideline revision, or a combination of these. This panel found that adherence to guidelines would have prevented 52% of injuries, while the use of safety devices would have prevented 56% (63). Even though both interventions appear effective in reducing injury rates, health care workers still fail to adhere to the guidelines. Cullen et al reported that most beneficial preventive strategy would be the introduction of safety devices, and that they were more likely (OR 2.70) to prevent percutaneous injuries (63).

A retrospective study of factors contributing to the reduction of SIN injury during phlebotomy procedures, found that changes in worker education and work practices, implementation of devices with safety features and encouragement of injury reporting were all associated with a steady decline in the injury rate (49). Similarly, providing educational and training support and ensuring complete logging of sharps injuries, has been shown to result in a higher level of acceptance of needlestick prevention devices among staff and better implementation of devices (64).

Implementing safety devices incurs a greater cost due to the higher purchase price of the devices, as well as the cost of educating and training employees. However, Tan (2001) reported that safety devices were a cost effective part of a prevention program (64). Due to the high costs associated with safer devices, perhaps only purchasing

devices that will prevent high risk injuries may be more cost effective (35). Cost effectiveness analyses of safety devices have been conducted that determined the cost savings associated with elimination of new HIV and hepatitis cases would substantially exceed the cost of implementation of safety devices (California OSHA 1998 cited in Lee et al 2005) (15). Other costs associated with sharps-related injuries include psychological symptoms, fear, adjusting sexual practices and insecurity about keeping jobs (15). The use and provision of safer medical devices has also been considered as an ethical issue in terms of the question "who has the right to decide whether health care workers should risk injury" (15).

3 Project Aims

The collaborators in this project conducted a cross-sectional study utilising a survey of sharps including needlestick (SIN) injuries of a representative sample of members of the NSW Nurses' Association (NSWNA). The sample was selected to represent nurses from the five major workplace categories of public hospitals and private hospitals, aged-care facilities, disability services, and community nurses; and the four major workplace locations of city, regional, rural and remote areas. The study aims were:

1. To establish nurse reported incidence of a SIN injury in the past 12 months.
2. To construct a profile of SIN injury among nurses in NSW

4 Project Objectives

To achieve these aims, the objectives of the study were:

1. Assess the perceptions of risk associated with a SIN injury
2. Quantify the occurrence of SIN injury during the last 12 months
3. Evaluate the reporting and follow-up where a SIN injury has occurred
4. Assess the provision of safety engineered devices in the workplace and the perception of nurses that SIN injuries are prevented by the use of these devices
5. Identify the existence of sharps safety programs to prevent the occurrence of SIN injury in their place of employment
6. Evaluate the nurses' perceptions of risk control measures by their employers for the prevention of SIN injury in their workplace
7. Compare the data between the public and private sector employees; city, regional, rural and remote area nurses; public hospitals and private hospitals, aged-care

facilities, disability services, and community nurses; and perspectives reported by managers and nurses.

8. Demonstrate the effect of routine adherence with follow-up procedures with recommended guidelines.

4.1 Expected Benefits/Outcomes

This project was designed to contribute to the epidemiological evidence reported in peer-reviewed journals of the true pattern of SIN injury and the use of safety engineered devices in a variety of health care settings across city, regional, rural and remote areas of New South Wales. The project specifically focused on nurses across the spectrum of their clinical practice (workplaces), which constitutes the professional group of highest risk for SIN injury.

In addition, it was envisaged that this research would benefit the wider health community including administrators, regulators and professional organisations by providing current evidence about various aspects of SIN injury in NSW.

The study will complement the NSW Department of Health's Sharps Safety Project in two ways:

1. The Sharps Safety Project was conducted only in NSW public health organisations. This study evaluated practices in public and private health care settings.
2. The current study will provide valuable baseline data that would serve as an appropriate comparison for an evaluation of the sharps safety policy framework to be introduced in NSW, including uptake in the private sector.

While employers are attempting to manage risks as required by OHS legislation, the survey measured the perceptions of nurses in NSW health care facilities regarding the effectiveness of risk control strategies. Although there is no requirement to provide safety engineered devices in NSW health care facilities, they have been provided on a variable basis in some high risk areas. This study also collected data to show how widely they have been adopted and whether they are perceived as effective in reducing SIN injuries.

It is interesting to note that the US Needlestick Safety and Prevention Act 2000 has made it compulsory for employers to provide needles and sharps with built-in safety features. Where safety engineered devices are used it is likely that needlestick injuries will be prevented and nurses will have better protection from microbiological hazards in the workplace (35, 49, 58, 65).

This project will contribute to the epidemiological evidence reported in peer-reviewed journals about the incidence of SIN injury, the perceptions of nurses, sharps safety practices and programs, and the use of safety engineered devices in a variety of health care settings.

The project focused on nurses across the range of workplaces in which nurses' practice because they are the health professional group at highest risk of SIN injury.

5 Advisory Panel

An advisory panel was established to assist the investigators with specialist advice when required. The members included:

1. Mary McLeod and Trish Butrej from the NSW Nurses' Association.
2. Catherine D'Este from the University of Newcastle for sampling and statistical consultation.
3. Mark Friedewald, the study coordinator for the NSW Department of Health Sharps Safety Project.

6 Methods

6.1 Study Design

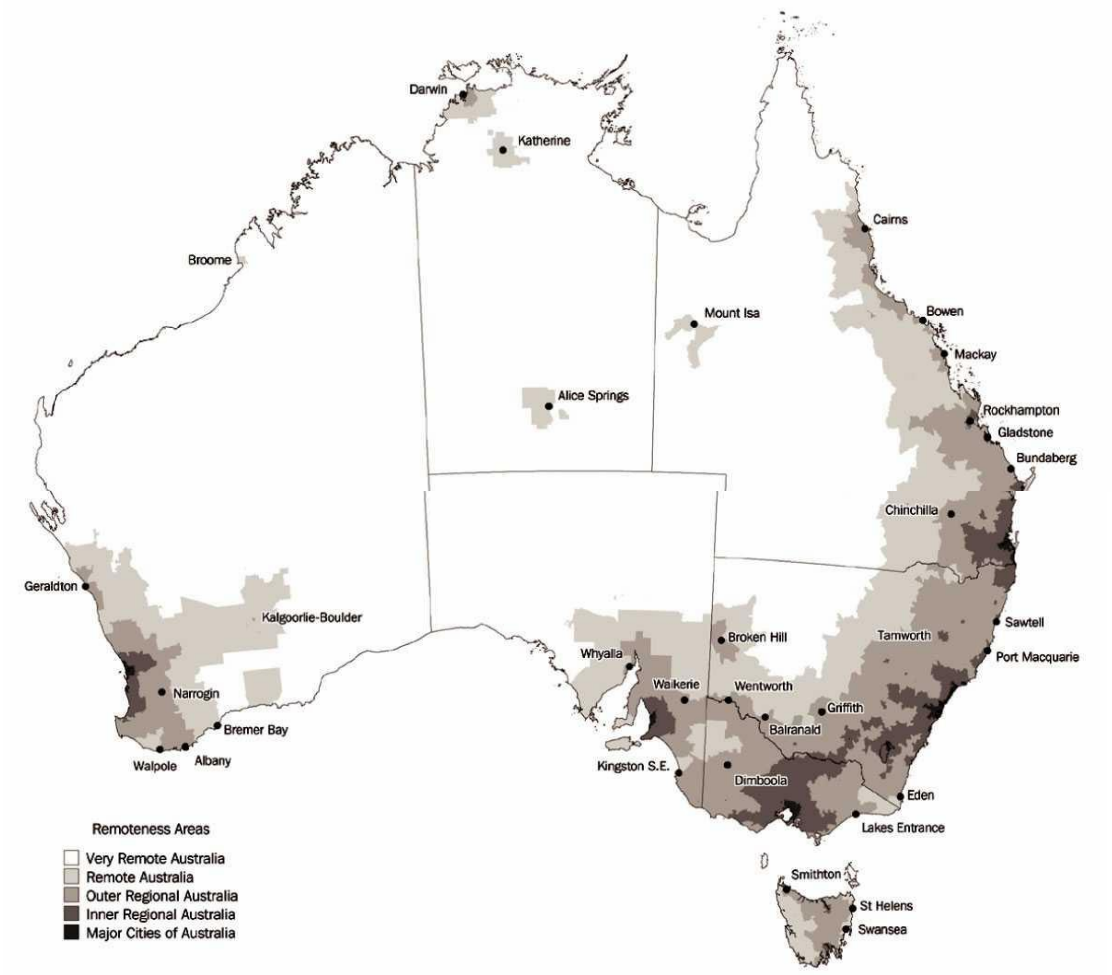
This study utilised a cross-sectional design to survey a representative sample of the membership of the NSW Nurses' Association. A postal questionnaire was used to establish nurse reported incidence of SIN injury in the past twelve months.

6.2 Study Population and Recruitment

Potential participants were randomly selected from the membership database of the NSW Nurses' Association which was stratified to represent nurses from the five major workplace categories of public and private hospitals, aged care facilities, disability services and community services; and the four major workplace locations of city, regional, rural and remote areas.

The membership database of the NSWNA contained information about award title, the employment sector in which members worked and the postcode of their employer. This information was used to create employment sector and workplace location categories. Workplace location categories were created using the employer postcode, defined by the Australian Standard Geographic Classification (ASGC) Remoteness Area categories.

Figure 2: Australian Standard Geographical Classification: Remoteness Areas



ASGC Remoteness Areas

Released by the Australian Bureau of Statistics (ABS) in 2001, the Australian Standard Geographic Classification (ASGC) Remoteness Area is a classification of remoteness and groups geographic areas into five categories. These categories are based on Census Collection Districts and define use of the Accessibility / Remoteness Index for Australia. It is based on the ARIA classification (Accessibility / Remoteness Index of Australia). ARIA is a measure of remoteness of a location from the services provided by large towns or cities. A high ARIA score denotes a more remote location. The five categories are ‘major cities’, ‘inner regional’, ‘outer regional’, ‘remote’ and ‘very remote’. Figure 2 shows the areas in each ASGC Remoteness Category. The ABS provided to the researchers a concordance tool which categorised postcodes to ASGS categories.

The five categories were subsequently collapsed into four to represent city, regional, rural and remote in the following way:

1. City: major cities and inner regional
2. Regional: outer regional
3. Rural: remote
4. Remote: very remote

Selection of Study Sample

To select the study sample the NSW Nurses' Association provided the researchers with an EXCEL spreadsheet with the following three variables:

1. Workplace sector of employment - six categories as available in the membership database: public health system, private hospitals, aged-care facilities, Department of Ageing, Disability and Home Care, medical centres and GP services and other including private sector specialist services
2. Postcode of employer: subsequently categorised by researchers to major city (including inner regional), (outer) regional, rural (remote) and remote (very remote).
3. Award title – The list of Award titles (128) were reclassified into eight categories by the researchers including registered nurse, enrolled nurse, assistant in nursing, assistant care coordinator, mental health nurse, nursing unit manager, nurse manager and clinical nurse specialist to ensure adequate representation of nurses from all these levels.

These data were only provided for these three variables for each member of the NSWNA, thus it was not possible to identify individuals in any way. The researchers then generated strata based on the combination of these variables (6 x 4 x 8 strata) and determined the number of individuals in each of the strata.

6.3 Recruitment

Once selected, initial contact was made with the study participants by the NSW Nurses' Association by mailing potential participants a study package including: an invitation to participate in the form of an Information Statement (see Attachment 1), a Survey Form (see Attachment 2) and a pre-addressed reply paid envelope. Participation was voluntary, with consent deemed to be given through the completion and return of the survey form to the researchers. Seven weeks after the initial package despatch, a Thank you/Reminder postcard was sent to all potential participants as a reminder to participate (see Attachment 3).

6.4 Study Instrument

Data relating to sharps including needlestick injuries were collected using a survey instrument composed of five sections. (See Attachment 2)

Section A Study Eligibility

Section B General Workplace Information

Section C Needlestick and Sharps Injuries in Your Workplace

Section D Sharps-Related Incident Follow-up

Section E Nurses' Knowledge/Perceptions of Sharps Injuries

The development of the survey form for this study was conducted in three stages.

Stage 1

This stage involved development of questions for the purpose of measuring the proposed objectives of the study. It included reference to relevant NSW Health policy documents and some key literature. The study aims and objectives were the primary reference point for development of the draft survey form.

Questions were included in the draft survey form for the purpose of meeting the aims and objectives of the study as follows:

- Self reported sharps-related incidents and estimates of the number of these during the previous 12 months,
- Perceptions of risk associated with sharps-related incidents,
- Reporting and reasons for reporting/not reporting sharps-related incidents,
- Follow-up of sharps-related incidents,
- Availability of safety engineered devices,
- Perceptions of the effectiveness of safety engineered devices in preventing needlestick injury,
- Existence of sharps injury prevention programs in the organisation/workplace,
- Perceptions of risk control measures including sharps injury prevention training and policies/procedures/protocols and reporting/response requirements.
- Items included for the purpose of comparisons described in objective 7 including: principal employer category and postcode of principal place of employment.

The NSW Health Policy Directive PD2005_311 (HIV, Hepatitis B and Hepatitis C – Management of Health Care Workers Potentially Exposed) (53) was also used to develop the draft version of the survey form. It was a key reference for questions in the Sharps-Related Incident Follow-up section including blood testing, information provided about risk of blood borne disease, access to counselling services, changes to or modifications of work practices, advice about prophylactic treatment, measures for prevention of possible transmission of blood borne diseases to secondary contacts and support and follow-up after sharps-related incidents, and questions about reporting incidents.

A study recently conducted in the UK on working lives of nurses included a section on needlestick injuries (18). There were 12 questions in the UK survey that were relevant to this study however they were modified for this survey form. These questions were about use of sharps, procedures for dealing with SIN injuries, occurrence of SIN injuries, knowledge of source patients and blood testing after SIN injuries, incident reporting, SIN injury follow-up and perceptions of risk associated with SIN injuries.

Another NSW Health Policy Directive PD2007_052 (Sharps Injuries – Prevention in the NSW Public Health System) (66) refers to a survey form used in a study recently conducted in NSW about Safety with Sharps for Clinicians in Public Health Organisations (10). There were 17 questions in the NSW survey that were relevant to this study however they were also modified for this survey form. These questions were about years of experience as a nurse, average hours worked per week, reporting of SIN injuries, follow-up of SIN incidents, sharps safety engineered devices, use of gloves for procedures where staff may be exposed to SIN injury, availability of sharps disposal containers, recapping of non-safety needles, workplace safety culture and vaccination against Hepatitis B virus.

Questions generated from stage 1 include the following items in the ethics approved survey form, however many of them have been modified since stage 1 was completed.

