

ORIGINAL ARTICLE

Risk Factors of Needle Stick and Sharps Injuries among Healthcare Workers in a Tertiary Care Hospital in Egypt: a Retrospective Study

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ABSTRACT

Key words:

Needle-stick and sharps injuries, occupational exposure, healthcare workers, reporting

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Background: Exposure to needle stick and sharps injuries is probably one of the most common accidents in medical care practices. **Objective:** The present study was conducted to determine risk factors of exposure to sharps injuries and select priorities for minimizing future incidents. **Method:** A retrospective survey was implemented from January to December 2016 on healthcare workers and anonymous self-administered questionnaire was completed by participants. **Results:** Nurses represented 62.5% of the study group. High rate of injuries was encountered in inpatient (42.5%) and emergency room (19%) mainly during use of needles in patients. The situation of exposure was mainly during use of the device through sampling, intravenous injection (53%). **Conclusions:** Nurses are among the highest group at risk who need adequate training on safe handling and disposal of sharps as well as application of policies and post-exposure prophylaxis.

INTRODUCTION

Infectious diseases potentially transmitted by needle stick and sharps injuries (NSSIs) are constantly widespread and are of growing concern¹. Health care workers (HCWs) are at increased risk of NSSIs which have been widely recognized as a source of exposure to hepatitis B virus (HBV), hepatitis C virus (HCV) and human immunodeficiency virus, (HIV), as well as other illnesses transmitted by blood and bodily fluids^{2,3}. NSSIs are defined as percutaneous injuries with sharp items contaminated with blood or other bodily fluids. The Center for Disease Control and Prevention (CDC) estimated 385000 sharps-related injuries that occur annually among health care personnel in hospitals¹. It was reported by World Health Organization (WHO) that about 40% of all hepatitis B and hepatitis C cases present in HCWs were attributed to sharps injuries⁴. More than 5 million workers in the healthcare occupations are at risk of exposure to blood-borne pathogens. The occupational safety and health administration created universal precautions and guidelines for blood-borne pathogen exposure and needle stick safety guidelines⁵. The design of the device can increase the risk of injury. Under-reporting of needle-stick incidents represents a missed opportunity for initiating post-exposure prophylaxis and implementation of prevention strategies^{4,6}. The form of sharp objects, availability of protective devices, policies for reporting injuries and disposal-related behavior like recapping are the major concerns associated with sharps injuries^{7,8}. Because of the high burden of sharps injuries,

our goal was to review risk factors of exposure to needle stick injuries and the possible solutions for risk management.

METHODOLOGY

Study design, group and ethical considerations

This study was implemented from January to December 2016 in Obstetrics and Gynecology Hospital in collaboration with Quality Assurance Unit, Cairo University Hospitals. A retrospective study was carried out on HCWs analyzing the most important risk factors involved in NSSIs events. All high-risk units were involved in our study. The study was approved by the local ethical and audit committees at the hospital and was conducted on participants who approved to participate in the study. To ensure privacy, dignity and integrity of the participants, an anonymous self-administered questionnaire was taken⁸. The occupational group, syringe type and department where the injury took place and during which procedure the injury has occurred were noted. Pareto chart and fishbone diagram were helpful tools used for detecting the defects, analyzing data about frequency and causes of the problem. An action plan for improvement strategies was developed based on a selection grid or prioritization matrix tool and analysis of the priorities of suggested solutions were done. WHO best practices for injections toolkit and CDC Workbook for designing a sharps injury prevention program were taken as guidelines for the study design^{8,9}.

Statistical analysis

The outcome data was cross-tabulated and analyzed using computer program IBM SPSS (Statistical Package for the Social Science; IBM Corp, Armonk, NY, USA) release 22 for Microsoft Windows. Data were described as frequencies and percentages.

RESULTS

One hundred sixty respondents who were exposed to NSSIs at least once during their professional life and were willing to share in the survey were included in the study. The nurses (n=100) were the most commonly injured group constituting (62.5%) of all the incidents reported by HCWs. Twenty-nine (18%) of the incidents were reported by doctors, 24 (15%) by health aid and 7 (4.5%) by technicians (Figure 1).

