# Knowledge and experiences of needle prick injuries (NPI) among nursing students at a university in Gauteng, South Africa

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## Abstract

**Background:** Healthcare workers and students on training who are directly involved in treating and nursing patients face a great risk of acquiring blood-borne infections from the workplace. Needle prick injuries (NPI) are the commonest route by which such infections are transmitted from patients to healthcare providers. Nursing students on training are no exception, as they get exposed to accidental needle pricks and contamination during their hospital activities. Lack of appropriate resources, knowledge and skills, coupled with the unavailability of the universal standard precautionary procedures and compliance thereof, constitute high risks for needle prick injuries. Adequate knowledge and adherence to safety practices could prevent the occurrence of NPI and the related consequences. A survey was conducted among nursing students at a specific university in Gauteng to assess their knowledge of NPI, to identify and describe factors that contribute to the occurrence of NPI, and to discover the circumstances of needle prick accidents among the targeted group of students.

**Methods:** A cross-sectional quantitative survey was conducted among nursing students from the second to the fourth year of study registered at the specific university for the 2007 academic year. Questionnaires were hand delivered to a convenient sample of nursing students attending mandatory nursing classes. Those who consented signed a consent form. Participants completed and handed back the questionnaires to the researchers on the same day that they were delivered. Data collected included factors contributing to NPI and high-risk procedures leading to NPI, as perceived by these students. A knowledge assessment of NPI guidelines, policies and protocols and prevalence of NPI among these students was also done.

**Results:** A response rate of 96 (74%) was achieved. The average age of the respondents was 23 years, with a minimum age of 18 and a maximum age of 35. The sample consisted of more females than males. The majority of respondents were in the second year of study. The majority (56%) rated needle recapping, disposing used needles (28.1%) and cleaning sharp instruments (56.3%) as extremely high-risk procedures. Furthermore, 30.2% of the respondents thought suturing and blood taking (33.3%) were high-risk procedures for NPI, while 25% rated administering injections, 35.5% rated blood transfusion and 74.8% rated the lack of adequate containers for sharps disposal to be highly associated with the risk of NPI. A significant proportion of the respondents rated the lack of knowledge about NPI (policies and protocols) at institutions of clinical training as an extremely high risk, followed by the lack of accompaniment and in-service training. Only 16.0% of the respondents had suffered NPI and only 8.3% had reported the incident.

**Conclusion:** Procedures rated as high risk were considered to be most likely associated with the occurrence of NPI. Appropriate guidelines, adequate knowledge and the enforcement of compliance with standard precautionary measures could reduce the incidence of NPI among nursing students.

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## Introduction

Needle prick injuries (NPI) are the commonest route by which blood-borne viruses and/or infections such as HIV and hepatitis B and C are transmitted from patients to healthcare workers. Such infections serve as high occupational risks and threats to healthcare workers, especially where basic rules of occupational safety and health are not implemented. The risk of contracting acute hepatitis C infection due to a needle prick injury is estimated to range from 1% to 5%.[1,2]

It is estimated that the risk of contracting hepatitis B infection due to a needle prick injury is 100 times higher than that of contracting HIV. A blood-exposure accident refers to a needle prick or a cut caused by another sharp object that occurs at a hospital. The prevalence of occupational HIV is 0.3% after parenteral exposure, as opposed to 0.09% after mucosal exposure.[1]

According to the World Health Organization, the exact scale of occupational risk in the health sector is unclear, partly because of the stigma and blame attached to the reporting of sharps injuries and the lack of available post-exposure prophylaxis.[3,4,5] Nursing students are also at risk of such infections and injuries due to accidental contamination during their practical occupational exposure.

A survey was conducted among nursing students enrolled at a university with a health sciences faculty to determine their knowledge of and the circumstances of needle prick injuries and how the risk of blood exposure is managed. A well-trained, adequately resourced, safe and secure health service workforce is essential to curbing the transmission of blood-borne diseases resulting from needle prick injuries in order to promote efficient and effective healthcare service delivery.

## Methods

A cross-sectional quantitative survey was conducted among second-, third- and fourth-year nursing students registered for the 2007 academic year at a medical university in Gauteng province, South Africa. Students enrolled for the first year of nursing studies and those who were not present during the period of this study were excluded. First-year students were excluded because they are not expected to handle sharps during their practical work in the hospital.