Question numbers: 1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36. Questions 8 (age) and 39 (perceptions of effective prevention of SIN) were added by the researchers. The draft survey produced at the end of stage 1 was presented to the project advisory committee.

Stage 2

This stage included a search of the literature and identification of previous studies relevant to this project. Each study and associated instruments were analysed and where relevant items were identified, they were either added or modified for use in this study. A survey conducted in 2003, the needle-stick and sharps-safety survey (67), contained 3 questions that were relevant to this study. These questions were about nurses' involvement in selection of safety engineered devices, distribution of SIN injury data and types of sharps training provided. These questions were modified and included in this survey form (questions 37, 38 and 11).

The Australian *Hollow-bore needlestick injuries in a tertiary teaching hospital: epidemiology, education and engineering* study (2002) (1) reported higher risks of blood borne virus transmission associated with hollow-bore needlestick injuries. A review of the literature on sharps injuries also reported blood borne virus transmission risks associated with sharps injuries(35). These risk factors have also been reported by NIOSH (61) and NSW Health (50, 53) and have been included in question 27 about nurses perceptions of risk associated with incidents due to contact with needles or sharps that have been used on a patient. A study by Knight and Bodsworth (48) included questions about knowledge of HBV transmission and associated activities and reported a range of results including correct responses for childbirth and sexual intercourse activities (69%, 93%) and incorrect responses for eating contaminated food and contact with urine and faeces without gloves (25%, 87%). These results prompted the expansion of the items in question 27.

A study by Cutter and Jordan (55) reported reasons for not reporting inoculation injuries and under-reporting. This is a recurrent issue in the literature (47) (44) (48) (1, 20, 50, 59) and was included in the survey form in question 16, 17 and 28.

Some literature reports differences in NSI rates due to the clinical area/location of practice (2) (48). Questions 9 and 14 have been designed to collect this data in this study.

Reductions in sharps injuries have been reported by Elder and Paterson (37) and Hanrahan and Reutter (35, 61) where safety engineered devices are used. Questions about safety engineered devices have been included in question 29.

Some surveys included questions about wearing gloves for procedures where the potential exists for nurses to be exposed to blood and body fluids (48) (42, 50) and this issue is included in this study in question 32. Knight and Bodsworth also reported

differences between males and females wearing gloves and in rates of exposure and clinical area.

Recapping of non-safety needles is another issue identified in the literature and previous surveys as a contributing factor for sharps-related injuries (50) (16) (1, 5). This study included question 31 to assess this issue.

Vaccination of health workers against the hepatitis B virus has also been reported as an important means of prevention of transmission of this virus due to sharps-related injury (50). This factor has been included in this survey in question 33.

Question 26 was added by the researchers to check for nurses' perceptions of high risk activities and whether they are supported by results of published studies.

Stage 3

This stage involved an expert panel of nurse clinicians and academics, which was convened to test and provide feedback and advice about the draft survey form. This process provided face and content validity of the survey form. The survey form was revised on the basis of the expert panels' advice and submitted for ethics approval. It was approved by the University of Newcastle Human Research Ethics Committee.

The expert panel spent almost 4 hours working through the survey form and suggested the addition of items to questions 6 (full time, part time or casual employment status), and 33 (awareness of currency of hepatitis B status and whether a blood test was done to check immunity) and multiple minor modifications were made to most of the other questions in the survey form. Many of the changes were recommended to clarify the intended question or to provide items that were more directly relevant to current practices or terminology. Some reordering of items was also recommended. Question 29 required multiple corrections to more clearly define items in the safety engineered devices and non-safety devices categories. The panel confirmed the importance of including question 26 due to a range of activities that may be conducted outside acute clinical environments, and in particular in the community (See Attachment 2).

6.5 Optical Mark Readable Survey

To facilitate speed and accuracy of data entry, Optical Mark Readable Survey technology was utilised. The ethics approved survey was formatted by an external organisation. In addition a ScanTools Plus program was produced to enable the scanner to read the survey forms.

6.6 Allocation of Study Numbers

Study numbers were not generated prior to the distribution of the survey, rather survey forms were bar-coded sequentially by the printing company. The barcode subsequently became the study number. The allocation of study numbers to surveys was done only for the purpose of data checking (i.e. to check electronic data with paper records for possible data entry error, outliers, etc). This had the additional advantage of making responses completely anonymous.

6.7 Promotion of the Study

Prior to the mail out of the study packages, an article was published in the NSW Nurses' Association publication, "The Lamp". The article announced the study to the members and advised that members may be asked to participate. It also included a description of the study and encouraged members who received an invitation, to participate.

6.8 Receipt of Surveys

All surveys were entered manually into a book and electronically into an Excel spreadsheet. The total number of surveys received each day was recorded to calculate the response rate. The date of receipt and status of each survey was recorded next to the relevant study identification number. The codes for status were as follows: 1=Completed, 2=Ineligible, 3=Blank/Not consenting, 4=Email or Phone/Ineligible, 5=Email or Phone/ not consenting, 6=Return to sender, 7=Not sent.

6.9 Data Entry

Prior to scanning, surveys were manually checked to ensure that all "response bubbles" were filled in sufficiently for the scanner to read and also that the number response boxes were filled in correctly. An OpScan Insight 4 scanner and ScanTools Plus software program purchased from Pearson NCS, were used to scan all surveys. Surveys were compiled into groups of 40 for scanning with each group given a unique file name in reference to the date and time of scanning. The responses for the qualitative questions were typed into the relevant sections for each survey. Each file was archived and converted into a data file that could be opened in Excel.

6.10 Data Checking

To ensure the scanner was reading all responses correctly, the data from the first 40 surveys that was derived from scanning was checked manually against the original hardcopies of surveys. Once it was established that the scanner was accurate in

picking up responses, the remaining data files were checked against a printed check file. This print out revealed any missing identification numbers and postcodes, multiple answers and unusual number responses (eg. 6 as age) and corrections were made within the Excel file.

6.11 Ethical Considerations

Ethical approval was provided by the Human Research Ethics Committee of the University of Newcastle prior to the administration of the survey.

6.12 Data Storage

Data security was maintained by ensuring that study records were held on password protected computers and/or in locked filing cabinets in secure offices of the researchers.

6.13 Statistical Methods

Data Analysis

Injury rates, descriptive statistics and bivariate relationships were assessed and two-tailed 95% confidence intervals calculated. Contingency table analysis of the association between demographic and occupational variables and sustaining a SIN injury were assessed with a χ^2 for nominal and ordinal variables.

Logistic regression modelling with backwards stepwise was used to identify variables that were associated with a SIN incident, provision of sharps injury data and provision of sharps disposal containers at point-of-use locations. The variables tested for association with the outcomes of interest were: region of employment, employment sector, nursing role, risk rating of principal area of practice, years of experience, employment status, employer sharps injury prevention programs, availability of safety engineered devices, sharps disposal containers at point of use and gender.

All data analyses were performed using SAS or Stata statistics/data analysis software (68, 69).

6.14 Sample Size, Power and Precision

The objective of the sampling frame was to select 7,500 nurses, with a minimum of 1,500 study participants from each workplace category. These numbers were based on a sample size calculation assuming that with a response rate of 30% there would be sufficient statistical power to find a difference if a difference truly exists between groups (Type 1 error 5%, Type 2 error 80%). The large sample size would yield more precise

estimates of rates. However, power would be reduced when making comparisons across more than four categories.

7 Results

7.1 Sampling Results

At the time of sampling there were 53,944 members of the NSW Nurses' Association. Table 2: shows the distribution by sector of employment and Table 3 shows the distribution by location category.

Three hundred and eighty five members were trainee nurses. As trainee nurses are not registered to practice and therefore do not use needles, this award category was dropped in the sampling process.

As workplace sector, workplace location and type of nurse (which relates to type and level of work) have been identified in the literature and the NSW Nurses' Association as factors likely to be associated with the study outcomes of interest, the statistical analysis compared outcomes across these strata. Thus it was important to ensure that there were adequate numbers of potential participants included in each stratum. This required over sampling of some strata.

All nurse executives were included in the over sampling process at the request of the funding organisation (WorkCover NSW) to ensure these nurses were specifically represented in the study to enable the comparison of management perspectives with employee perspectives on this study topic.

All nurses working in disability services, and community nursing / community health services were also included in the sample. This was for the following reasons. Firstly, there has been no study reported in the peer-reviewed or grey literature that included these two groups, therefore this study had the opportunity to fill this gap. Secondly, the numbers available to survey, particularly in the community field were small; therefore all nurses working in these sectors were selected.

Characteristics of Members and Study Sample

The characteristics of the members of the Association by sector of employment and remoteness category are shown in Table 2 and Table 3 below.

Table 2: Composition of study sample selected by sector of employment

Sector of Service	Initial Count	Initial %	Sample Count	Sample %
Public Hospital	34,267	63.5	1,934	25.6
Private Hospital	5,265	9.8	1,608	21.2
Age Care Facility	8,824	16.3	1,678,	22.2
Disability Service	1,102	2	1,098	14.5
Community Nursing	896	1.7	896	11.8
Other	3,590	6.7	360	4.8
TOTAL	53,944	100	7,577	100

Table 3: Composition of study sample selected by remoteness category

	Initial Count	Initial %	Sample Count	Sample %
City	37,842	70	4,163	55
Regional	11,265	20.9	2,179	28.8
Rural	952	1.8	661	8.7
Remote	462	0.08	447	5.9
Not Reported	3,423	6.3	127	1.7
TOTAL	53,944	100	7,577	100

The final figures for participation are shown in Table 4.

Table 4: Final participation figures

Potential Participants	Numbers	Number of Participants
Sample Selected	7577	
Unable to send, poor address details	122	
Surveys Sent		**7455**
Returned to Sender	32	
		7423
Participants responses		
Email or Phone indicating Ineligibility	3	
Returned, Question 1 = Ineligible	64	
Returned blank, non-consenting	4	
Returned survey misplaced	1	
Eligible Participants – returned completed survey	**1301**	
Total Participants		**1373**
Non-respondents	6050	

From the selected sample of 7,577, a total of 7,455 study packages were sent. Some respondents indicated they were either ineligible or not consenting. A total of 1,373 participants from the 7,423 contactable participants responded yielding a response rate of 18.5%. The total number of eligible participants with a completed survey was 1,301. The geographic distribution of eligible participants is shown in Table 5 below.

Table 5: Geographic distribution of eligible participants

Eligible	City N (%)	Regional N (%)	Rural N (%)	Remote N (%)	Unreported N (%)	Total N
Yes	533 (97.8)	394 (99.2)	127 (99.2)	73 (98.7)	174 (78.7)	1301
No	12 (2.2)	3 (0.8)	1 (0.8)	1 (1.4)	47 (21.2)	64
Total	545 (100)	397 (100)	128 (100)	74 (100)	221 (100)	1365

7.2 Characteristics of Participants

The characteristics of the participants are reported in Table 6 below. Of the 1301 respondents 13% did not provide the postcode of their employer. A few indicated a reluctance to do so because they were concerned they could be identified, therefore an additional category (Unreported) was added to the regional variables.

Table 6: Characteristics of participants

Variable	Category	n =	%
Region	City	533	41.0
	Regional	394	30.3
	Rural	127	9.8
	Remote	73	5.6
	Unreported	174	13.4
	Total Responses	1301	
Employment Sector	Public Hospital	442	34.3
	Private Hospital/Health Facility employer	282	21.9
	Aged-Care Facility	219	17.0
	Disability Services	79	6.1
	Community Nursing	162	12.6
	Other	103	8.0
	Total Responses #	1287	
Nursing Role	Assistants in Nursing	36	2.8
	Enrolled Nurses	153	11.9
	Registered Nurses	793	61.8
	Nurse Manager	131	10.2

Variable	Category	n =	%
	Nurse Executive	106	8.3
	Other (includes nurse educators and nurse practitioners)	65	5.1
	Total Responses #	1284	
Gender	Male	113	8.8
	Female	1177	91.2
	Total responses #	1290	
Employment Status	Full time	649	50.5
	Part time	544	42.3
	Casual	92	7.2
	Total Responses #	1285	
Principal Area of Practice*			
	Emergency Nursing	84	5.1
	Operating Theatres/Recovery/Anaesthetics	126	7.7
	Medical wards/services	135	8.3
	Surgical wards/services	145	8.9
	Intensive care/HDU/CCU/NICU	47	2.9
	Midwifery	75	4.6
	Mental Health / Drug and Alcohol	54	3.3
	Aged Care	262	16.0
	Community services	130	7.9
	Management	119	7.3
	Disability Services	85	5.2
	OHS	78	4.8
	Other	296	18.1
Participants who normally handle sharps in their principal job			
	Yes	1004	77.4
	No	294	22.7
	Total Responses #	1298	
		Median	**q1, q3**
	Age (n = 1289)	49	43, 55
	Years of experience (n=1251)	27	15, 33
	Hours per week, patient care (n = 1285)	28	16, 38

* Participants were able to select more than one area of practice (n = 1636 total areas selected)

Number may not total 1301 due to unanswered question

Fifty six percent of the respondents worked in acute care (hospital) settings. The remaining 44% worked in various community settings. The majority of the respondents were registered nurses (60%) and 8% were nurse executives. Fifty percent of respondents worked full-time. The median hours per week worked providing patient care was reported to be 28 hours, with 50% reporting between 16 – 38 hours. The largest group of respondents worked in the aged care sector. Less than 6% of respondents were midwives and at the time this study was conducted, most registered midwives in NSW were also registered nurses, therefore in reporting results for this study, the use of the descriptor 'nurse' includes midwife participants. The Other category in the principal area of practice item included: sexual health/family planning, paediatrics, nephrology/renal transplant, primary care/general practice, education, research, blood/pathology services, rehabilitation, equipment processing and sterilization (CSU), infectious diseases/public health/infection control, general hospital (rural) and indigenous health.

Seventy seven percent of participants reported that they normally handle sharps in their principal job. The median age of this sample is consistent with the ageing nursing workforce (43 years) in NSW. Eighty six percent of the respondents have at least 10 years nursing experience.

7.3 Incidence, Profile of SIN Injury among NSW Nurses and Comparative Data

Ninety five respondents reported being involved in an incident during contact with needles or sharps that had been used on a patient in the last 12 months. However, 11 of these reported involvement in the incident but were not the person who sustained the injury and these were excluded for the purpose of calculating an injury rate.

The incidence for nurses who were injured was calculated for all participants (7%) and for participants who reported that they normally handle sharps (8%) (see Table 7). There was a similar distribution of injury occurrence across the employer categories (χ^2_5 = 4.2, p = 0.5). Participants reported having from one to four injuries in the previous 12 months; however 88% reported having only one injury.