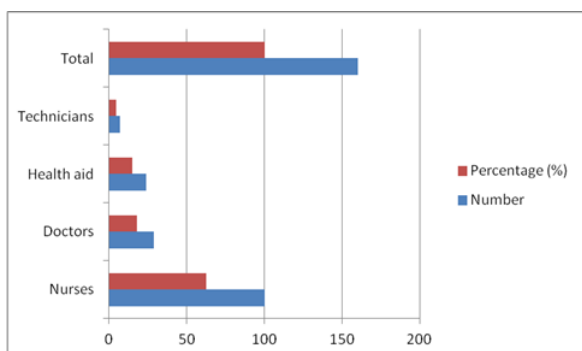
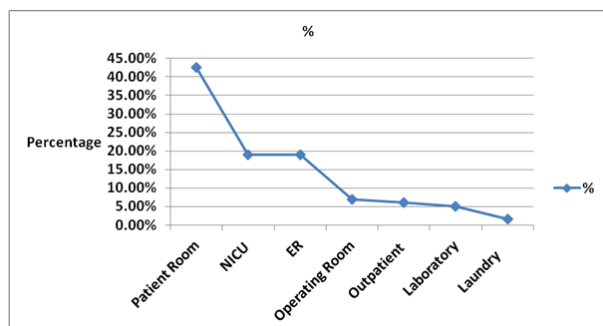


Fig. 1: Occupational groups of healthcare personnel exposed to needle stick and sharps injuries

Sixty-nine (42.5%) of injuries occurred in inpatient unit (including medical ward and intensive care unit), 30 (19%) in neonatal ICU, 30 (19%) in emergency room, 11 (7%) in the operation theater, 10 (6%) in outpatient, 8 (5%) in the laboratory and 2 (1.5%) in the laundry (Figure 2).



NICU= neonatal intensive care unit ER= emergency room
Fig. 2: Frequency of needle sticks and sharps injuries in different units

Seventy-five (47%) incidents occurred during use of the needles and sharps while 67(42%) occurred after use and before disposal and 18 (11%) occurred during and after disposal. Eighty-four (52.5%) incidents occurred during a clinical procedure (blood sampling and venous access insertion), 28 (17.5%) during recapping of needles, 20 (12.5%) during handling equipment in operations, 20 (12.5%) due to improper sharps disposal and 8 (5%) incidents were during bending of needles before disposal. Pareto chart was drawn for better demonstration of the circumstances of exposure to needle stick and sharps injuries (Figure 3).

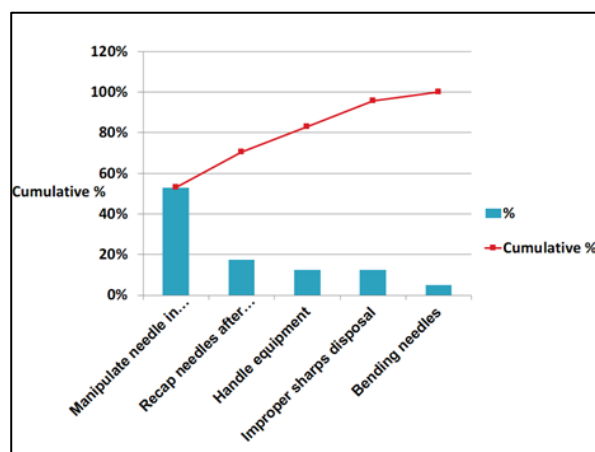


Fig. 3: Pareto chart for the circumstances of exposure to needle stick and sharps injuries

Hollow-bore needles were responsible for 66% of the injuries (43% for disposable syringes and 23% for stylet cannula), while 34% of injuries were caused by solid sharps (21.5% for suture needles, 7.5% for glass and scalpels and 5% for others) (Table 1).

Table 1: Devices involved in sharps injuries

Devices	Proportion (%)
Hollow-bore needles:	66%
Disposable syringes	43%
Intravenous catheter	23%
Solid sharps:	34%
Suture needles	21.5%
Glass & scalpels	7.5%
Others	5%

While discussing the circumstances beyond the injuries, the respondents had variable perspectives regarding the cause of injury. We illustrated the causes in a more detailed and analytical method by designing the root cause analysis or fishbone diagram (Figure 4).

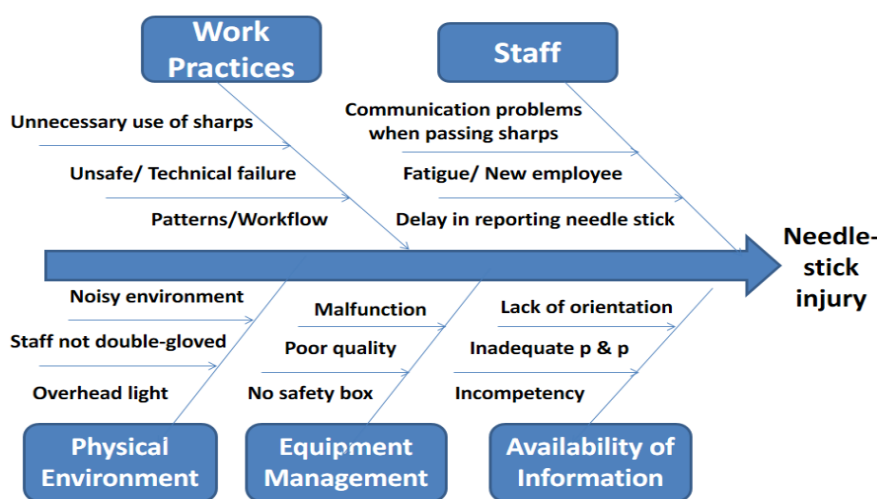


Fig. 4: Fishbone diagram analyzing the causes of exposure to needle stick and sharps

A set of priorities was put into considerations for improvement strategies based on (availability, effectiveness, resources, time factor, accessibility, management support) with a scoring system from 1 to 5.

