

# Risk management approach of needle stick and sharp injuries among nurses, Saudi Arabia: An interventional study

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## Background/aim

Nurses are the most frequent health occupational group to suffer from needle stick and sharp injuries (NSI), which puts nurses under the risk to acquire serious blood-borne diseases. The aim of the study was to assess the incidence of NSIs among nurses, and to assess their knowledge and evaluate the effect of intervention on raising knowledge, awareness, and decreasing the incidence of NSIs.

## Patients and methods

An intervention study was carried out among all nurses of both sexes working at a military hospital in Saudi Arabia during the period from February 2015 to May 2016. The study was carried out in three phases, the pre-intervention phase where data collection was carried out using a questionnaire, the second phase where health education and a training program were provided to the nurses, followed by the post-intervention assessment after 1 year of the intervention.

## Results

The incidence of NSIs among nurses decreased after the intervention from 9.42 to 3.93%. Whereas the total knowledge score increased from 54.45 to 91.57%. After intervention, all incidents were reported and had proper management after exposure, whereas before intervention 66.67% reported the incident and 55.56% had proper management after exposure.

## Conclusion

Health education and training program provided to the nurses about NSIs had a great effect on decreasing the incidence and raising the knowledge and awareness of nurses toward reporting and proper management after exposure.

## Keywords:

education, intervention, needles stick injury, nurses, sharps

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## Introduction

Needle stick and sharp injuries (NSIs) are defined as accidental skin-penetrating wounds of healthcare providers by sharp instruments in a healthcare setting [1]. Thus, healthcare workers (HCWs) are at risk to acquire infectious diseases [2]. Hepatitis C virus, hepatitis B virus (HBV), and HIV are of highest concern because they may cause significant morbidity [1]. There is also the financial burden that is imposed on health institutions because of occupational exposure to blood-borne diseases, which includes costs related to lost working hours, investigations, and treatment [3].

The risk for potentially experiencing NSIs during work and the risk for acquiring blood-borne diseases may lead to psychological stress affecting the workers' personal life as well as functioning in their work [4].

Nurses are the most susceptible occupational group to suffer from NSI, which can be explained by the fact that nurses are responsible for a lot of high-risk activities, for example, administering medication, suturing, withdrawal of blood, and inserting intravenous

lines [5]. The heavy workloads, frequent shifts, inadequate nurse-to-patient ratio, and excessive fatigue are among the factors contributing to an increased risk for NSIs among nurses, especially in developing countries [6–8].

Three intervention strategies are used in occupational health for preventing sharp injuries and splash exposures among HCWs: elimination or management of the workplace hazards, prevention of infectious disease and associated disabilities, and changes in HCWs knowledge, skills, and behavior [9]. There are multiple factors for sharp injuries that could be modified by educational interventions [10]. Such factors include decreased professional experience, suboptimal use of personal protective equipment (PPE), a lack of education and training on infection control and the

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principles of occupational health, subjective risk perception, and improper sharps management [11,12].

Educational interventions consist of group-based instruction or other information delivery types, whereas active educational interventions that promote interactivity have a great chance of altering the behavior of healthcare providers and sustaining such changes [13]. The intervention could be delivered by the hospital infection control committee, an occupational safety and health department, or other educational personnel [10].

The objectives of the study were to determine the incidence of NSIs during the last 12 months retrospectively, and to assess the knowledge and evaluate the effect of health education on raising knowledge and awareness and decreasing the incidence of NSIs among nurses.

## Patients and methods

### Study design and setting

This intervention study was carried out during the period from February 2015 to May 2016 at a military hospital in Saudi Arabia.

### Study population and sampling

The study was conducted among all nurses of both sexes (191) working for at least 1 year at the military hospital. The number decreased to 178 in the post-intervention phase.

