



## Incidence and Causes of Needlestick Injury among Nurses in Emergency Departments of Egyptian University Hospitals

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### Abstract

**Background:** Rates of NSIs among hospital HCWs worldwide range between 14.9% to 69.4%, with the highest rates occurring in nurses. In Egypt several NSI studies have already been published, but there has been a gap in research since 2013.

**Objective:** The present study aims to provide an updated assessment of the current situation of sharp injuries among nurses across several university hospitals in Egypt.

**Methods:** A cross-sectional survey was conducted on 895 nurses across 13 university hospitals in Egypt between September 2018 and February 2019. A self-filled survey was administered, collecting detailed information on the history of every NSI incident occurring in the past 3 months.

**Results:** 41.5% (n = 371) of nurses reported  $\geq 1$  NSI during the past three months. Hollow needles were the most common category of sharp device injury (81%) and 54.3% of injuries occurred when the devices were used for injecting a patient. Nurses that received safety training in the past year and reported a job experience of > 10 yrs were at a lesser risk of experiencing a NSI.

**Conclusion:** The rate of NSI indicates a high risk of blood borne infections among HCWs in Egypt. Without appropriate assessments of the burden of NSI, directed prevention efforts, availability of pre and post-exposure prophylaxis for bloodborne injuries and extensive training programs for HCW, NSIs will remain a major challenge.

**Keywords:** Needlestick Injuries; Sharps Injury; Healthcare Workers; Nurses; Blood-borne Pathogens

## Abbreviations

HBV: Hepatitis B Virus; HCW: Health Care Workers; HCV: Hepatitis C Virus; NSI: Needlestick Injury; WHO: World Health Organization

## Introduction

Needlestick injury (NSI) is a wound caused by an accidental piercing of sharp instruments and is one of the most frequent routes of transmission of more than 20 blood borne occupationally acquired infections. According to the 2002 World Health Organization (WHO) report, NSIs result in about 4.4% of HIV/AIDS, 37.6% of Hepatitis B (HBV), and 39% of Hepatitis C (HCV) infections in health care workers (HCW) around the world. The rates of HBV and HCV infections in HCW attributed to percutaneous injuries were higher among developing regions (40 - 65%) compared to developed regions (8 - 27% for HCV and < 10% for HBV) of the world. These blood borne infections have serious consequences, including long term illness, impairing the quality of life and death [1].

Although the World Health Organization has recommended the transition to the exclusive use of safety injection devices by the year 2020 [2] and despite its already existent legislation in many western countries, NSIs remain a significant issue among health care workers, and in specific among the Arab World. Preventive measures that are lacking include, but are not limited to the exclusive use of safety injection devices, but also the availability and knowledge of post-exposure prophylaxis to prevent or manage potential blood-borne virus transmission, immunization against HBV within health care systems and the availability of complete data on incidents of NSI to correctly assess its burden.

A previous review on NSIs in hospitals worldwide, including studies from Egypt and Saudi Arabia, have reported NSIs in HCW ranging from 14.9% to 69.4%, and 3.2 - 24.7 NSIs per 100 occupied hospital beds, with the highest rates of NSIs occurring with nurses (more specifically female nurses) [3]. Although the review was for comparison purposes across countries, the rates of NSIs varied due to differences in settings and methodologies (including potential underreporting) used to determine these rates. Research on NSIs in the Arab world does not only differ by settings and methodology but are also still lacking comprehensive assessments that include but are not limited to the rates of NSIs, the device causing the injury, the purpose and activity associated with the injury, the reporting of NSI incidents, receiving safety trainings, knowledge of post-exposure prophylaxis and receiving immunization against HBV. In Egypt several NSI studies have already been published, but there has been a gap in research since 2013 [4-6].

The present study aims to provide an updated assessment of the current situation of sharp injuries across several university hospitals in Egypt, with nurses being the targeted study population, as they are the top concern for personal safety. Data from this study will be able to provide up-to-date comprehensive information re-

lated to NSIs to be able to correctly formulate more-specifically targeted safety measures for the future.