A total of 121 nursing students who were eligible for the survey were registered at the university where the study was conducted. About 25 students were not available on the day of the study. They were either sick or had missed class on that day.

A pre-tested questionnaire was self-administered to a convenient sample of nursing students attending mandatory nursing classes. Special arrangements were made for students to complete questionnaires during mandatory class attendance and the authors collected all the questionnaires immediately on completion. Data collected included factors contributing to NPI and high-risk procedures leading to NPI, as perceived by these students. A knowledge assessment of NPI guidelines, policies and protocols and an estimation of the prevalence of NPI among these students were also done.

A pilot study was conducted with 15 nursing students not enrolled at the same medical university where the major study was done. The limitations of the study design are that selection and/or recall bias could have occurred due to the reliance on self-report by the respondents, and that a sample size of 74% was achieved because the responses of the other 26% who did not participate in the study were not obtained.

Written informed consent was obtained from all participants when they were asked to participate. The Ethics Committee of the Faculty of Health Sciences (School of Public Health) approved the study. Data were collected from January to March 2007.

## Results

A total of 96 questionnaires was delivered to a convenient sample of nursing students during mandatory class attendance. The average age of the respondents was 23.4 years, with the minimum age being 18 and the maximum being 35 years, as depicted in Table I. The respondents consisted of 77 (80.2%) females and 19 (19.8%) males and the majority of the respondents (34; 35.4%) were in their second year of nursing studies.

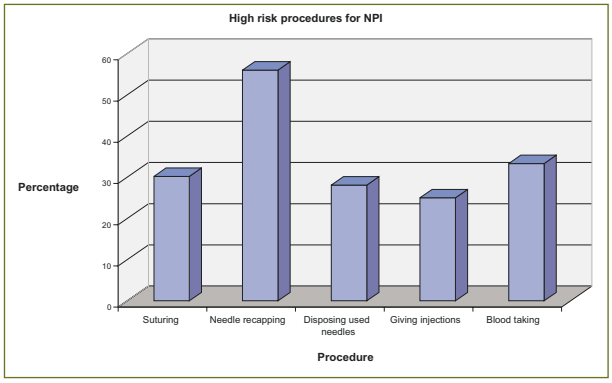
**Table I:** Age groups

| Age groups | Frequency | Percentage |
|---|---|---|
| 18–21 | 47 | 49 |
| 22–25 | 37 | 38.5 |
| 26–29 | 8 | 8.3 |
| 33–35 | 4 | 4.2 |
| **Total** | **96** | **100** |

The majority of the respondents (75; 83.3%) displayed a fairly high level of awareness of the NPI guidelines. More than half (51; 56.3%) had a fair knowledge and understanding of the content of the NPI guidelines, while 75 (78.1%) indicated that the standard operating procedures (SOPs) for NPI were available and easily accessible in the hospitals and clinics where they conducted their clinical practice.

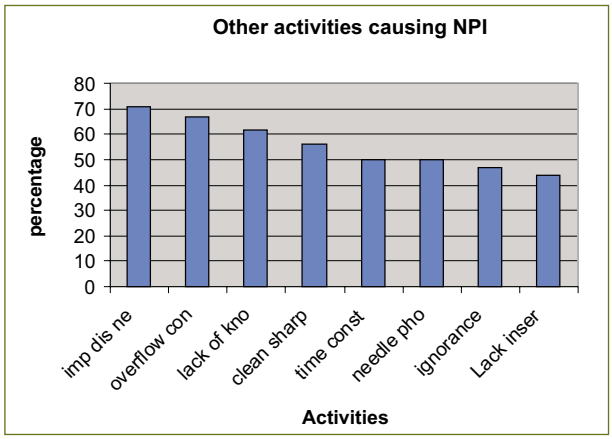
The participants also indicated that they clearly understood the content and specifications of the prescribed SOPs. Very few of the respondents (31; 32.3%) declared adherence to SOPs, while the majority (65; 67.7%) stated that they did not conform to the stipulated SOPs. With regard to rating the level of risk associated with the occurrence of NPI while performing nursing care procedures, Figure 1 indicates that most of the respondents (29; 30.2%) thought that suturing had an extremely high risk for NPI. About 32 (33.3%) of the respondents rated blood-taking as the most frequent circumstance for NPI and 26.0% rated the administering of injections as carrying a high risk to NPI According to many of the respondents (35.5%), blood transfusion carries a moderate risk. Other activities responsible for NPI are shown in Figure 2.