The 1 means that the idea is least qualified and 5 means that the idea is very qualified based on the selected criteria (Table 2).

Table 2: Action plan selection grid= prioritization matrix (1-5)

Categories	Training and educational workshops	Safer devices	HBV vaccination	Reporting system	Improved staffing
Availability	4	3	4	2	1
Effectiveness	5	5	5	5	4
Resources	4	2	4	4	2
Time	3	3	2	2	3
Accessibility	3	3	3	2	1
Management support	4	4	2	2	2
Total points	23	20	20	17	13

The best practice that could be achieved was through educational program especially for new employee and was guided by flyers for behavior change (e.g. safe handling of sharps, not recapping needle, safe disposal related issues), post-exposure prophylaxis process mapping (Figure 5). Adequate HBV vaccination was promoted for all workers. Other suggestions have been made for preventing and limiting sharps injuries among HCWs like introduction of devices with safer techniques (e.g. needleless and self-sheathing equipment), adoption of electronic reporting system and improvement of staffing levels.

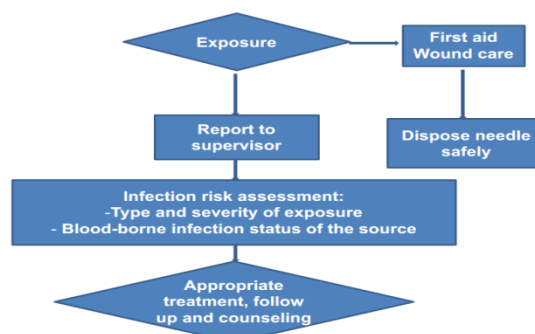


Fig. 5: Post-exposure prophylaxis process mapping

DISCUSSION

Health care workers are at increased risk of occupational needle stick and sharps injuries that can be lethal². Analysis of the needle stick and sharps injuries incidents during the period of the study from January till December 2016 recorded a total of 160 HCWs who recalled at least one incident through their professional career. Various studies have reported variable numbers in needle stick and sharps exposures among different HCWs. A study conducted in Saudi Arabia reported a total of 73 NSSIs¹⁰. Other studies in Saudi Arabia reported incidents of 477¹¹ and 117¹² of NSSIs. Another study from Turkey reported 214 NSSIs¹³. A study from Egypt reported 195 HCWs who experienced NSSIs¹⁴. The variations in the exposure to NSSIs in different regions can be explained by different number of HCWs per hospital, various work cultures and environments, differences in availability of resources, measurement methods and research designs¹⁵.

The proportion of NSSIs pertaining to each occupational group differed across various studies. In this study nurses have been reported to be the major occupational group exposed to the highest incidents rate (62.5%) which was consistent with the findings of 2 studies from Saudi Arabia which reported that 65.8% and 64.6% of incidents were sustained by nurses respectively^{10,11}. A study from Turkey reported 64% of incidents from nurses¹³. This could be explained by the fact that nurses are responsible for intravenous access procedures in the hospital. A study from Saudi Arabia reported 45%¹⁶ while a lower incidence rate of 30.9% involving nursing staff was reported in Malaysia⁶. Higher incidence was reported in a study from Thailand showing that 70% of nurses had experienced NSSIs¹⁷. These differences were dependent on the type of sharp devices used and the variations in clinical practices between different healthcare setting¹⁶.

Regarding the location of occurrence of sharp injuries, the inpatient (including medical floor and intensive care unit) was the most common place of NSSIs (42.5%) which was consistent with the finding of other studies^{10,11,16}. Another study was conducted in Turkey reported higher incidents (31%) from surgical ward¹³. Nearly one third (31.7%) of the injuries occurred in emergency unit in a study conducted in Ethiopia¹⁸. While another study found that operating room had the highest number of sharp object injuries¹⁹. The type of sharp devices used by HCWs during the clinical practice is closely related to the clinical specialty and the mechanism of exposure¹¹.