Table 7: Incidence of SIN injury reported by participants by employer category

Employer Category	N	Injuries	Injury Rate (%)	95% CI of Injury Rate
Public Hospital	442	28	6.3	4, 8.6
Private Hospital/Health Facility employer	282	22	7.8	4.7, 10.9
Aged-Care Facility	219	17	7.8	4.2, 11.4
Disability Services	79	2	2.5	0, 5.9
Community Nursing	162	8	4.9	1.6, 8.2
Other	103	6	5.8	1.3, 10.3
Missing	14	1		
Overall	1301	84	6.5*	5.2, 7.8

* Of 1004 participants who reported they normally handle sharps, 80 had injuries giving a point estimate of 8.0% with 95% CI (6.3, 9.7).

The injury rate for assistants in nursing is higher than may have been expected. However, this result should be viewed cautiously as the numbers are small and the confidence intervals are wide. There was a similar distribution of injury occurrence across the current nursing role categories (χ^2_5 = 3.7, p = 0.5).

Table 8: Incidence of SIN injury reported by participants by current nursing role

Current Nursing Role	N	Injuries	Injury Rate	95% CI of Injury Rate
Assistants in Nursing	36	4	11.1	3.1, 26.1
Enrolled Nurses	153	10	6.5	3.2, 11.7
Registered Nurses	793	55	6.9	5.3, 8.9
Nurse Manager	131	6	4.6	1.7, 9.7
Nurse Executive	106	4	3.8	1.0, 9.4
Other (includes nurse educators and nurse practitioners)	65	5	7.7	2.5, 17.0
Overall	1284	84	6.5	5.3, 8.0

Participants could select up to two principal areas of practice. Injury rates by area of practice are reported in Table 9. Some areas of practice have higher injury rates (emergency nursing, operating theatres/recovery/anaesthetics, medical and surgical wards, mental health and aged care), however there were no statistically significant differences between these rates (χ^2_{12} = 11.0, p = 0.53). NB. Some categories contain small numbers and should be interpreted cautiously due to low power.

Table 9: Incidence of SIN injury reported by participants by principal area of practice

Area of Practice*	N	Injuries	Injury Rate	95% CI of Injury Rate
Emergency Nursing	84	10	11.9	5, 18.8
Operating Theatres/Recovery/Anaesthetics	126	14	11.1	5.6, 16.6
Medical wards/services	135	12	8.9	4.1, 13.7
Surgical wards/services	145	10	6.9	2.8, 11
Intensive care/HDU/CCU/NICU	47	1	2.1	0, 6.3
Midwifery	75	3	4.0	0, 8.4
Mental Health / Drug and Alcohol	54	4	7.4	0.4, 14.4
Aged Care	262	20	7.6	4.4, 10.8
Community services	130	6	4.6	1, 8.2
Management	119	6	5.0	1.1, 9
Disability Services	85	4	4.7	0.2, 9.2
OHS	78	4	5.1	0.2, 10
Other	296	20	6.8	3.9, 9.6

* Participants were allowed to select more than one category

There was a difference in the distribution of injury occurrence across geographic regions which was strongly significant (χ^2_4 = 16.8, p = 0.002), as shown in Table 10.

Table 10: Incidence of SIN injury reported by participants by geographic location

Geographic Region*	N	Injuries	Injury Rate	95% CI of Injury Rate
City	533	29	5.5	(3.7,7.7)
Regional	394	22	5.6	(3.8,8.3)
Rural	127	5	3.9	(1.3,8.9)
Remote	73	12	16.4	(8.8,27.0)
Unreported postcode	174	16	9.2	(5.3,14.5)
Overall	1301	84	6.5	(5.2,7.9)

There was a similar distribution of injury occurrence across the years of experience categories (χ^2_6 = 4.7, p = 0.6), as shown in Table 11.

Table 11: Incidence of SIN injury reported by participants by years of experience

Experience	N	Injuries	Injury Rate	95% CI of Injury Rate
< 10 Yrs	180	16	8.9	4.6, 13.1
10-19 Yrs	210	17	8.1	4.4, 11.9
20-29 Yrs	344	20	5.8	3.3, 8.3
30-39 Yrs	386	23	6.0	3.6, 8.4
40-49 Yrs	124	5	4.0	0.5, 7.5
>50 Yrs	6	0	0	0, 0
Not Reported	51	3	5.9	-0.8, 12.6
Overall	1301	84	6.5	2.7, 7.9

There was a similar distribution of injury occurrence across the number of hours per week directly involved in patient care categories (χ^2_6 = 11.3, p = 0.08), as shown in Table 12.

Table 12: Incidence of SIN injury reported by participants by average number of hours per week directly involved in patient care

Hours Worked per week	N	Injuries	Injury Rate	95% CI of Injury Rate
0-9 Hrs	188	5	2.7	0.3, 5.0
10-19 Hrs	168	8	4.8	1.5, 8.1
20-29 Hrs	319	18	5.7	3.1, 8.2
30-39 Hrs	362	34	9.4	6.4, 12.4
40-49 Hrs	211	16	7.6	4.0, 11.2
> 50 Hrs	38	2	5.4	-2.2, 13.0
Not Reported	15	1	6.7	-7.6, 21.0
Overall	1301	84	6.5	2.7, 7.9

A logistic regression model was constructed to identify factors associated with SIN injury for this study population.

Participants could select up to two principal areas of practice. These were categorised into one of three risk categories: high, medium and low. Areas of practice categorised as high risk were: emergency nursing, operating theatres/recovery/anaesthetics, intensive care/HDU/CCU/NICU, drug and alcohol services, nephrology/renal/transplant, blood/pathology services, equipment processing and sterilization, and infectious diseases/public health/infection control. Medium risk categories were assigned to medical wards, surgical wards, and midwifery. All other principal areas of were assigned to a low risk category. If a participant was identified as being in two different

risk categories for their two principal areas of practice then the area in which most of their time was spent determined the risk category. If this could not be determined or the time was spent equally then the highest risk category was used.

As shown in Table 13, the only factor associated with SIN injury was geographic location. Nurses working in remote areas are 2.9 times as likely to sustain SIN injuries compared with nurses working in city/inner regional areas. No other factors were identified by logistic regression modelling.

Table 13: Logistic regression model for SIN injury (Full Model)

Effect	Odds Ratio Estimate	Odds Ratio 95% CI	DF	Wald χ^2	p =
Aged-Care Facility vs Public Hospital	1.5	0.7, 2.9	5	2.0	0.9
Community Nursing vs Public Hospital	0.9	0.4, 2.1	.	.	.
Disability Services vs Public Hospital	0.6	0.1, 2.7	.	.	.
Other vs Public Hospital	1.1	0.4, 2.9	.	.	.
Private Hospital/Health Facility employer vs Public Hospital	1.1	0.6, 2.1	.	.	.
Regional vs City	1.0	0.6, 1.9	4	13.7	0.01
Remote vs City	2.9	1.3, 6.2	.	.	.
Rural vs City	0.5	0.2, 1.5	.	.	.
Unreported vs City	1.9	1.0, 3.7	.	.	.
Assistant Nurses vs Registered Nurses	3.0	0.8, 11.0	5	5.6	0.3
Enrolled Nurses vs Registered Nurses	1.0	0.5, 2.1	.	.	.
Nurse Executive vs Registered Nurses	1.1	0.3, 5.0	.	.	.
Nurse Manager vs Registered Nurses	0.9	0.4, 2.4	.	.	.
Other vs Registered Nurses	2.4	0.7, 6.5	.	.	.
Years of experience	1.0	1.0, 1.0	5	5.6	0.3
Casual vs Part Time	0.8	0.3, 2.2	2	0.3	0.9
Full Time vs Part Time	1.1	0.6, 1.7	.	.	.
Male vs Female	0.6	0.2, 1.7	1	0.9	0.3
Employer has Prevention Program	0.7	0.3, 1.6	1	0.6	0.4
Safety Engineered Sharps Yes vs No	3.4	0.5, 25.4	1	1.5	0.2
Sharps Disposal Containers at Point of use Yes vs No	1.0	0.4, 2.6	1	0.0	1.0
Employer Sharps Safety Orientated Yes vs No	0.7	0.4, 1.2	1	2.2	0.1
Risk High vs Medium	2.0	0.9, 4.5	2	3.8	0.2
Risk Low vs Medium	2.0	1.0, 4.0	.	.	.

7.4 Reporting of SIN injuries

In this section the factors associated with participants who reported an injury are presented (n=84). For all nurses who reported having a SIN injury, 88% (95% CI: 80, 96) reported just one injury, with the remaining 12% reported up to four injuries. The perception of almost two thirds of nurses following an SIN injury was that they were not at risk of contracting a blood borne disease (65%, 95% CI: 54, 75). As shown in Table 14 below 90% of nurses who sustained a SIN injury reported the incident.

Table 14: Reporting of an SIN injury

Did you report this/these incidents when they occurred?	N	%	95% CI
Yes (all reported)	68	86.1	78.3, 93.9
Yes (some reported)	3	3.8	0, 8.1
No (none reported)	8	10.1	3.3, 16.9
Overall	79		

Participants' responses for how and why they reported incidents are shown in Table 15 below. Of those participants who reported the injury the three main reasons for reporting the injury were to have the hazard registered (66%), to have the injury assessed (58%) and fear of acquiring HBV, HCV or HIV (54%). Eighty nine percent of participants verbally reported the incident to a manager or team leader and completed either a paper or electronic report form. An additional 13% only completed a report form.

Table 15: How and why SIN incidents were reported (n = 71)

How were incidents reported?	N*	%	95% CI
Verbally to my manager/team leader	63	88.7	81.2, 96.3
Completing a report form (paper)	47	66.2	54.9, 77.5
Completing a report form (electronic)	24	33.8	22.5, 45.1
Not sure how to do this	1	1.4	0, 4.2
Reasons for reporting incident			
To have the injury assessed	41	57.7	46.0, 69.5
Fear of acquiring HBV, HCV or HIV	38	53.5	41.6, 65.4
Knowing who would manage the incident	11	15.5	6.9, 24.1
Assured of confidentiality	19	26.8	16.2, 37.3
The need to have the hazard registered	47	66.2	55.0, 77.5
Other	10	14.1	5.8, 22.4

* Participants were able to select more than one response.

7.5 Follow-up after a SIN Injury

In this section the sharps-related incident follow-up practices are presented for those participants who reported their injury (n=71).

A series of questions about blood testing following sharps-related incidents were answered by 70 participants. Blood tests were done as a result of the SIN injury in 59 (84%) cases. Of the 59 participants who answered yes to the question relating to blood tests, 56 (95%, 95% CI: 89.1, 100.0) reported having a blood test themselves, 45 (79%, 95% CI: 68.0, 89.9) reported having follow-up blood tests and 41 (70%, 95% CI: 57.4, 81.6) reported blood testing of the patient involved. Fourteen nurses were not blood tested (24%, 95% CI: 12.5, 34.9).

Upon the reporting of an incident (n=71), 50 (70%, 95% CI: 59.5, 81.3) reported receiving information about the risk of blood borne diseases, and this information was provided between 0 – 30 hours after the incident (median = 1 hour, IQR: 1, 2); 42 (60%, 95% CI: 48.2, 71.8) were offered counselling, 33 (47%, 95% CI: 34.6, 58.4) were provided with advice about prophylactic treatment and 41 (58%, 95% CI: 46.0, 69.5) were advised regarding measures to prevent possible transmission of blood borne diseases to secondary contacts during the window period. Only 12 participants (17%, 95% CI: 8.1, 26.2) were required to change or modify their work practices during the window period as a result of the incident. Overall, 51 participants (72.9%, 95% CI: 62.2, 83.5) reported that they were provided with adequate information, support and follow-up after reporting a SIN injury.

7.6 Organisational Sharps Safety Programs and Practices

In this section we report the responses of all 1301 participants, to questions about the safety culture in their workplaces, and organisational safety policies and procedures associated with sharps injury prevention. Respondents are categorised to executive manager or all others (labelled nurse) where statistically significant differences are identified between these groups.

The majority (84%, 95% CI: 82.3 86.4) of respondents reported that their workplaces are ‘sharps safety oriented’ or have a sharps safety culture. There was a similar distribution of existence of a sharps injury prevention program in the workplace for managers (n = 106) compared to nurses, (n=1187), 101 (95%) and 1101 (93%) respectively (χ_1^2 = 0.95, p = 0.3). Ninety percent of 1165 participants reported that they thought the program was effective (95% CI: 88.1 91.6). A total of 520 participants reported reasons why the programs were considered to be either effective or not

effective in a free text form. The responses were categorised into 13 categories. Fifty six percent of participants reported that the two major reasons why the program was effective were: good awareness/compliance/training in their organisation and that there has been a reduction in injuries; and there was no difference in the distribution of the responses of managers and nurses (χ^2_{12} = 11.2, p = 0.51).

A total of 1252 of 1289 (97%, 95% CI: 96.2, 98.0) participants reported that their workplaces had policies/procedures/protocols for responding to incidents associated with contact with needles or sharps that have been used on a patient. The format of these policies was a printed manual (86%, 95% CI: 84.3, 88.1), electronic format (43% CI: 40.4, 45.9), and (19% CI: 16.7, 21.0) reported these policies were attached to their ID card. The policies were reported as being accessible by 1203 of 1246 participants (97%, CI: 95.5, 97.6).

Respondents were asked to identify the three most frequently practiced sharps safety strategies in their organisation. These responses were categorised into nine major categories. The top three strategies overall are: correct disposal of sharps in sharps disposal containers, availability and use of safety engineered devices, and receiving sharps education and training. These data are reported in Table 16. The "Other" category included the following strategies: use of sharps carriers/injection trays, preloaded injections, approachable/supportive managers, product testing and approval, sharps auditing/incident monitoring, counselling, blood testing of staff and patients, and hepatitis B immunisation.

Table 16: Sharps safety strategies: three most frequently identified

Categories of reported strategies	Nurses reporting one or more strategy N = 878* (%)	Total reported strategies N = 2452* (%)
Correct disposal of sharps in sharps containers	**562 (64)**	**616 (25)**
Safety engineered devices	**344 (39)**	**412 (17)**
Sharps education and training	**247(28)**	**258 (11)**
No recapping	156 (18)	156 (6)
Sharps Protocols and policies	155 (18)	174 (7)
Use of gloves and other Personal Protective Equipment)	125 (14)	132 (5)
Sharps awareness and organisational culture	107 (12)	111 (5)
Report incidents	76 (9)	79 (3)
Other	339 (39)	419 (17)

* 878 respondents reported 1 to 3 strategies providing a total of 2452 strategies.

There was a statistically significant difference in the perception of executive managers and nurses, that managers/team leaders were approachable in the event of a sharps-related injury (χ_1^2 = 7.6, p = 0.006), as shown in Table 17.