**Figure 1:** High-risk procedures leading to NPI




The results from Figure 2 show the following most important activities that gave rise to NPI and the percentage of respondents who thought so: improper disposal of needles (70.8%), overflowing of used sharps containers (66.7%), lack of knowledge of healthcare providers (61%),

**Figure 2:** Other activities causing NPI




cleaning sharp instruments contaminated with blood (56.3%), time constraints (50%), patients with needle phobia (50%), ignorance of healthcare workers (46.9%) and the lack of in-service training (43.8%).

In order to determine whether the differences in age made a difference in knowledge, adherence to standard operating procedures (SOPs) and occurrence of NPI, the information was separated into age groups (see Table II). The majority of students were between the ages of 18 and 21 years. It was found that age made no difference to knowledge ($p = 0.198$ using Fisher's exact test), adherence to SOPs ($p = 0.540$) and events of NPI ($p = 0.470$).

Table II shows the relationship between NPI and selected variables based on evidence from the literature. Extremely high risk procedures were considered to be most likely associated with the occurrence of NPI. Only one variable, i.e. following universal procedure, is significantly related to the occurrence of NPI.

**Table II:** Relationship between selected variables and NPI

| Variables | | Chi²/ Fisher exact value | P value |
|---|---|---|---|
| Level of study | 2nd year | 0.832 | 1.00 |
| Recapping needle | 3rd year<br>4th year | 0.048 | 0.872 |
| | Ext high risk | | |
| | Low risk | 0.290 | 0.731 |
| Administering injection | Ext high risk | | |
| Cleaning sharp instruments | Low risk | 0.067 | 0.795 |
| | Ext high risk | | |
| | Low risk | 1.34 | 0.854 |
| Lack of app. instruments | Na<br>Mild<br>Moderate<br>High<br>Ext high | | |
| Lack of experience | ------do------ | 6.304 | 0.169 |
| Lack of knowledge about procedure | ------do------ | 1.227 | 0.87 |
| Knowledge of NPI consequences | ------do------ | 5.810 | 0.214 |
| Lack of in-service training | ------do------ | 1.83 | 0.80 |
| Knowledge of contents of NPI guidelines | ------do------ | 0.124 | 0.725 |
| Adherence while conducting procedures | -------do------ | 0.573 | 0.464 |
| Follow universal procedures | ------do------ | 7.889 | 0.005* |
| Attending patient in emergency | ------do------ | 5.47 | 0.242 |

The sign* is placed next to p values $\leq 0.05$

Only 15 (15.6%) of the respondents declared that they had experienced an NPI sometime during their clinical practice. Among those who had NPI, only 8.3% had reported the incident, as illustrated in Table III. The most common reasons for failure to report the incidents of NPI, as declared by most of the participants, included fear of stigmatisation and discrimination and fear of the consequences of such injuries.

**Table III:** Experience of NPI

| Ever had NPI | Frequency | Percentage |
|---|---|---|
| Yes | 15 | 15.6 |
| No | 79 | 82.3 |
| No response | 2 | 2.1 |
| **Total** | **96** | **100** |
| **Followed SOP after NPI** | **Frequency** | **Percentage** |
| Yes | 8 | 8.3 |
| No | 7 | 7.3 |
| **Total** | **15** | **15.6** |

## Discussion

The findings of this study reveal that 56% of the respondents regarded needle recapping as the most frequent circumstance causing NPI. Consequently, the lack of adequate containers for sharps disposal was also rated by the majority of respondents (78.4%) as the most important cause for the occurrence of NPI. These findings are similar to those of studies conducted by the International Labour Organization (ILO) and World Health Organization (WHO).[3] The WHO has further stipulated that blood-filled devices that are used to access an artery or vein, e.g. phlebotomy needles and the hollow bore blood-filled needles, are the most important risk factors for NPI.[1,3]

In 2003, the WHO and the International Council of Nurses began a pilot project in South Africa to prevent HIV and hepatitis infection from occupational exposures to blood-borne pathogens. The aim of the project was to assess and address policy gaps, implement universal (or standard) precautions, educate workers and health systems managers, develop surveillance systems, immunise against hepatitis B, and implement appropriate post-exposure follow-up, including prophylactic medication.[6]