Identification of the major activities leading to these injuries was critical for implementing control measures. Clearly, not every NSSI is preventable, but research has shown that 74% of injuries from needle stick can be prevented¹⁶. Looking at circumstances associated with

NSSIs in HCWs for the entire survey period, 47% of injured HCWs were in the process of using a device. A similar rate was reported by a study in which more than 46.4% of incidents occurred during use of the device¹¹. This finding is similar to another study demonstrating that 55% of injuries occurred during the use of devices and was caused by malpractice in handling sharp instruments^{16,20}. Another study reported that 39.7% of incidents occurred during use while 60.3% after use of the device¹⁰. Variable rates of percutaneous injuries during use of devices were reported in a study done in collaboration with WHO⁵. This ensures the importance of educating staff at risk in order to take high precaution during handling of sharps.

A high rate (42%) of NSSIs occurred before disposal of the device was reported in our study. Meanwhile, a higher rate (53.4%) of incidents was reported from another study¹⁰. In this study 52.5% of incidents occurred during a clinical procedure mainly blood sampling and venous access insertion. While lower incidence of injuries occurred during drawing blood (21.8%) was reported in another study¹⁶. Another study reported that the commonest mechanism of sharps injury was self-inflicted needle stick injury due to sudden movement of patients¹. Our study reported that 17.5% of incidents occurred during recapping of needles. Another study reported incidents during needle recapping (26.4%)¹⁹. A study from Turkey reported that the most frequent cause of the NSSIs was recapping of needles (45%)¹³. Other incidents from recapping of used needles were reported in a study from Egypt (21.4%)¹⁴ and in a study from Saudi Arabia (29%)¹⁰. In addition, a study conducted in India showed that 56.1% of medical personnel exposed to injuries while recapping needles with two hands²¹. Although needles and other contaminated sharps should not be bent, recapped, or removed, many studies have revealed that recapping being still common among HCWs²². The practice of needle recapping was forbidden according to the WHO guidelines since 1987 but it is still widely practiced. This clearly shows that there is a redundancy between the knowledge and practice of the universal work precaution⁶. Varieties of causes were analyzed when discussing the real cause of the injuries with the participants. Fish bone diagram for analyzing the causes of exposure to needle stick and sharps was designed based on our survey. Different studies reported variable causes of injuries including lack of time, improper assistance, fatigability, absence of reporting system, lack of knowledge about the reporting procedure and others^{6,12,14}. Due to lack of training, HCWs may not have sufficient knowledge and skill to prevent sharps injury and perhaps increased the risk of injury as a result. A study carried out in Sub-Saharan Africa also supported the importance of training among HCWs²³.

Regarding the types of needles involved during incidents, most of the reported injuries occurred due to

hollow-bore needles (66%) mainly disposable syringes which was consistent with the findings of other studies^{10,11}. In a study conducted in Egypt, 52.3% of incidents were reported due to suture needle injury while 16.4% of NSSIs were due to injury from disposable syringes as the study was adopted in the operating rooms¹⁴.

The study was subject to some limitations as it was carried out on a small sample. To fully understand the problem, a multispecialty and multisite analysis is required. The study was also subject to the recall bias in respondents' memories.

CONCLUSION AND RECOMMENDED IMPROVEMENT PLAN

Analysis of needle stick and sharps injuries represent a major occupational challenge revealing the problem definition in which nurses sustained the major occupational group at risk, with the major activities occurred in inpatient units, during use of needles mainly during manipulation using hollow-bore needles. Educational programs, clear policies and procedures, promoting hepatitis B vaccination and application of post-exposure prophylaxis are the most important strategies for NSSIs control. An action plan for reducing NSSIs accidents should be implemented and indicators for attitude improvement should be established in order to improve patient safety. Improving the reporting system should be a priority. This study should increase the awareness of the need to report NSSIs to the hospital. Incidents should be recorded in special forms and their causes should be analyzed and checked by infection control committee. Awareness of the safety climate by implementing devices with safety features such as auto disposable syringes, needle-less devices and retractable or sheathed needles should be promoted to control such incidents and protect the safety of HCWs in the hospital.

Authors' contribution

Dr. Basma A. Elawady as the head of Infection Control Unit in the Obstetrics and Gynecology hospital, Cairo University during the period of the study carried out the study design, coordinated the questionnaire data analysis and was the facilitator and supervisor of all the steps in the study as well as preparation of the manuscript. Dr. Dina Sherif Omar has integrated quality in the study design and revised the study survey. Dr. Ahmad Mahmoud Ali is the director of the hospital and infection control committee, who was facilitating data collection for the survey and approved the study design.

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- Each author listed in the manuscript had seen and approved the submission of this version of the manuscript and takes full responsibility for it.
- This article had not been published anywhere and is not currently under consideration by another journal or a publisher.

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