Table 17: Approachability of managers/team leaders in the event of a sharps-related injury

	Nurse N = 1151 (%)	Executive Manager N = 104 (%)	Total N = 1255
Yes	1072 (93.1)	104 (100)	1176

Managers and nurses reported overall that 93% (95% CI: 91.6, 94.4) of their organisations have a sharps injury prevention program. However, the reported attendance at an orientation programs or in-service programs (that included sharps injury prevention training during the last 12 months) was only 32% overall (95% CI: 29.7, 34.8) and there were no significant differences between managers and nurses (χ_1^2 = 0.94, p = 0.3), as shown in Table 18.

Table 18: Attendance at sharps injury prevention training

Training in the 12 months that included sharps injury prevention	Nurse N = 1183 (%)	Executive Manager N = 106 (%)	Total N 1289 (%)
Yes	378 (31.9)	38 (36.5)	416 (32.3)

A logistic regression model for attendance at training was conducted. The following factors were included in the model: sector of employment, nursing role, years of experience, average hours per week involved in direct patient care, employment status (full-time, part-time or casual), gender and whether normally handle needles or sharps. The parsimonious model, shown in Table 19 identified that respondents employed at a disability service are less likely to attend training than respondents employed at a public hospital. Compared to registered nurses, enrolled nurses, executive nurses, and nurse managers were more likely to attend training. In addition, female nurses are less likely to attend training than male nurses.

Table 19: Parsimonious model for attendance at sharps injury prevention training

Effect	Odds Ratio Estimate	Odds Ratio 95% CI	DF	Wald χ^2	P values
Aged-Care Facility vs Public Hospital	0.7	0.5, 1.1	5	23.8	0.0
Community Nursing vs Public Hospital	1.2	0.8, 1.8	.	.	.
Disability Services vs Public Hospital	0.3	0.1, 0.5	.	.	.
Other vs Public Hospital	0.7	0.4, 1.2	.	.	.
Private Hospital/Health Facility employer vs Public Hospital	1.2	0.9, 1.7	.	.	.
Assistant Nurses vs Registered Nurses	1.9	0.8, 4.2	5	36.7	<0.01
Enrolled Nurses vs Registered Nurses	3.0	2.0, 4.3	.	.	.
Nurse Executive vs Registered Nurses	1.7	1.0, 2.7	.	.	.
Nurse Manager vs Registered Nurses	1.6	1.1, 2.4	.	.	.
Other vs Registered Nurses	0.9	0.5, 1.7	.	.	.
Female vs Male	0.6	0.4, 1.0	1	4.2	0.0

Table 20 shows the reported topics in sharps injury prevention training programs at participants' organisations. A total of 1016 participants responded to one of the six listed topics for this question. Two hundred and forty one of 1301 respondents (19%, 95% CI: 16, 21) reported that no training sessions were provided by their workplace.

Table 20: Topics in sharps injury prevention training programs

Topics contained in sharps injury prevention training	N = 1016	%	95% CI
Handling and disposal of sharps	914	90	88, 92
Reporting of sharps injuries	904	89	87, 91
Risks of blood-borne virus transmission	672	66	63, 69
Post exposure follow-up and prophylaxis	609	60	57, 63
New sharps devices	462	45	42, 49
Sharps counselling	448	44	41, 47

Managers and nurses reported overall (80%, 95% CI: 78.0, 82.4) that there was a designated person/department responsible for responding to sharps-related incidents (χ_1^2 = 3.18, p = 0.08), as shown in Table 21. Nineteen percent of respondents reported that there was no designated person/department responsible.

Table 21: Designated persons/department responsible for responding to sharps injury

Is there a designated person/department responsible for responding to sharps-related incidents	Nurse N = 1156 (%)	Executive Manager N = 106 (%)	Total N = 1262 (%)
Yes	920 (80)	92 (90)	1012 (80)

Of the 1012 participants that answered yes, 974 identified the type of persons/departments and 18 other participants also provided these data.

The perception of designated persons or departments was consistent between nurses and managers for most categories. However, there were statistically significant differences between managers and nurses views about the designated person/department responsible for responding to sharps injuries for two categories: nurse managers including executives (χ_1^2 = 9.2, p = <0.001), and accident and emergency/clinic/staff health (χ_1^2 = 4.1, p = 0.04) as shown in Table 22.

Table 22: Type of designated person/department responsible for responding to sharps injury

Type of designated person/department responsible for responding to sharps-related incidents	Nurse N = 900 (%)	Executive Manager N = 92 (%)	Total N = 992 (%)
Nurse managers (includes executives)	185 (20.6)	34 (37.0)	219 (22.1)
Accident & Emergency/Clinic/Staff Health	100 (11.1)	3 (3.3)	103 (10.4)
Clinical Manager/Nurse Specialist/Coordinator	58 (6.4)	5 (5.4)	63 (6.4)
Infection Control	311 (34.6)	32 (34.8)	343 (34.6)
Occupational Health & Safety	66 (7.3)	6 (6.5)	72 (7.3)
Other	180 (20.0)	12 (13.0)	192 (19.4)

Nurses reported whether sharps injury data were routinely provided in their organisation. There was a statistically significant difference between managers and nurses for the routine provision of sharps injury data (χ_2^2 = 69.2, p = <0.001), as shown in Table 23.

Table 23: Routine provision of sharps injury data

Is sharps incident/injury data routinely provided to staff in your organisation?	Nurse N = 1149 (%)	Executive Manager N = 104 (%)	Total N = 1253 (%)
Yes	407 (35.4)	78 (75.0)	485 (38.7)
No	346 (30.1)	22 (21.2)	386 (29.4)
Don't know	396 (34.5)	4 (3.9)	400 (31.9)

Logistic regression models were conducted for the responses 'yes' versus 'no' and for 'yes' versus 'don't know'.

Nurses reported whether sharps injury data is routinely provided in their organisation or not. The following factors were associated with a significantly lower likelihood of routine provision of sharps injury data: private hospital employer, enrolled nurses, nurse executives, the availability of sharps safety prevention programs and the perception that the organisation is sharps safety oriented. Whilst fewer years of experience and fewer average hours per week were statistically significant p values in the model, the odds ratio for these two factors is close to 1 and therefore not of any practical relevance (see Table 24).

Table 24: Logistic regression model for routine provision of sharps injury data (Yes vs No)

(Multivariate Model)

Yes vs No	Odds Ratio Estimate	95% Confidence Interval	Wald	P-value
Regional vs City	0.820	0.6, 1.2	0.9	0.3
Remote vs City	1.360	0.6, 3.1	0.5	0.5
Rural vs City	1.170	0.7, 2.1	0.3	0.6
Unreported vs City	1.010	0.6, 1.7	0.0	1.0
Aged-Care Facility vs Public Hospital	0.790	0.5, 1.4	0.7	0.4
Community Nursing vs Public Hospital	0.610	0.4, 1.1	3.0	0.1
Disability Services vs Public Hospital	1.300	0.5, 3.3	0.3	0.6
Other vs Public Hospital	1.040	0.5, 2.0	0.0	0.9
Private Hospital/Health Facility employer vs Public Hospital	0.410	0.3, 0.7	13.9	<0.0
Assistant Nurses vs Registered Nurses	0.460	0.1, 1.8	1.2	0.3
Enrolled Nurses vs Registered Nurses	0.400	0.2, 0.7	10.1	<0.0
Nurse Executive vs Registered Nurses	0.400	0.2, 0.9	5.3	<0.0
Nurse Manager vs Registered Nurses	0.830	0.5, 1.5	0.4	0.5
Other vs Registered Nurses	0.690	0.3, 1.6	0.8	0.4
Years of experience	0.980	1.0, 1.0	9.0	<0.0
Average hours per week involved in direct patient care	1.020	1.0, 1.0	6.3	<0.0
Casual vs Full Time	0.660	0.3, 1.4	1.1	0.3
Part Time vs Full Time	1.150	0.8, 1.7	0.5	0.5
Male vs Female	1.050	0.6, 1.9	0.0	0.9
Normally handle sharps: Yes vs No	1.050	0.6, 1.7	0.0	0.8
Workplace has a sharps injury prevention policy: Yes vs No	0.110	0.0, 0.3	17.9	<0.0
Work in sharps safety orientated organisation: Yes vs No	0.170	0.1, 0.3	38.9	<0.0

There were 400 respondents (32%) who did not know whether sharps injury data were routinely provided. The following factors were associated with a significantly lower likelihood of knowing whether sharps injury data were routinely provided: aged care facilities, nurse executives, and nurse managers. The factors associated with a significantly higher likelihood of knowing whether injury data is routine provided were being an assistant in nursing, existence of a sharps safety program and culture in the organisation. As shown in Table 25, assistants in nursing are 3.8 times more likely to not know if routine safety data are provided when compared to registered nurses. Whilst fewer years of experience and fewer average hours per week were statistically significant p values in the model, the odds ratio for these two factors is close to 1 and therefore not of any practical relevance.

Table 25: Logistic regression model for routine provision of sharps injury data (Yes vs Don't Know) (Multivariate Model)

Yes vs Don't Know	Odds Ratio Estimate	95% Confidence Interval	Wald	P-value
Regional vs City	1.1	0.8, 1.7	0.3	0.6
Remote vs City	1.0	0.5, 2.0	0.0	1.0
Rural vs City	0.6	0.4, 1.1	2.6	0.1
Unreported vs City	0.7	0.4, 1.2	1.7	0.2
Aged-Care Facility vs Public Hospital	0.4	0.2, 0.8	6.8	<0.0
Community Nursing vs Public Hospital	1.0	0.6, 1.7	0.0	0.9
Disability Services vs Public Hospital	1.2	0.6, 2.4	0.2	0.6
Other vs Public Hospital	0.8	0.4, 1.4	0.7	0.4
Private Hospital/Health Facility employer vs Public Hospital	0.9	0.6, 1.4	0.2	0.6
Assistant Nurses vs Registered Nurses	3.8	1.1, 12.7	4.6	0.0
Enrolled Nurses vs Registered Nurses	1.6	0.9, 2.7	2.6	0.1
Nurse Executive vs Registered Nurses	0.2	0.1, 0.7	6.4	<0.0
Nurse Manager vs Registered Nurses	0.4	0.2, 0.8	6.6	<0.0
Other vs Registered Nurses	0.7	0.3, 1.5	1.0	0.3
Years of experience	1.0	1.0, 1.0	2.6	0.1
Average hours per week involved in direct patient care	1.0	1.0, 1.0	7.9	<0.0
Casual vs Full Time	1.2	0.6, 2.4	0.3	0.6
Part Time vs Full Time	1.0	0.7, 1.5	0.0	0.9
Male vs Female	1.0	0.5, 1.7	0.0	0.9
Normally handle sharps: Yes vs No	0.8	0.5, 1.4	0.6	0.4
Workplace has a sharps injury prevention policy: Yes vs No	2.1	1.2, 3.7	6.0	<0.0
Work in sharps safety orientated organisation: Yes vs No	1.6	1.1, 2.4	5.3	<0.0

Safety Engineered Sharps Devices

In this section we report the responses about safety engineered devices (SEDs). Table 26 presents the responses of participants for multiple categories of SEDs available in their workplaces. Safety Engineered Devices (SEDs) were reported by 92% of participants (95% CI: 90.2, 93.7) to be available. The two most commonly reported categories were lancets and syringes/needles and injection devices. SEDs were more widely available in public and private hospitals. IV insertion and delivery devices are less widely available in aged care and disability services as may be expected in non-acute care settings. There was a statistically significant relationship between employment sector and the availability of SEDs. The availability of SEDs in acute (public and private) employment sectors (59%) was compared with all other employment sectors (42%) and was found to be significantly different (χ_1^2 = 31.7, p = <0.001).

Table 26: Availability of safety engineered sharps devices

Types of SEDs available	Public Hospital N (%)	Private Hospital N (%)	Aged Care N (%)	Disability Service N (%)	Community Service N (%)	Other N (%)	Total N = 1287 (%)	Pearson χ_5^2	p value
Lancets	369 (83.5)	234 (83.0)	192 (87.7)	53 (67.1)	92 (56.8)	70 (68.0)	1010 (78.5)	78.8	<0.01
Syringes, needles and injection devices	271 (61.3)	155 (55.0)	87 (39.7)	30 (38.0)	67 (41.4)	60 (58.3)	670 (52.1)	44.8	<0.01
IV access insertion devices	329 (74.4)	197 (69.9)	19 (8.7)	4 (5.1)	39 (24.1)	30 (29.1)	618 (48.0)	423.6	<0.01
Blood collection and venepuncture	300 (67.9)	155 (55.0)	29 (13.2)	31 (39.2)	35 (21.6)	59 (57.3)	609 (47.3)	232.7	<0.01
Pre-loaded syringes	230 (52.0)	149 (52.8)	80 (36.5)	23 (29.1)	74 (45.7)	43 (41.8)	599 (46.5)	29.3	<0.01
IV delivery systems	315 (71.3)	204 (72.3)	14 (6.4)	3 (3.8)	30 (18.5)	27 (26.2)	593 (46.1)	452.7	<0.01
Surgical scalpels	147 (33.3)	83 (29.4)	34 (15.5)	18 (22.8)	23 (14.2)	24 (23.3)	329 (25.6)	39.2	<0.01
Suture needles	87 (19.7)	63 (22.3)	11 (5.0)	16 (20.3)	6 (3.7)	16 (15.5)	199 (15.5)	53.1	<0.01

SEDs were perceived to be effective by 90% of 1183 participants (95% CI: 88.1, 91.6). Five hundred and forty six participants reported reasons why safety engineered devices were considered to be or not to be effective. The main reason why they were

considered to be effective was reduced risk of injury/safety. Poor quality equipment, faulty or difficult to operate equipment was identified by some participants as the main reason why these devices were not effective, and of these almost 50% considered that the risk of injury still existed with the use of SEDs.

Table 27: Why safety engineered devices were considered to be or not be effective

Reported reason	Not effective N = 95 (%)	Effective N = 431 (%)	Other N = 20 (%)	Total N 546 (%)	95% CI
Reduced risk of injury/safer	1 (1.1)	332 (77.0)	1 (5.0)	334 (61.1)	57.1, 65.3
Equipment poor quality / faulty or difficult to operate	15 (15.8)	1 (0.2)	0 (0)	16 (2.9)	1.5, 4.3
Dependent on correct use	6 (6.3)	32 (7.4)	0 (0)	38 (7.0)	4.8, 9.1
Not in use / not widely available	11 (11.6)	12 (2.8)	11 (55.0)	34 (6.2)	4.2, 8.3
Risk of exposure / injury still exists	45 (47.5)	13 (3.0)	2 (10.0)	60 (11.0)	8.4, 13.6
Other comment	17 (17.9)	41 (9.5)	6 (30.0)	64 (10.7)	9.0, 14.4

Ninety five percent of 1169 participants reported a preference to use SEDs (95% CI: 94.2, 96.6), and of these 487 (44%) stated that they believed SEDs would reduce their risk of a sharp injury.