In South Africa, Rabbits found that 91% of junior doctors reported having sustained a needle prick injury in the preceding 12 months, and 55% of these injuries came from source patients who were HIV positive.[7]

Other factors, such as a lack of experience and knowledge about the procedure conducted, poor orientation and a lack of in-service education and accompaniment, were declared by these students as being associated with the risk of occurrence of NPI. Methods suggested by most participants for reducing the occurrence of NPI during clinical practice include the proper use of safety equipment, like gloves, for all standard procedures, proper disposal of used needles

and sharps, including proper segregation of hazardous medical waste. Seventy-two per cent of the nursing students were of the opinion that all inpatients should be screened for HIV and HBV infections, yet they feared being tested themselves. Intensive and on-going in-service education and training about NPI and the related consequences were identified as the most essential preventive measures by most of the respondents.

Of the 96 participants, only 15 (15.6%) stated that they had received an NPI and only eight (8.3%) had followed the prescribed guidelines and procedures. A total of 7.3% of the respondents did not report the incident, and reasons given included the fear of an HIV test, that they did not know where or to whom to report the incident, fear of disciplinary action, and concern about the maintenance of confidentiality (see Table IV). These findings concur with the WHO findings on factors leading to under-reporting of needle prick injuries.[3,4]

**Table IV:** Reasons for non-adherence to SOPs

| Reasons | Frequency | Percentage |
|---|---|---|
| Fear of HIV testing | 3 | 41.1 |
| Did not know where/to whom to report | 1 | 13.6 |
| Fear of disciplinary action | 2.3 | 31.7 |
| Fear of confidentiality | 1 | 13.6 |
| **Total** | **7.3** | **100** |

Furthermore, the WHO has described the consequences of under-reporting of such injuries, which include lack of follow-up care for the injured healthcare worker, and lost opportunities to evaluate the circumstances under which such injuries occur, the effectiveness of the policy and practices implemented, as well as the quality of the products used.[1]

Some of the possible solutions for reducing needle prick injuries among nursing personnel are to **implement** engineering, work practice controls and universal precautions to minimise exposure to blood and blood-borne pathogens. Engineering and work practice controls must be the primary means used to eliminate or minimise exposure to blood-borne pathogens. Engineering controls are measures such as containers for sharps disposal, self-sheathing needles, and safer medical devices, such as sharps injury protections and needleless systems that isolate or remove the hazard of blood-borne pathogens from the workplace. Work practice controls are measures that reduce the likelihood of exposure by altering the manner in which a task is performed, for example prohibiting the recapping of needles by a two-handed technique.

Universal precautions are an approach to infection control to treat all human blood and certain human body fluids as if they were known to be infectious for HIV, HBV and other blood-borne pathogens. These include standard precautions such as hand washing, using appropriate personal protective equipment such as gloves, gowns and masks whenever touching or exposure to patients' body fluids is anticipated. **Transmission-based precautions** such as airborne precautions, droplet precautions, and contact precautions provide additional precautions beyond standard precautions to interrupt transmission of pathogens in hospitals.[8]

## Conclusion

The results of this study indirectly point to the fact that there is a risk of acquiring blood-borne infections through NPI, as the students admitted to not following all the standard precautionary measures, indicating a lack of adequate knowledge among these students about the consequences of needle prick injuries. Therefore, proper steps are needed to promote the awareness of and educate students about the dangers and prevention of these occupational injuries. Emphasis should be placed on the establishment of specific programmes for the occupational health and safety of healthcare workers, including students undergoing training, and to offer post-exposure prophylaxis in a discrete yet systematic manner, which would encourage and/or enable students on training to report incidents without fear of repercussions.

The immunisation against hepatitis B of students undergoing training is also essential.[9,10,11] To achieve the above measures, a joint commitment and collaboration from academic institutions and health service authorities is needed to form committees that would aim at improving the safety and health of workers in the workplace and promote adherence to safe work practices.[1–4] This can be achieved by implementing effective workplace health and safety promotion programmes that address the principles of risk assessment, management and control, injury prevention, ongoing awareness, information and training for all healthcare workers.[12,3,4,5, 7,8,12,13,14]

## Acknowledgment

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