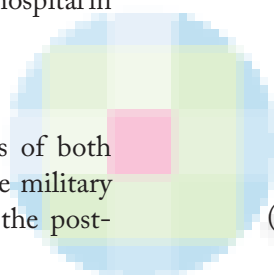
### Data collection and tools

(1) Phase I (pre-intervention phase): for data collection for the pre-intervention phase, hospital records were accessed and nurses were interviewed by an infection control nurse by using a questionnaire adapted from Salehi [14] and Chan *et al.* [15]; it consisted of the following:

- (a) Part 1: sociodemographic and work characteristic as regards age, sex, educational level, working hours, past experience, previous training, and working department.
- (b) Part 2: incident of NSIs during the last 12 months and previous training program.
- (c) Part 3: assessment of the nurses' knowledge, which included the following:
  - (i) Knowledge about universal precautions of NSIs: the body fluids for which the universal precaution applied, needles recapping, sharps and needles removing, blood or body fluids (BBFs) spills cleaning, use of PPE (gowns, goggles, masks, and

gloves), hand-washing after exposure to BBF, and hand-washing after any patient care.

- (ii) Knowledge about proper sharp, BBF waste disposal: BBFs bags felling, sharps and BBFs waste collection, prevention of leak from BBF waste container during collection, smashing of sharps before burning, sterilization of sharps and BBF wastes before burning, sharps container disposal, and when to close BBF waste bags and sharp container.
  - (iii) Knowledge about the availability of preventive measures and universal precaution: enough hand-washing facilities, free HBV vaccination, color-specific sharp waste container, colored biological waste bags, and suitable way for container evacuation,
  - (iv) Knowledge about the surveillance system for exposure and follow-up management: post-exposure wand management, post-exposure investigation for the exposed and source patient, and post-exposure prophylaxis for HIV and HBV.
  - (v) Knowledge about reporting the system of NSIs: availability of incident reporting form, time for reporting, and whom you should report.
  - (vi) Obtaining training program for the management of exposure to NSIs, either inside or outside the hospital.
  - (vii) Knowledge scores were computed for each participant. Adequate knowledge was defined as correctly answering more than 60% of the items.
- (2) Phase II (intervention phase): intervention depended on two strategies.
- (a) First: health education and training programs were provided to all hospital nurses, focused on raising the nurses' skills, knowledge, and behavior. The selected channels for health education program were carried out through lecture presentations, leaflets, and distribution of copies of hospital policy and procedures for NSIs management.
  - (b) Second: orientation of the nurses about the workplace availability of preventive measures, which included PPE, washing facilities, disinfectants, waste bags, and sharp containers.
- (3) Phase III (post-intervention): outcomes of the benefits of health education and training program were evaluated after a period of 1 year



by using the same questionnaire and hospital records.

### Data management and analysis

For data entry and statistical analysis, the statistical package for the social sciences (SPSS; IBM SPSS statistics 21), version 21 for Windows, was used. Frequency distribution tables, mean, and SD were used for descriptive purposes. The  $\chi^2$ -test was used for testing the significance of difference between qualitative variables. The level of significance was considered at a *P*-value of less than 0.05.

### Ethical issues

Proposal acceptance was obtained from the hospital research unit of family and community administration. Moreover, an informed verbal consent was obtained from all participants after explaining the purposes of the study, and the confidentiality of the information was assured.

## Results

The data represented in Table 1 explain the sociodemographic and work characteristics of the studied nurses, which revealed that majority of the nurses were females (80.1%) and non-Saudi (71.73%) and that most of them worked in shifts (75.4%). According to the experience, 53.4% had experience between 5 to 10 years, whereas 17.28 and 29.32% had an experience of less than 5 years and more than 10 years, respectively. In addition, most of the nurses had a bachelor of nursing (85.34%) and only 14.66% had a diploma of nursing, with a mean±SD age of 31.2±6.29 years.

**Table 1 Sociodemographic and work characteristics of the studied nurses**

Variables	Frequency [n (%)]
Sex	
Male	38 (19.9)
Female	153 (80.1)
Nationality	
Saudi	54 (28.27)
Non-Saudi	137 (71.73)
Type of work	
Nonshift work	47 (24.6)
Shift work	144 (75.4)
Experience	
<5	33 (17.28)
5	102 (53.4)
>10	56 (29.32)
Education	
Bachelor of nursing	163 (85.34)
Diploma of nursing	28 (14.66)
Age (mean±SD)	31.2±6.29

Table 2 shows the incidence of NSI during the last year among the studied nurses, which revealed that the overall incidence was 9.42%. The incidence was high among nurses of the emergency department, medical-surgical ward, laboratory department, and dental department (15.62, 13.79, 12.5, and 10.52%, respectively). There was no statistically significant difference of the incidence of NSIs regarding sex, nationality, and education. As regards experience, nurses with an experience of less than 10 years were prone to NSIs.