Overall, 55% of 1160 participants reported that nurses were involved in selecting and evaluating SEDs however executive nurse managers were more likely to have this opinion than nurses ($\chi_1^2 = 15.18$, $p < 0.0001$), as shown in Table 28.

Table 28: Nurses' involvement in the selection and evaluation of safety engineered devices

	Nurse N = 1057 (%)	Executive Manager N = 103 (%)	Total N = 1160 (95% CI)
Yes	558 (52.8)	75 (72.8)	633 (54.6)

Of the 1301 respondents 97% reported that non-SEDs are also used in their workplace (95% CI: 96, 98). Table 29 shows the two most common non-SEDs in use are: syringes, needles and injection devices and surgical scalpels.

Table 29: Availability of non-safety engineered devices

Availability of non-Safety Engineered Devices	N = 1301	%	95% CI
Syringes, needles and injection devices	867	66.6	64.1, 69.2
Surgical scalpels	474	36.4	33.8, 39.1
Lancets	460	35.4	32.8, 38.0
Suture needles	410	31.5	29.0, 34.0
Blood collection and venepuncture	381	29.3	26.8, 31.8
IV access insertion devices	353	27.1	24.7, 29.6
Pre-loaded syringes	338	26.0	23.6, 28.3
IV delivery systems	269	20.7	18.5, 22.9

Handling and Disposal of Sharps

The provision of sharps containers at point of use locations was reported by 1172 participants. A logistic regression model was used to determine the factors associated with this practice. Statistically significant factors were: point of use sharps containers were much more likely to be provided in organisations with sharps injury prevention programs and less likely in disability services.

Table 30: Logistic regression model for provision of sharps containers at point-of-use locations

(Parsimonious Model)

Provision of sharps containers at point-of-use locations	Odds Ratio Estimate	95% Confidence Interval	Wald χ^2	P-value
Regional vs City	1.6	0.8, 3.1	1.6	0.2
Remote vs City	0.4	0.2, 1.1	3.4	0.06
Rural vs City	0.8	0.4, 2.1	0.1	0.8
Unreported vs City	0.6	0.3, 1.2	2.2	0.1
Aged-Care Facility vs Public Hospital	0.7	0.3, 1.3	1.5	0.2
Community Nursing vs Public Hospital	2.3	0.8, 6.8	2.1	0.1
Disability Services vs Public Hospital	0.3	0.1, 0.7	8.0	0.0
Other vs Public Hospital	1.3	0.5, 3.6	0.2	0.6
Private Hospital/Health Facility employer vs Public Hospital	1.6	0.7, 3.5	1.3	0.2
Years of Experience	1.0	1.0, 1.1	6.4	0.01
Organisational sharps injury prevention program	5.1	2.7, 9.7	25.1	<0.0

Overall 61.6% of respondents reported that they never recap needles, however executive nurse managers were more likely to report this than nurses ($\chi_1^2 = 13.5$, $p < 0.0001$), as shown in Table 31. Recapping after drawing up medications was reported

by 33.1% of participants, however nurses were more likely to report this practice than managers (χ_1^2 = 9.2, p = 0.002), as shown in Table 31. There were no statistically significant differences between nurses and managers reporting recapping after administering medications (4.9%) or obtaining blood samples (1.8%). These results are clinically significant because of the risk of contact with blood borne viruses associated with these practices.

Table 31: Recapping of non-safety needles

	Nurse N (%)	Executive Manager N (%)	Total N (%)
Yes - after drawing up medications	410 (34.3)	21 (19.8)	431 (33.1)
Yes - after administering medications	61 (5.1)	3 (2.8)	64 (4.9)
Yes - after obtaining blood samples	24 (2.0)	0 (0)	24 (1.8)
No – never	719 (60.2)	83 (78.3)	802 (61.6)

There were no differences between nurses and managers reported use of gloves during procedures where a potential exists for exposure to blood. Only 2.5% reported that gloves were not usually necessary for these procedures. For most procedures reported compliance with using gloves was approximately 80% or higher. Less than 50% of respondents reported using gloves when SEDs were not available.

Table 32: Use of gloves during procedures where a potential exists for exposure to blood

Use of gloves	Total N (%)
Yes - for administering injections, obtaining blood, removing cannulae and handling blood infusions	1086 (83.5)
Yes - for invasive procedures	1022 (78.6)
Yes - if safety engineered sharps aren't available	595 (45.7)
Yes for cleaning up blood spills/sprays/leaks	1108 (85.2)
No - not usually necessary	32 (2.5)

Hepatitis B Vaccination of Staff

Respondents were asked about hepatitis B vaccination, 1203 of 1273 (94.5%, 95% CI: 93.2, 95.8) had received a hepatitis B vaccination. Of these, 1040 (81.8%, 95% CI: 79.6, 83.9) were aware of their current hepatitis B status. Only 1086 of 1266 (85.6%, 95% CI: 83.9, 87.7) reported having had a blood test to check their immune status. There were no differences in responses between nurses and managers to these questions. However, there was a significantly lower vaccination rate for nurses working in disability services (79.7%, 95% CI: 70.8, 88.6, p < 0.001).

Nurse Reported High Risk Activities for SIN Injury

Nurses were asked to report three common activities during their working day which they consider to be high risk activities for a sharps-related injury. These data were categorised as shown in Table 33. The most commonly reported activities were: administering injections, assisting with procedures, activities associated with intravenous and other major vessel lines (including IV injections and cannulation), disposing of sharps and waste, blood collection/ venepuncture and testing/screening of blood glucose levels/haemoglobin and newborns.

Table 33: Common activities considered to be high risk activities for a sharps injury at work

Categories of reported high risk activities	Nurses reporting one or more activity N = 2668 (%)	Total reported activities N = 2917* (%)
Administering Injections	766 (28.7)	845 (29.0)
Assisting with procedures (including birth)	279 (10.5)	336 (11.5)
Major vessel lines including IV injections and cannulation	275 (10.3)	304 (10.4)
Disposing of sharps and waste	204 (7.6)	229 (7.9)
Blood collection/venepuncture/arterial blood gas	206 (7.7)	213 (7.3)
BGL/BSL, Hb testing and newborn screening	198 (7.4)	199 (6.8)
Razors	106 (4.0)	106 (3.6)
Agitated, anxious, aggressive, confused and paediatric patients	94 (3.5)	105 (3.6)
Removal of Sutures and/or Drains	95 (3.6)	99 (3.4)
Preparing Injections	82 (3.1)	89 (3.1)
Cleaning after procedures and broken glass	82 (3.1)	86 (2.9)
Removal of cannulae or needles	55 (2.1)	55 (1.9)
Use of scalpels and blades	50 (1.9)	51 (1.7)
Re-sheathing/recapping	23 (0.9)	23 (0.8)
Other	130 (4.9)	153 (5.2)
Not applicable, not working with sharps	23 (0.9)	24 (0.8)

* 1168 respondents reported 1 to 3 strategies providing a total of 2917 strategies.

7.7 Nurses' Knowledge and Perceptions of Sharps Injuries

Participants were asked to select from a list the three most important factors that would influence them to report a sharps incident in which they were involved. Table 34 below reports the results. The three most frequent responses selected were: fear of acquiring a blood borne virus, the need to have their risk assessed and being informed about their blood test results.

Table 34: Factors that would influence nurses to report a sharp injury

Factors that would influence reporting an incident	N = 1301	%	95% CI
Fear of acquiring hepatitis B, C or HIV	903	69.4	66.9, 71.9
Need to have my risk assessed	866	66.6	64.0, 69.1
Being informed about my blood test results	556	42.7	40.0, 45.4
The need to have the hazard registered	500	38.4	35.8,41.1
Raised awareness from regular education	339	26.1	23.7, 28.4
Confidence in management to address cause	328	25.2	22.8, 27.6
Assurance of confidentiality	326	25.0	22.7, 27.4
Not being blamed	285	21.9	19.7, 24.2
Counselling about the incident	278	21.4	19.1, 23.6
An easier reporting process	222	17.1	15.0, 19.1
Knowing who will manage the incident	165	12.7	10.9, 14.5
Other	19	1.5	0.8, 2.1

The following activities are recommended by the Centers for Disease Control (70) for the prevention of transmission of blood borne diseases to secondary contacts: using condoms during sex, covering wounds to prevent direct contact with blood, avoiding donating blood, avoiding donating tissue or other bodily fluids, and avoiding sharing personal items. Although participants correctly identified these items as the top five of ten possible responses, it is of concern that the items related to the donation of blood and tissue were only reported by approximately 60% of respondents. For the activities which are not part of the recommended practices, wearing fluid repellent masks and avoiding exposure prone procedures have higher than expected response rates.

Table 35: Prevention of transmission of blood borne diseases to secondary contacts

Prevention of transmission to secondary contacts	N	%	95% CI
Avoiding sharing personal items e.g. razors, toothbrushes and syringes	1198	92.1	90.1, 93.6
Covering wounds to prevent direct contact with blood	1163	89.4	87.8, 91.0
Using condoms during sex	1080	83.0	81.0, 85.1
Avoiding donating blood	807	62.0	59.4, 64.7
Avoiding donating tissue or other bodily fluids	792	60.9	58.2, 63.5
Wearing fluid repellent masks	655	50.3	47.6, 53.1
Avoiding performing exposure prone procedures	612	47.0	44.3, 49.8
Avoiding food that may be contaminated	146	11.2	9.5, 12.9
Avoiding kissing	143	11.0	9.3, 12.7
Removing staff from routine patient contact	91	7.0	5.6, 8.4

Perceptions of Risk

In this section nurses' perceptions of risk associated with contact with patients and items used on patients are reported. For low risk patients (not regularly injecting substances, known to practice safe sex, and blood borne virus status known to be negative), participants consistently reported a lower perceived risk from these patients (> 60%). For high risk patients (known to regularly inject substances, to not practice safe sex and to be blood borne virus positive) participants consistently reported a higher perceived risk from these patients (> 80%). For patients where the risk is unknown (injected substance use is unknown, safe sex practices unknown, and/or blood borne virus status unknown) participants consistently reported a higher perceived risk from these patients (ranging from 57.8% to 65.4%). See Table 36.

Table 36: Perceived risks for blood borne viruses associated with sharps used on patients potentially carrying blood borne viruses

Nurse perception of risk	Low % 95% CI	Medium % 95% CI	High % 95% CI	Total N
Patient known to regularly inject substances	18 (1.4) (0.8 – 2.1)	47 (3.7) (2.7 – 4.8)	1201 (94.9) (93.6 – 96.1)	1266
Patient known to not regularly inject (un-prescribed) substances	757 (60.7) (58.0 – 63.3)	277 (22.2) (19.9 – 24.5)	214 (17.1) (15.1 – 19.2)	1248
Patient's injected (un-prescribed) substance use unknown	58 (4.6) (3.5 – 5.8)	376 (30.0) (27.4 – 32.4)	821 (65.4) (62.8 – 68.1)	1255
Patient is known to not practice safe sex	55 (4.4) (3.2 – 5.5)	187 (14.9) (12.9 – 16.9)	1016 (80.8) (78.6 – 83.0)	1258
Patient is known to practice safe sex	796 (63.8) (61.2 – 66.5)	298 (23.9) (21.5 – 26.3)	153 (12.3) (10.4 – 14.1)	1247
Patient's safe sex practices unknown	81 (6.5) (5.1 – 7.9)	446 (35.7) (33.0 – 38.3)	723 (57.8) (55.1 – 60.6)	1250
Patient's HIV, HBV, HCV status unknown	47 (3.7) (2.7 – 4.9)	419 (33.4) (30.8 – 36.0)	788 (62.8) (60.2 – 65.5)	1254
Patient's HIV, HBV, HCV status known to be negative	861 (68.6) (66.0 – 71.2)	239 (19.0) (16.9 – 21.2)	155 (12.4) (10.5 – 14.2)	1255
Patient known to be HIV positive	27 (2.1) (1.3 – 2.9)	69 (5.5) (4.2 – 6.7)	1170 (92.4) (91.0 – 93.9)	1266
Patient known to be HBV positive	26 (2.1) (1.3 – 2.9)	90 (7.1) (5.7 – 8.5)	1151 (90.8) (89.3 – 92.4)	1267
Patient known to be HCV positive	26 (2.1) (1.2 – 2.8)	76 (6.0) (4.7 – 7.3)	1163 (91.9) (90.4 – 93.4)	1265

In Table 37 responses to perceived risk associated with some used items, injuries and body substances are reported. The following items have been reported to be associated with a higher risk for contracting a blood borne virus (deep puncture wounds, wide bore needles, invasive procedures and exposure to body substances including blood and semen). Participants consistently reported a statistically significant higher perceived risk for these items.

There was less certainty about the degree of risk associated with alternate responses to this question. Participants perceived various degrees of risk (none >50%) for contracting a blood borne virus from a superficial scratch to the skin, a stitch cutter used on a clean wound, and contact with urine and/or faeces or with saliva/sputum; and a high degree of risk associated with a sharps injury from a fine bore needle.

Table 37: Perceived risks for blood borne viruses associated with various sharps injuries, items and exposure to body substances

Nurses' perception of risk	Low (%) 95% CI	Medium (%) 95% CI	High (%) 95% CI	Total
Superficial scratch to skin	387 (31.3) (28.7 – 33.9)	446 (36.1) (33.4 38.8)	402 (32.6) (29.9 – 35.2)	1235
Deep puncture wound	16 (1.3) (6.6 – 19.1)	87 (7.0) (5.6 – 8.4)	1145 (91.7) (90.2 – 93.3)	1248
Fine bore (27 gauge) needle	115 (9.2) (7.6 – 10.8)	288 (23.0) (20.7 – 25.6)	848 (67.8) (65.2 – 70.4)	1251
Wide bore (19 gauge) needle	55 (4.4) (3.3 – 5.6)	148 (11.9) (10.1 – 13.7)	1043 (83.7) (81.6 – 85.8)	1246
Stitch cutter used on a clean wound	281 (22.5) (20..2 – 24.9)	390 (31.3) (28.7 – 33.9)	576 (46.2) (43.4 – 49.0)	1247
Scalpel used to debride an infected wound	56 (4.5) (3.4 – 5.7)	176 (14.2) (12.2 – 16.1)	1010 (81.3) (79.1 – 83.5)	1242
Contact with urine and/or faeces	330 (26.5) (24.1 – 29.0)	447 (35.9) (33.2 – 38.6)	468 (37.6) (34.9 – 40.3)	1245
Contact with saliva/sputum	355 (28.4) (25.9 – 30.9)	439 (35.1) (32.5 – 37.85)	455 (36.4) (33.8 – 39.1)	1249
Contact with blood	33 (2.6) (1.7 – 3.5)	133 (10.5) (8.8 – 12.2)	1095 (86.8) (85.0 – 88.7)	1261
Contact with semen	167 (13.4) (11.5 – 15.3)	344 (27.7) (25.2 – 30.1)	733 (58.9) (56.2 – 61.7)	1244

8 Discussion

Sharps-related incidents and injuries have previously been reported in the Australian context in individual hospital settings (1) (20). A study in NSW in 2007 on this topic was conducted on a sample of health care workers in the public sector (10). Needlestick injuries have also been reported from a survey of Australian Nursing Federation members in 2008 (4) about occupational exposures.

Key features of this study

This study has been focused specifically on the nursing workforce in NSW; including nurses in public hospitals, private hospitals, aged care, disability services and community nursing services; and city, regional, rural and remote areas. Although the response rate was 18.5%, the number of respondents (n=1301) constitutes the largest sample of nurses reporting on SIN injury in Australia in a one year period. Of the respondents, 56% were from the acute care (hospital) setting and 44% from community settings. Median hours per week providing patient care was 28 and 50% of respondents worked full time. Most participants had more than 10 years experience (86%). The largest group of respondents reporting their principal area of practice was aged care nurses. The proportion of respondents who reported that they normally handle sharps in their principal job was 77%.

Incidence

The reported incidence of nurses injured as a result of a sharps-related incident (during contact with needles or sharps that have been used on a patient) was 6.5% and this increased to 8.0% for the respondents who normally handled sharps in their principal job. These rates are comparable with other reported rates in the UK (7%) (n= 6,000) in 2006 (18) and (10%) (n=4,407) in 2008 (71); and Australia (7%) (n=259) in 2007 (10) and (11%) (n=955) in 2008 (4). No significant differences between injury rates were identified when employer categories, nursing role categories, years of experience and average hours per week directly involved in patient care were compared.

Principal areas of clinical practice

No significant differences were identified between injury rates in principal areas of clinical practice. The areas with the highest SIN injury rates in this study were: emergency department, operating theatres and medical wards. These results are consistent with higher rates and relative risk in operating theatres reported by Perry (2005) (23), Clarke et al (2007) (17) and Phipps (2002) (24). However, other studies reported some clinical areas as low risk environments for sharps-related injuries that

were not consistent with the results of this study, for example, mental health nurses (17) and maternity/neonatal wards (2, 17). The results for the ICU area of practice in this study are affected by low numbers. It is clinically plausible that operating theatres are a high risk environment for SIN injury due to the extent of exposure to sharps during any surgical procedure for the operating team (including anaesthetic staff). Furthermore, the types of sharps in common use include those that may not be easily engineered to be safer to use, for example: suture needles, trocars, surgical instruments and wire, saws, drills, reamers and some scalpel blades. Doebbeling et al (2003) reported that the odds of percutaneous injury increased 2%-3% for each sharp handled and was inversely related to routine standard precaution compliance (5). The ACORN Standards (2008) "S25 Management of Sharps in the Perioperative Environment" recommends the use of SEDs, hands free technique and a neutral zone for passing sharp instruments and needles; in addition to the use of appropriate personal protective equipment, correct disposal of sharps and a sharps injury prevention strategy included in the operating suite education program (72). Implications for practice in high risk areas are to develop a sharps safety culture and safe practices particularly where Safety Engineered Devices (SEDs) cannot be substituted for items in current use.

Remote geographic regions

Nurses in remote geographic regions reported a significantly higher rate of SIN injury (16.4) and logistic regression modelling determined that they are 2.9 times more likely to sustain SIN injuries compared with nurses in city/inner regional areas. These nurses have not been previously identified as a high risk group. Additional research may be required to determine factors that contribute to the increased risk for nurses in remote areas.

Reporting and Under-reporting

Nurses in NSW are required to report SIN injuries when they occur (53). Under-reporting has been identified in the literature as an issue in determining incidence of SIN injuries (1, 3, 5, 15, 42, 47, 48, 55). Whitby and McLaws (2002) reported the true rate of reporting is between 76% - 96% (1) and this is similar to the reporting of SIN injuries in this study of 86%, the NSW Health Environmental scan of sharps safety in 2007 of 76% (10) and in the UK in 2008 of 90% (71). However, Driscoll reported a rate of 53% in 2008 (4), Smith et al (2006) reported a rate of 59% (20) and Lee et al reported a rate of 22% in 2005 (42). Doebbeling et al (2003) reported that reporting of SIN injuries decreased as the number of injuries increased: 84% for a single injury,

63% for 3-4 injuries and 24% for more than 5 injuries (5). Although the reporting of SIN injuries has increased, there is scope to improve this reporting practice.

Reasons for reporting SIN injuries

Nurses who sustained SIN injuries (n=84) major reasons for reporting included: the need to have the hazard registered, have the injury assessed, and fear of acquiring blood borne viruses. The most important factors respondents (n=1301) considered would influence them to report were: fear of acquiring blood borne viruses, the need to have their risk assessed and being informed about their blood test results. These results are consistent with the results from the NSW Health Environmental scan of sharps safety in 2007 (10). The UK study in 2008 also reported that half the nurses surveyed feared needlestick injury (71). These results suggest that nurses are aware of the risk associated with exposure to blood borne viruses.

Designated persons/department responsible for responding to SIN injuries

Nineteen percent of respondents reported that there was no designated person/department responsible for responding to sharps-related incidents. Identification of designated persons/departments responsible for responding to sharps-related incidents is a critical component of post-exposure management and this can be improved.

Perceptions of risk

The reporting of SIN injuries has been determined to be due in part to perceptions of risk associated with these incidents (45-47). In this study, 65% of respondents who sustained an SIN injury from a contaminated sharp (n=84) considered that they were not at risk of contracting a blood borne disease and this is consistent with results reported by Lee et al of 95% of 400 respondents' perceptions that the incident was not a health risk (42). It is noteworthy that 42% of participants in the study by Lee et al were anxious, depressed or stressed as a result of SIN incidents (even though they didn't consider the incident to be a health risk).

The remaining 35% in this study did think they were at risk and this result is comparable to the UK study in 2008 that reported 34% of participants considered their risk as medium or high for contracting a blood borne disease (71). The reasons for this perception may be due to knowledge about patient factors (histories, BBV status, and life style practices) and degree of exposure. Responses to questions (by all participants) about patient factors revealed that nurses consistently reported a lower

perceived risk (>60%) from low risk patients; higher perceived risk (>80%) from high risk patients; and for patients where the risk was unknown, a higher perceived risk (58% - 65%) was consistently reported. Perceptions about the degree of exposure were assessed for various sharps injuries, items and body substances. For injuries, items and body substances that have been reported in the literature to be associated with a high risk for contracting a blood borne virus, nurses consistently reported a significant higher perceived risk. There was less certainty about the degree of risk for alternate responses to this question. This result suggests that nurse's knowledge about the risk associated with alternate injuries, items and body substances is unclear. However, although the risk of seroconversion may be considered to be low based on knowledge of patient factors and degree of exposure, these exposures are still associated with clinically significant risk, particularly in view of the window period during which a patient's status may be unknown (i.e. 'Low risk' does not equal 'no risk'). This perception should be addressed in sharps safety training programs.

Prevention of transmission of blood borne diseases to secondary contacts

Nurses (all participants) knowledge of activities for prevention of transmission of blood borne diseases to secondary contacts were correctly identified however, only 60% identified donating blood and body tissues as undesirable and approximately 50% of nurses considered that it was necessary to wear fluid repellent masks and avoid exposure prone procedures for these purposes. Using condoms during sex was correctly identified by 83% of respondents which is similar to the results from Knight (1998) of 93% of 192 nurses to this question (48). The perceptions about activities recommended for the prevention of transmission of blood borne diseases to secondary contacts should be addressed in sharps safety training programs.

Hepatitis B vaccination

Public Health Organisations in NSW are required to offer hepatitis B vaccination to health care workers considered to be at risk (53). Respondents to this question (n=1273) reported 95% of nurses had been vaccinated (a similar result was reported in the NSW Environmental Scan of 95% (10)) and of these, 82% were aware of their current hepatitis B status. However, nurses working in disability services reported a significantly lower HBV rate of 79.7% and this is of concern. There is scope to increase the number of nurses vaccinated for hepatitis B.

High risk activities for SIN injury

Nurses reported the most common activities that they considered to be high risk for SIN injury were: administering injections, assisting with procedures, activities involving intravenous and major vessel lines, disposal of sharps, blood collection and testing/screening for blood glucose, haemoglobin and newborns Guthrie testing. This is consistent with activities reported in the literature to be associated with a high risk for SIN injury (3, 13, 27-30).

Use of gloves where potential exists for exposure to blood

Health care workers in NSW are required to wear gloves during procedures where a potential exists for exposure to blood (51). Compliance with use of gloves during these procedures was reported to be approximately 80% or higher. This result compares well with reported use of gloves in other studies, 67% (5), 59% (19) and approximately 55% (24). There is scope to improve the use of gloves during procedures where a potential exists for exposure to blood.

Recapping

Recapping of needles and other sharps is a practice that has been identified in the literature as contributing to SIN injury (2, 5, 24, 73) and is resistant to change. Recapping is considered to be an unsafe work practice for NSW health care workers (excluding dental nurses) (51) and SIN injuries that occur as a result of this practice are considered to be preventable (73). Doebbeling et al (2003) reported that nurses who never recapped needles experienced a risk reduction of one third (5).

In this study, 38% of nurses (n=802) reported that they recap needles. Nurses were twice as likely to report recapping compared with executive managers. There is a perception that it is not hazardous to recap after drawing up medications because the needle has not been contaminated by use on a patient. However, injuries due to recapping after drawing up medications still involve a skin puncture (damaging normal skin integrity and creating access for pathogens) and may also involve exposure to potentially toxic substances (e.g. chemotherapy agents). In this study, 33% of respondents reported that they recap after drawing up medications and this is similar to the NSW Health Environmental scan of sharps safety result of 27% of 441 respondents (10). In addition, they reported recapping after administering medications (5%) and obtaining blood samples (2%). These practices constitute a clinically significant risk of contact with blood borne viruses. Recapping continues to constitute an unsafe work practice. This practice should be addressed in sharps safety training programs.

However, historically it has proven to be resistant to change and may require new strategies to effect change.

Follow-up of SIN injuries

When SIN injuries are sustained by health care workers in NSW, there are a number of requirements for following up an injury once it has been reported.

Blood testing should be conducted on the injured worker (including follow-up blood testing) and on the source patient involved in the incident if they are known and if they consent.

Information should be provided to the injured person about the risk of blood borne disease, accessing counselling services and any required changes or modifications to work practices. Advice should also be provided about prophylactic treatment and measures to be adopted to prevent possible transmission of BBV to secondary contacts (53).

In this study, 84% of injured nurses who responded to these questions (n=70) reported that blood tests were done following sharps-related incidents. Of these, 95% of nurses were tested and 79% had repeat testing and this compares well with the result of two thirds of nurses tested and 60% repeat tested in the UK study in 2006 (18). Seventy percent of these nurses reported that patients also had blood tests and this result compares well with the UK studies in 2008 and 2006 where 50% of injuries reported resulted in testing of source patients (18, 71). Additional follow-up included the provision of information about BBV (70%) usually within one hour of reporting, counselling services (60%), advice about prophylactic treatment (47%), prevention of transmission to secondary contacts (58%). Overall 73% reported that they were provided with adequate information, support and follow-up after a SIN injury and this result is similar to the UK study in 2008 where two-thirds regarded support offered by employers as adequate (71). Only 17% were required to change/modify work practices during the window period. It is important to note that 27% of respondents were not adequately followed-up after an SIN injury. These episodes may be associated with significant psychological sequelae and NSW OHS legislation requires an employer to protect the health, safety and welfare of employees (including psychological health). There is scope to improve follow-up of nurses who sustain SIN injuries and improve compliance with the requirements for management of potentially exposed health care workers.

Sharps injury prevention programs

In New South Wales, the *Policy Directive: Sharps Injuries - prevention in the NSW public health system* (2007) was revised in June 2007. The policy is a reference for developing sharps injury prevention programs (50). Sharps Injury Prevention Programs should be conducted in NSW Public Health Care organisations and respondents answered several questions about organisational aspects of sharps safety including safety culture, sharps injury prevention training, provision of sharps injury data and policies. Respondents (n=1301) reported that they are working in organisations that have a sharps safety culture (84%) and 93% reported sharps injury prevention programs in their workplaces and 90% considered these programs were effective. This is similar to the UK study in 2008 that reported 94% of employers have sharps policies (71). More than half of the respondents reported 2 major reasons for this were good awareness/compliance/training in their organisation and a reduction in injuries. However, only 32% of respondents reported attending sharps injury prevention training in the previous 12 months and 19% reported no training was provided in their workplace. This is similar to the results of the NSW Health Environmental scan of sharps safety (2007) where 32% of 441 participants received annual sharps injury prevention education (10). Attendance at sharps safety training was significantly lower for nurses employed in disability services, registered nurses and female nurses. There is scope to improve provision of, and attendance at, sharps injury prevention training programs.

Provision of sharps injury data to staff

Only 39% reported that sharps injury data were provided to staff in their organisations and this view was significantly different between executive managers (75%) and nurses (35%). Routine provision of sharps injury data was less likely in private hospitals, and to be provided to enrolled nurses and nurse executives. Nurses employed in aged care facilities and assistants in nursing were unlikely to know if these data were routinely provided. There is scope to substantially improve the provision of sharps injury data in health care organisations.

Policies for responding to sharps incidents

Policies for responding to sharps incidents were reported to exist and to be accessible in 97% of respondent's organisations (n=1289) and this is similar to the results of a study in the UK of 97% (18); and 90% (n=1233) considered that these policies are followed. It is worthwhile noting that the nurses who reported SIN injury (n=84), 73%

considered that they were provided with adequate information, support and follow-up after a SIN incident.

Approachability of managers

Managers were considered to be approachable in the event of a sharps-related injury by 93% of nurses. This result is different to the 61% reported in the NSW Health Environmental scan of sharps safety (10).

Sharps safety strategies

The most frequently reported sharps safety strategies practised in these health care organisations were: correct disposal of sharps in sharps disposal containers (25%), availability and use of safety engineered devices (17%) and receiving sharps safety education (11%).