Table 3 illustrates that the knowledge about universal precaution was 92.67% and knowledge about proper sharp, BBF waste disposal and that about the availability of preventive measures were more than 60%. Whereas knowledge about the surveillance system for exposure and follow-up management and knowledge about the reporting system of NSIs were less than 25% with a total knowledge score of 54.45%. Regarding training program for the management of exposure to NSIs, only 8.9% had undergone a training program.

Table 4 showed that the incidence of NSIs among the studied nurses decreased from 9.42 to 3.93. Whereas the total knowledge score increased from 54.45 to 91.57%. After intervention, all incidents were reported and had proper management after exposure, whereas before intervention, 66.67% reported the incident and 55.56% had proper management after exposure.

## Discussion

Among all healthcare personnel providing patients care inside healthcare facilities, nurses are the most susceptible group to suffer from NSIs [16]. According to our study the incidence of NSIs during the last year among the studied nurses was 9.42%. It is higher than that reported by Yoshikawa *et al.* [17], which was 6.2% (5.7–6.7). But this is much lower than that reported in a Jordanian study, which reported 92% of nurses in Jordan have had at least one NSI in a period of 12 months [18]. Cho *et al.* [19] reported that 70.4% of the nurses in South Korea experienced at least one NSI during the last year, and another study in Turkey reported an incidence rate of 30% [20].

The incidence was high among the emergency department, medical-surgical ward, laboratory department, and dental department (15.62, 13.79, 12.5, and 10.52%, respectively). But this is lower than that reported by Abu-Gad and Al-Turki [21], who found that the patients' wards had the major incidents (48.5%), followed by ICUs and dialysis

**Table 2 Incidence of needle stick and sharp injuries during the last year among the studied nurses**

Variables	Total (N=191)	Exposed patients [n (%)]	$\chi^2$	P
Overall incidence	191	18 (9.42)	–	–
Incidence according to departments				
Out-patient clinics	41	2 (4.87)		
Emergency department	32	5 (15.62)		
ICU	21	2 (9.52)		
Medical-surgical ward	29	4 (13.79)	5.08	0.64
Obstetrics and gynaecology department	23	2 (8.69)		
Paediatric department	18	0 (0)		
Laboratory department	8	1 (12.5)		
Dental department	19	2 (10.52)		
Incidence according to shift work				
Nonshift work	47	5 (10.63)	0.10	0.7
Shift work	144	13 (9.03)		
Incidence and experience of work				
<5 years	33	2 (6.06)	7.59	0.02
5	102	15 (14.7)		
>10	56	1 (1.78)		
Education				
Bachelor of nursing	163	16 (9.81)	0.2	0.62
Diploma of nursing	28	2 (7.14)		
Nationality				
Saudi	54	3 (5.55)	1.32	0.25
Non-Saudi	137	15 (10.95)		
Sex				
Male	38	2 (5.26)	0.96	0.32
Female	153	16 (10.45)		

**Table 3 Frequency distribution of the knowledge among the studied nurses**

Variables	Frequency [n (%)]
Knowledge about universal precaution	
Adequate	177 (92.67)
Inadequate	14 (7.33)
Knowledge about proper sharp, blood and body fluid waste disposal	
Adequate	132 (69.1)
Inadequate	59 (30.9)
Knowledge about the availability of preventive measures and universal precaution	
Adequate	128 (67.02)
Inadequate	63 (32.98)
Knowledge about reporting system of needle stick and sharp injuries	
Adequate	45 (23.56)
Inadequate	146 (76.44)
Knowledge about the surveillance system for exposure and follow-up management	
Adequate	43 (22.5)
Inadequate	148 (77.5)
Total score of knowledge	
Adequate	104 (54.45)
Inadequate	87 (45.55)
Training program for management of exposure to needle stick and sharp injuries	
In the hospital	0 (0)
In another hospital	17 (8.9)
No training	174 (91.1)

units (17.7%), theaters (15.6%), and accidents and emergency departments (13.8%).

There was no statistically significant difference between the incidence of NSIs regarding nationality and sex, which was in contrast to Bijani [22], who found male sex to be more prone to NSI.

Our study revealed that nurses with an experience of less than 10 years were prone to NSIs. This was in line with Smith *et al.* [23] who reported that nurses 25 years of age or less had 2.2 times the risk for NSIs compared with nurses over 25 years old. Moreover, Bijani [22] found that younger age had significant statistical correlation with a high incidence of NSIs. This might be because middle-aged workers at health institutions deal less frequently with patients or other tasks that are associated with a high risk for NSI, and are focused on more administrative tasks [17]. Therefore, young HCWs have a priority when providing educational training program concerning NSI prevention.

Our study revealed that 66.67% of the nurses before the intervention reported the incident of NSI to the infection control department. This is consistent with Mehrdad *et al.* [24], who found that half of the nurses reported a NSI after exposure. But this is much higher

**Table 4** Frequency distribution of the effects of the intervention among the studied nurses

Variables	Before the intervention [n/N (%)]	After the intervention [n/N (%)]	$\chi^2$	P
Incidence of needle stick and sharp injury	18/191 (9.42)	7/178 (3.93)	4.399	<0.05
Total score of knowledge				
Adequate	104/191 (54.45)	163/178 (91.57)	63.48	<0.0001
Inadequate	87/191 (45.55)	15/178 (8.43)		
Reporting of the incident				
Yes	12/18 (66.67)	7/7 (100)	3.07	0.07
No	6/18 (33.33)	0 (0)		
Proper management after the incident				
Yes	10/18 (55.56)	7/7 (100)	4.57	<0.05
No	8/18 (44.44)	0 (0)		

than that reported by Jacob *et al.* [25], who reported that only 18% of exposed nurses filled in an incident reporting form. Many studies found ~6–95% of all the NSI fail to be reported by the HCWs [26]. The frequency of NSI is significantly higher than what is currently reported and therefore a low prevalence or incidence of NSI should not be interpreted as a nonexisting problem [27]. Inadequate communication and lack of experience were found to be among the major barriers for NSI reporting.

Standard precautions should be followed at all times by healthcare personnel, as we can never be sure of a patient's infection status; all patients must be treated as if they are infected. All exposures to blood or other body fluids carry the risk of infection. It is vital to protect both healthcare personnel and the patient [28].

Our study revealed that knowledge of the studied nurses about universal precaution was 92.67% and knowledge about proper sharp, BBF waste disposal and knowledge about the availability of preventive measures was more than 60%. This was much higher than that reported by Ofili *et al.* [29]; in their study the nurses had a poor knowledge (34.2%) about standard precautions.

Whereas knowledge about the surveillance system for exposure and follow-up management and knowledge about the reporting system of NSI were less than 25%, with a total knowledge score of 54.45%. Regarding training program for the management of exposure to NSIs, only 8.9% underwent a training program; this explains the poor knowledge of the studied nurses about proper management of the incident of NSI.

In our study the incidence of NSIs among the studied nurses decreased from 9.42 to 3.93 after the intervention. A previous study revealed that ~80% of NSI could be prevented through the use of appropriate precautionary measures [30].

On the other hand, the total knowledge score increased from 54.45 to 91.57%. This was in agreement with

Shrestha [31], who found that there was a significant difference in the pre-intervention and post-intervention test mean knowledge. The total mean scores of knowledge of standard precautions as a whole were 31.86 and 68.61 in the pre-intervention and post-intervention tests, respectively.

After intervention all incidents were reported and had proper management after exposure, whereas before intervention, 66.67% reported the incident and 55.56% had proper management after exposure.

## Conclusion

Providing health education and training programs to the nurses about NSIs have a great effect on decreasing the incidence and raising the knowledge and awareness of nurses toward the reporting and proper management after exposure. Thus, it is recommended that regular health education sessions for all nurses about the updates and training programs for new staff should be a part of the orientation before assigning them work.

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## Conflicts of interest

There are no conflicts of interest.

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