The NSW Health requirement for provision of sharps containers at point-of-use locations (50) was reported by 93% of respondents and they were more likely to be provided in organisations with sharps injury prevention programs and less likely in disability services.

Safety Engineered Devices

Safety engineered sharps devices were reported to be available in the employing organisation by 92% of respondents and 95% reported a preference to use SEDs. This is consistent with results from the UK study in 2008 that reported 95% of nurses consider SEDs as essential or preferable (71). The 2 most common types were lancets (78%) and syringes/needles/injection devices (52%). The availability of SEDs in the acute sector (59%) compared with all others (42%) was significantly different. SEDs were considered to be effective in reducing the risk of SIN injury by 90% of respondents however some nurses still consider there is a risk associated with using SEDs. The NSW Health *Policy Directive: Sharps Injuries - prevention in NSW public health system* (2007) includes involving nurses in selecting and evaluating products (including SEDs) (50) and 55% of respondents reported this occurs in their organisations however this view was significantly different for executive nurse managers (73%) compared with nurses (53*%).* The availability of SEDs in health care organisations can be increased, particularly in the non-acute sector, because these devices can substantially reduce the incidence of SIN injury. Nurses should be more involved in selecting and evaluating SEDs.

Achievement of study aims and objectives

These data demonstrate the achievement of the proposed aims and objectives of this study including:

- nurse reported incidence of SIN injury in the past 12 months,
- assessment of the perceptions of risk associated with a SIN injury,
- evaluation of the reporting and follow-up where a SIN injury has occurred and routine adherence with follow-up procedures with recommended guidelines,
- assessment of the provision of safety engineered devices in the workplace and the perception of nurses that SIN injuries are prevented by the use of these devices,
- identification of the existence of sharps safety programs to prevent the occurrence of SIN injury in participants' place of employment,
- evaluation of nurses perceptions of risk control measures by their employers for the prevention of SIN injury in their workplace, and
- comparisons of the data between the public and private sector employees; city, regional, rural and remote area nurses; public hospitals and private hospitals, aged-care facilities, disability services, and community nurses; and perspectives reported by managers and nurses.

8.1 Study Strengths and Limitations

8.1.1 Strengths

This study has included participants from the private and aged care sectors, and disability and community nursing services and from rural and remote area. These groups have not been well represented in other studies in Australia. The resultant number of respondents constitutes the largest sample of nurses reporting on SIN injury in a one year period in Australia in the last decade.

8.1.2 Limitations

The response rate to the survey was low and consequently the results may not be representative of the nursing population sampled. However, the SIN injury rate and several other data items reported in this study are similar to other reported rates and suggest that the results are unlikely to be affected by the low response rate. Under-reporting may also be an issue in this study and would be consistent with previous published studies. However, it is expected to be better than the reporting rates based

on routine monitoring and voluntary reporting of incident data. Factors that would influence nurses to report sharps-related injuries have also been reported in this study.

The retrospective approach for this survey involved respondents reporting data for a period of 12 months prior to completing the survey. This approach may be affected by recall bias and associated under-reporting however, it is considered to be unlikely to substantially affect the results and is a limitation of many similar studies with which this study has been compared.

9 Conclusions

Sharps-related injury continues to be an important OH&S issue for nurses and is associated with clinically significant risks including the potential for transmission of blood borne viruses, exposure to toxic substances, physical injury, psychological effects and related costs. The risk is significantly higher in remote areas. Some clinical areas may have a higher risk. Reporting of SIN injuries is good but less than desired and nurses fear acquiring a blood borne virus. Follow-up of SIN injuries according to policies is high but there is scope to improve. Recapping remains a high risk activity and compliance can be improved by one third of nurses. SEDs continue to offer a solution to the risks associated with handling sharps devices and nurses' preference to use these devices is high. Compliance with hepatitis B vaccination and point of use sharps containers is high. Reported access and attendance to sharps safety training (during the previous 12 months) was less than desired and there is scope to improve this in health care organisations. Overall, nurse reported practices are consistent with NSW Health policy directives for provision of sharps disposal containers, product evaluation, reporting of injury data, hepatitis B vaccination and reporting of SIN injury however there is scope for some of these practices to be improved.

10 Recommendations

1. Health care organisations should develop a culture of sharps safety and safe practices in high risk areas, particularly where Safety Engineered Devices (SEDs) cannot be substituted for items in current use.

2. Further research should be conducted to determine factors that contribute to the increased risk of SIN injury for nurses in remote areas.

3. Health care organisations should actively develop reporting processes and encourage reporting of SIN injuries.

4. Health care organisations should identify designated persons/departments as responsible for responding to sharps-related incidents because this is a critical component of post-exposure management.

5. Sharps safety training programs should be modified to address the perception that 'low risk' equals 'no risk' in the event of a SIN injury.

6. Sharps safety training programs should include activities recommended for the prevention of transmission of blood borne diseases to secondary contacts.

7. Health care organisations should vaccinate all nurses for hepatitis B.

8. Health care organisations should train and require nurses to use gloves during procedures where a potential exists for exposure to blood.

9. Sharps safety training programs should include information that recapping is an unsafe work practice. Other strategies may also be required to assist nurses to change this practice.

10. Health care organisations should follow-up all nurses who sustain SIN injuries and comply with the requirements for management of potentially exposed health workers.

11. Health care organisations should provide sharps injury prevention training programs and support nurses to attend them annually.

12. Health care organisations should routinely provide sharps injury data to staff.

13. Health care organisations should increase the availability of SEDs, particularly in the non-acute sector, because these devices can substantially reduce the incidence of SIN injury. Nurses should be involved in selecting and evaluating SEDs.

11 Acknowledgements

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Expert Panel Members:

1. Sandy Berenger – Infection Control Consultant Hunter New England Health
2. Mark Friedwald – Project Officer (Safety with Sharps for Clinicians working in NSW Public Health Organisations 2006) Population Health Division NSW Health
3. Karen Cairney – Nurse Educator Nephrology, Hunter New England Health
4. Tracy Levett-Jones – Senior Lecturer Nurse Academic, University of Newcastle

5. Jan Roche – Lecturer, Clinical Assessor, Nurse Academic, University of Newcastle
6. Ashley Kable - Senior Lecturer Nurse Academic, University of Newcastle
7. Maya Guest – Lecturer, OH&S Researcher, University of Newcastle
8. Amy Jurd – Research assistant (Needlestick and Sharps Injuries Survey of NSW Nurses 2007 Project)

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13 Attachments

Attachment 1: Information Statement

Information Statement for the Research Project:

Needlestick and Sharps Injuries among NSW Nurses

THE UNIVERSITY OF NEWCASTLE AUSTRALIA

Document Version 3; Dated 17/09/07

You are invited to participate in the research project identified above which is being conducted by Dr Ashley Kable and Ms Maya Guest, from the Faculty of Health at the University of Newcastle.

Why is the research being done?

The NSW Nurses Association is interested in the issue of needlestick and sharps injuries among its members and is currently involved in a research study on this topic in collaboration with the University of Newcastle. The purpose of the research is to measure nurses' perceptions of sharps injuries including needlestick (SIN) and associated risk, in NSW health care facilities including aged care facilities. Nurses have a higher risk for SIN than any other health professional group. This study will provide valuable information about Nurses and SIN in NSW including assessing nurses' perceptions of how often these injuries occur and how they may be prevented.

The expected benefit of this research to the nursing profession is to identify nurses' perceptions of risk associated with SIN and reported occurrence of SIN. The results of this study may provide evidence for development of policy and OH&S programs to reduce hazards associated with SIN. In particular, it will provide additional evidence about the issue of provision of safety engineered sharps devices. Recommendations for changes to the regulation and associated policy may have direct safety benefits in the clinical workplaces of NSW nurses.

Who can participate in the research?

All nurses currently employed in NSW are eligible to participate in this study. Potential participants have been selected from the NSW Nurses Association membership data base from a range of workplace categories and geographic locations. If you are not currently employed in NSW then unfortunately you are not eligible to participate. This invitation has been distributed by the NSW Nurses Association, on behalf of the researchers.

What choice do you have?

Participation in this research is entirely your choice. Only those people who give their informed consent will be included in the project. Whether or not you decide to participate, your decision will not disadvantage you.

What would you be asked to do?

If you agree to participate, you will be asked to complete and return a survey form about SIN in your workplace. The survey is anonymous. No information will be collected on this survey that will identify you. The survey form is to be returned to the researchers in a pre-addressed reply paid envelope provided with the project documents.

How much time will it take?

The survey form should take about 20 minutes to complete.

What are the risks and benefits of participating?

There will be no direct benefit to you in participating in this research.

A collaborative research project between the University of Newcastle and the NSW Nurses Association.

How will your privacy be protected?

The survey form is anonymous and it will not be possible to identify you from your answers. Although a study number is printed on the survey it is not linked to any information that will identify you. The study number will provide a unique identification of each survey form and will only be used for the purpose of checking data.

Survey forms used to create data files will be stored in a secure location and disposed of, 5 years after the conclusion of the project. Data files will only be accessible by the research team and will be password protected.

How will the information collected be used?

This project has been funded by WorkCover Assist 2006 applied Research projects. The results of this project will be reported to WorkCover in a formal report, and presented at an annual workshop session convened by WorkCover. A copy of the report will be provided to NSW Nurses Association. Individual participants will not be identified in any reports arising from the project.

A summary of the results of the study will also be provided to the NSW Nurses Association for the purpose of providing feedback to their membership about the results of this study.

The results will also be published in a peer reviewed journal, and may be used to inform policies and presented at professional conferences.

What do you need to do to participate?

Please read this Information Statement and be sure you understand its contents before you consent to participate. If there is anything you do not understand, or you have questions, contact the researcher.

If you would like to participate, please complete and return the attached anonymous survey form in the reply paid envelope provided. This will be taken as your informed consent to participate.

Further Information

If you would like further information please contact:

Dr Ashley Kable

Faculty of Health, University of Newcastle, Callaghan NSW 2308

Phone: 02 49217038

Email: Ashley.kable@newcastle.edu.au

Thank you for considering this invitation.

Dr Ashley Kable

Complaints about this research

This project has been approved by the University's Human Research Ethics Committee, Approval No. H-591-0907. Should you have concerns about your rights as a participant in this research, or you have a complaint about the manner in which the research is conducted, it may be given to the researcher, or, if an independent person is preferred, to the Human Research Ethics Officer, Research Office, The Chancellery, The University of Newcastle, University Drive, Callaghan NSW 2308, Australia, telephone (02) 49216333, email Human-Ethics@newcastle.edu.au.

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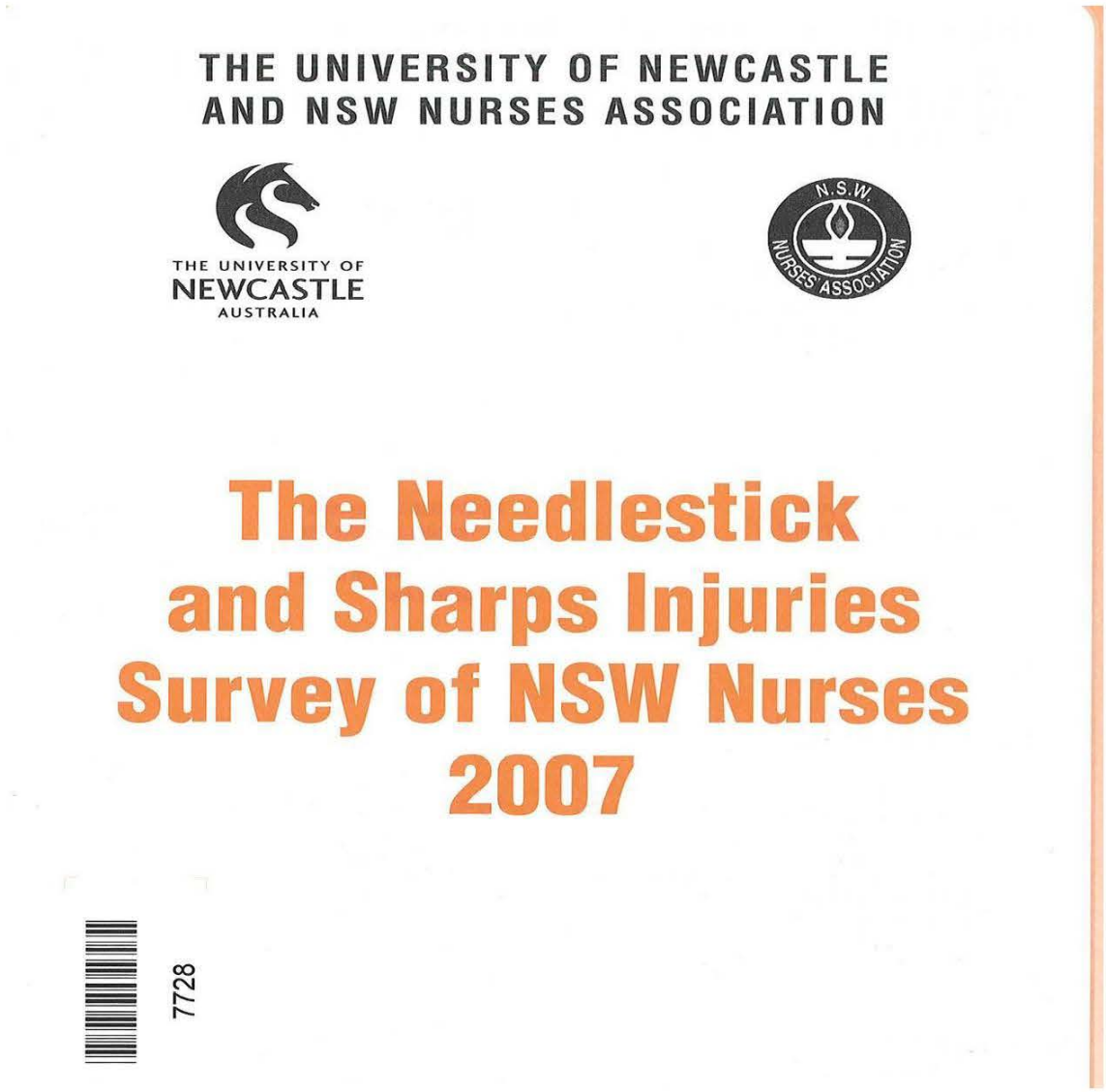
Attachment 2: Survey Instrument



INSTRUCTIONS: 2B PENCIL BLUE OR BLACK PEN

- Use a blue/black ballpoint pen or 2B pencil
- Do not use red or felt tip pens
- Erase mistakes fully
- Make no stray marks

Please MARK LIKE THIS:

Example: Please write in boxes provided, then mark oval corresponding to the number in each column. 2 1 3 0

Study number:

A. STUDY ELIGIBILITY

1. Have you worked as a nurse (including nurse educator, researcher or manager) in NSW in the last 12 months?

○ Yes ○ No

IF NO, YOU DO NOT HAVE TO ANSWER ANY MORE QUESTIONS.
Please return the survey in the envelope provided. Thank you.

B. GENERAL WORKPLACE INFORMATION

2. What is the postcode of your principal place of employment?

3. Current Principal Employer Category *(select ONE)*

- ○ Public Hospital
- ○ Private Hospital/Health Facility Employer
- ○ Aged-Care Facility
- ○ Disability Services
- ○ Community Nursing/Community Health Services
- ○ General/Private Practice
- ○ Self Employed
- ○ Nursing Agency
- ○ Other *(please specify)*

4. Current Nursing Role *(select ONE)*

- ○ Assistant In Nursing
- ○ Enrolled Nurse
- ○ Endorsed Enrolled Nurse
- ○ Registered Nurse
- ○ Registered Midwife
- ○ Clinical Nurse Specialist
- ○ Clinical Nurse Consultant
- ○ Clinical Educator
- ○ Nurse Educator
- ○ Nurse Manager
- ○ Accredited Nurse Practitioner
- ○ Nurse Executive (Director of Nursing, DDON, CEO)
- ○ Other *(please specify)*

5. Years of Experience as a nurse — years

6. (a) What is the average number of hours per week in which you are involved in direct patient care? — hours per week

(b) Is your principal employment…?
(please mark ONE option)

- ○ Full time
- ○ Part time
- ○ Casual

7. Are you...? *(please mark ONE option)*

- ○ Male
- ○ Female

8. What is your age? — years

9. Principal Area of Practice *(select ONE or TWO, if relevant)*

- ○ Emergency nursing
- ○ Operating theatres/Recovery/Anaesthetics
- ○ Medical wards/services
- ○ Surgical wards/services
- ○ Intensive Care/HDU/CCU/NICU
- ○ Midwifery
- ○ Mental Health
- ○ Drug and Alcohol services
- ○ Sexual Health/Family Planning
- ○ Aged Care/Older person nursing
- ○ Paediatrics
- ○ Nephrology/Renal/Transplant
- ○ Primary Care/General practice
- ○ Community services
- ○ Management
- ○ Education
- ○ Research
- ○ Red Cross Blood/Pathology services
- ○ Rehabilitation
- ○ Disability services
- ○ Equipment processing and sterilization (CSU)
- ○ Infectious diseases/public health/infection control
- ○ Occupational health and safety
- ○ General hospital (Rural)
- ○ Indigenous health
- ○ Other *(please specify)*

C. NEEDLESTICK AND SHARPS INJURIES IN YOUR WORKPLACE

10. In your principal job, do you normally handle needles or sharps?

○ Yes ○ No

11. (a) Does your organisation/workplace have a sharps injury prevention program to prevent needlestick and sharps injuries occurring? *(Eg may include Sharps Training, Disposal, Purchasing & supply and Management & follow-up of incidents)*

○ Yes ○ No

IF **YES**, do you think this program is effective in preventing needlestick and sharps injuries?

○ Yes ○ No

WHY/WHY NOT?

(b) Have you attended an orientation program or inservice program that included sharps injury prevention training during the last 12 months?

○ Yes ○ No

(c) Which of the following topics have been part of the sharps injury prevention training provided in your organisation? *(select ALL those provided)*

- ○ Risks of blood-borne virus transmission
- ○ Sharps counselling
- ○ Handling and disposal of sharps
- ○ Reporting of sharps injuries
- ○ Post exposure follow-up and prophylaxis (PEP)
- ○ New sharps devices
- ○ No training sessions about sharps injury prevention provided

12. Does your organisation/workplace have policies/ procedures/protocols for responding to incidents associated with contact with needles or sharps that have been used on a patient?

○ Yes ○ No

IF **YES**, can you locate/access them?

○ Yes ○ No

IF **YES**, in what format are they provided? *(select ALL relevant options)*

- ○ Electronic (Intranet)
- ○ Manuals (paper documents)
- ○ Attached to your ID card

13. Is there a designated person/department responsible for responding to sharps related incidents?

○ Yes ○ No

IF **YES**, who (role/designation of person) *OR* which department is responsible?

14. During the last 12 months, have you been involved in an incident during contact with needles or sharps *that have been used on a patient*?

○ Yes ○ No

IF **NO**, PLEASE GO TO QUESTION **25**. Thank you.

IF **YES**, please estimate how many of these incidents you had during the last 12 months?

0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9

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15. Did you think that you may have been at risk for contracting a blood borne disease as a result of this/these incidents?

○ Yes ○ No

WHY/WHY NOT?

16. Did you report this/these incidents when they occurred?

- ○ YES – all incidents were reported
- ○ YES – some incidents were reported
- ○ NO – no incidents were reported

IF **NO**, PLEASE GO TO QUESTION **17c**.

17. (a) IF **YES**, why did you report these incidents?
(select up to THREE most important reasons)

- ○ To have the injury assessed
- ○ Fear of acquiring hepatitis B, hepatitis C or HIV
- ○ Knowing who would manage the incident
- ○ I was assured of confidentiality
- ○ The need to have the hazard registered
- ○ Other *(please specify)*

(b) How did you report these incidents?
(select ALL relevant responses)

- ○ Verbally to my manager/team leader
- ○ Completing a report form (paper document)
- ○ Completing a report form (electronic document)
- ○ Not sure how to do this

PLEASE GO TO QUESTION 18.

(c) Why did you NOT report these incidents?
(select up to THREE most important reasons)

- ○ Device was not contaminated – incident occurred during drawing up medication
- ○ I considered the risk too low to report (minor injury)
- ○ I was unsure about who to report to
- ○ I was unsure about how to report these incidents
- ○ I was advised not to report
- ○ Too much time was required to complete the process
- ○ Reporting process was too complicated
- ○ I was concerned about my confidentiality
- ○ Fear of acquiring hepatitis B, hepatitis C or HIV
- ○ Concern over being judged incompetent
- ○ Fear of being disciplined
- ○ I accept injuries as an occupational hazard
- ○ I have been vaccinated for Hepatitis B
- ○ Fear of dismissal
- ○ Patient workload priorities
- ○ Other *(please specify)*

D. SHARPS-RELATED INCIDENT FOLLOW-UP

18. Were any blood tests done as a result of these sharps-related incidents?

○ Yes ○ No

IF **YES**:

i) Were these tests done on you? ○ Yes ○ No

ii) Did you also have follow-up blood tests? ○ Yes ○ No

iii) Were these tests done on the patient? ○ Yes ○ No ○ Don't know

IF NO BLOOD TESTS WERE DONE ON THE PATIENT:

– Did the patient refuse?
○ Yes ○ No ○ Don't know

– Was the source patient unknown?
○ Yes ○ No

19. Were you provided with information about the risk of blood borne disease after you reported the incident(s)?

○ Yes ○ No

IF **YES**, how soon after you reported the incident did you receive this information? ____ hours

20. Were you offered access to counselling services?

○ Yes ○ No

21. Were you required to change or modify any of your work practices after this/these incident(s) occurred (during the window period)?

○ Yes ○ No

IF **YES**, please outline the work practice changes required:

22. Were you provided with advice about prophylactic treatment (PEP)?

○ Yes ○ No

23. Were you advised regarding measures that should be adopted to prevent possible transmission of blood borne diseases to secondary contacts (during the window period)?

○ Yes ○ No

24. Do you think that you were provided with adequate information, support and follow-up after the sharps-related incidents in which you were involved?

○ Yes ○ No

WHY/WHY NOT?

E. NURSES' KNOWLEDGE/PERCEPTIONS OF SHARPS INJURIES

25. Which of the following is a means of preventing possible transmission of blood borne diseases to secondary contacts (during the window period)? *(select ALL measures that you think will be effective)*

- ○ Wearing fluid repellent masks
- ○ Using condoms during sex
- ○ Covering wounds to prevent direct contact with blood
- ○ Avoiding kissing
- ○ Avoiding performing exposure prone procedures
- ○ Avoiding donating blood
- ○ Avoiding food that may be contaminated
- ○ Avoiding donating tissue or other body fluids
- ○ Avoiding sharing personal items eg razors, toothbrushes and syringes
- ○ Removing staff from routine patient contact

26. Please list THREE common activities during your working day which you consider to be high risk activities for a sharps-related injury.

1.

2.

3.

27. Please rate the following as either HIGH/MEDIUM/LOW risk for contracting a blood borne virus as a result of incidents due to contact with needles or sharps that have been used on a patient.

	HIGH	MEDIUM	LOW
Patient is known to regularly inject (unprescribed) substances	○	○	○
Patient is known to not use injected (unprescribed) substances	○	○	○
Patient's injected (unprescribed) substance use is unknown	○	○	○
Patient is known to not practise safe sex	○	○	○
Patient is known to practise safe sex	○	○	○
Patient's safe sex practices are unknown	○	○	○
Patient's HIV, HBV, HCV status is unknown	○	○	○
Patient's HIV, HBV, HCV status is known to be negative	○	○	○
Patient is known to be HIV positive	○	○	○
Patient is known to be HBV positive	○	○	○
Patient is known to be HCV positive	○	○	○
Sharps-related incident involving...			
superficial scratch to the skin	○	○	○
deep puncture wound	○	○	○
27 gauge needle	○	○	○
19 gauge needle	○	○	○
stitchcutter used on a clean wound	○	○	○
scalpel used to debride an infected wound	○	○	○
contact with urine and/or faeces	○	○	○
contact with blood	○	○	○
contact with semen	○	○	○
contact with saliva/sputum	○	○	○

HIV – Human Immunodeficiency Virus
HBV – Hepatitis B Virus
HCV – Hepatitis C Virus

28. Which of the following factors would influence you to report all sharps incidents in which you are involved? *(select THREE most important reasons)*

- ○ The need to have my risk assessed
- ○ An easier reporting process
- ○ Knowing who will manage the incident
- ○ Fear of acquiring hepatitis B, hepatitis C or HIV
- ○ Assurance of confidentiality
- ○ Raised awareness from regular education
- ○ The need to have the hazard registered – some sharps designs may be hazardous to users
- ○ Confidence in Management to address cause
- ○ Being informed about my blood test results
- ○ Counselling about the incident
- ○ Not being blamed
- ○ Other *(please specify)*

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29. (a) Does your organisation have any of the following safety engineered sharps device categories available for you to use in the clinical area where you predominantly work?
(select ALL relevant items)

- ○ Syringes, needles and injection devices (eg retractable syringes/needles)
- ○ Pre-loaded syringes
- ○ IV access insertion devices (safety cannulae)
- ○ IV delivery systems (needle-less)
- ○ Blood collection and venepuncture
- ○ Lancets (as used in glucose readings)
- ○ Suture needles (blunt)
- ○ Surgical scalpels

(b) Do you consider these devices to be effective in preventing needlestick and sharps injuries?

○ Yes ○ No

WHY/WHY NOT?

(c) Are non-safety engineered sharps devices also available for you to use in the clinical area where you predominantly work?
(select ALL relevant items)

- ○ Syringes, needles and injection devices
- ○ Pre-loaded syringes
- ○ IV access insertion devices
- ○ IV delivery systems (conventional)
- ○ Blood collection and venepuncture
- ○ Lancets (as used in glucose readings)
- ○ Suture needles
- ○ Surgical scalpels

(d) Do you (would you) prefer to use safety engineered sharps devices in your daily work?

○ Yes ○ No

WHY/WHY NOT?

30. Does your organisation provide sharps containers at point-of-use locations, eg at the bedside, portable or attached to procedure trolleys?

○ Yes ○ No

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31. Do you ever recap (non-safety) needles?
(select ALL relevant options)

- ○ Yes – **after** drawing up medications
- ○ Yes – **after** administering medications
- ○ Yes – **after** obtaining blood samples
- ○ No – never

32. Do you wear gloves when you are involved in procedures where you may be exposed to blood or equipment that may be contaminated with blood?
(select ALL relevant options)

- ○ Yes – for administering injections, obtaining blood samples, removing cannulae and handling blood infusions
- ○ Yes – for invasive procedures
- ○ Yes – if safety engineered sharps devices are not available
- ○ Yes – for cleaning up blood spills/sprays/leaks
- ○ No – not usually necessary

33. (a) Have you received hepatitis B vaccination?

○ Yes ○ No

(b) Are you aware of your current hepatitis B status?

○ Yes ○ No

(c) Have you had a blood test to check if you are immune?

○ Yes ○ No

34. Do you think your organisation's sharps-related incident policies are followed in response to incidents associated with handling needles or sharps that have been used on a patient?

○ Yes ○ No

35. Do you think your managers/team leaders are approachable and supportive in the event of a sharps-related injury?

○ Yes ○ No

36. Do you think your organisation is "sharps safety oriented" or has a sharps safety culture?

○ Yes ○ No

IF **YES**, list THREE sharps safety strategies that are consistently supported/practised in your organisation

1.

2.

3.

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37. Does your organisation involve nurses in selecting and evaluating safety engineered sharps devices for use in the clinical environment?

○ Yes ○ No

38. Is sharps incident/injury data routinely provided to staff in your organisation?

○ Yes ○ No ○ Don't know

IF **YES,** how is this data made available?

39. In your opinion, what would be the most effective way to prevent sharps injuries occurring in your organisation?

Thank you for completing this survey.

Please return the survey in the envelope provided.

Attachment 3: Reminder/Thank You Card

Thank you for Participating

Needlestick and Sharps Injuries among NSW Nurses

Document Version 1; Dated 17/09/07

Recently you would have received a study package for the Needlestick and Sharps Study. The purpose of the study is to measure nurses' perceptions of sharps injuries including needlestick (SIN) and associated risk, in NSW health care facilities.

If you have already returned your completed survey form to the University of Newcastle,

Thank you!

If you have not yet returned the survey it is not too late – you can send it now.

If you need another package sent to you, please contact:

Mary McLeod at NSWNA on this number 1300367962

Further information

If you would like further information about the study please contact:

Dr Ashley Kable

Faculty of Health, University of Newcastle, Callaghan NSW 2308

Phone: 02 49217038 Email: 07sharpsstudy@newcastle.edu.au

Thank you for considering this invitation.

If you have any concerns about the study, you are welcome to contact the Human Research Ethics Officer, Research Office, The Chancellery, The University of Newcastle, University Drive, Callaghan NSW 2308, Australia, telephone (02) 4921 6333, email Human-Ethics@newcastle.edu.au.

CONTACT

School of Health Sciences
The University of Newcastle
Callaghan NSW 2308 Australia
T +61 2 4921 7735
F +61 2 4921 7479
E Maya.Guest@newcastle.edu.au

Visit us online
www.newcastle.edu.au

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