## Materials and Methods

A cross-sectional survey was conducted across 13 university hospitals in Egypt between September 2018 and February 2019. The study population consisted of a total of 895 nurses from various emergency departments of these hospitals. All nurses from the emergency departments were eligible to participate in the study as they are fixed staff that are in direct contact with patients and are highly exposed to NSIs since they consume different types of syringes. A written informed consent was signed by all enrolled nurses after explanation of the study. A self-filled survey was then administered to the nurses to collect detailed information on the history of every NSI incident occurring in the past 3 months (the number of NSIs, who was the user of the device, device type, the procedure the device was used for and when the injury occurred). Nurses were additionally asked if they have received safety training for preventing blood borne pathogen exposure in the past year; if they have ever been vaccinated against Hepatitis B, and if HIV post-exposure prophylaxis was available to them. After approving the protocol as part of Supreme IPC committee plan for improvement, the committee decided to publish the work and IRB approval for this research study was obtained from the research ethics committee of the Faculty of Medicine at Ain Shams University, Egypt.

The data were coded and entered using the statistical package SPSS version 24 (SPSS Inc, Chicago, IL, USA). The data were summarized using number and percentage for categorical values and means and standard deviations for continuous values. Bivariate and multivariate logistic regression analysis were used to assess the associations between receiving safety training for preventing blood borne pathogen exposure in the past year and having a job experience > 10 yrs respectively, with the outcome variable of experiencing a NSI in the past three months. P-values less than or equal to 0.05 were considered statistically significant.

## Results

### Study sample

A total of 895 nurses were interviewed for the study from 13 different university hospitals across Egypt. The mean number of years at their current job was  $11.4 \pm 9.98$  years (range 0.08 and 51 years), with 41.8% working for > 10 years.

### Availability of preventive measures

The majority of the sample (84.2%) had received safety training for preventing blood borne pathogen exposure in the past year: 59.8% had been vaccinated 3 full doses against Hepatitis B; 12.7% partially 1 or 2 doses and 27.5% haven't been vaccinated against Hepatitis B. 20.9% reported that HIV post-exposure prophylaxis was available to them if needed whilst 79.1% reported that it was not available to them or they had no information regarding its availability (Table 1).

	n (%)
<b>Safety Training</b>	
Yes	754 (84.2)
No	141 (15.8)
<b>Hepatitis B Vaccine</b>	
Fully-3 doses	535 (59.8)
Partially-1-or 2 doses	114 (12.7)
No	246 (27.5)
<b>HIV post-exposure prophylaxis available</b>	
Yes	187 (20.9)
No	601 (67.2)
I don't know	107 (12.0)

**Table 1:** Availability of preventive measures.

**NSI injuries**

41.5% (n = 371) of nurses reported at least one NSI during the past three months. One third of the sample (33.1%) reported one NSI, 8.2% reported 2-3 injuries and 0.1% reported five injuries in the past three months. The total number of NSI incidents reported among those injured was 469 with an average number of 1.26 ± 0.58 (min 1- max 5) injuries during the past three months, indicating a rate of 5 needle sticks per nurse annually. Among the total number of NSI incidents reported (n = 469), the majority were caused by the user him/herself (92.5%) and 54.8% reported that the injury caused them to bleed.

Based on binary logistic regressions, both receiving safety training for preventing blood borne pathogen exposure in the past year (OR: 0.649, p-value: 0.020) and having a job experience >10 yrs (OR: 0.560, p-value <0.0001) were protective factors for NSIs (Table 2).

	Bivariate			Multivariate		
	OR	95% CI	P-value	OR	95% CI	P-value
Safety Training* (Yes)	0.651	0.454,0.935	0.020	0.649	0.451,0.934	0.020
Safety Training Reference (No)	1.000	-	-	1.000	-	-
Years of Job Experience (>10 yrs)	0.561	0.426,0.739	<0.0001	0.560	0.425,0.738	<0.0001
Years of Job Experience (≤10 yrs)	1.000	-	-	1.000	-	-

**Table 2:** Results of binary logistic regression analyses of the studied factors for needlestick injuries among hospital nurses.

\*Safety Training: safety training for preventing blood borne pathogen exposure in the past year.

**Characteristics of the NSIs**

Hollow needles were the most common category of sharp device causing injury (81%), followed by glass (9.8%), solid sharp (7.2%) and others (2%). Detailed characteristics of the NSIs experienced by the nurses are presented in table 3. The highest rates of NSIs were caused by needles on disposable syringes (59.7%), IV catheter stylet (7.8%), medication ampoule (7.8%), vacuum tube blood collection holder/needle (5.9%), suture needle (5.4%) and needle on IV line (3.5%). In slightly more than half of the situations the sharp devices were visibly contaminated with blood (54.6%) (Table 3).

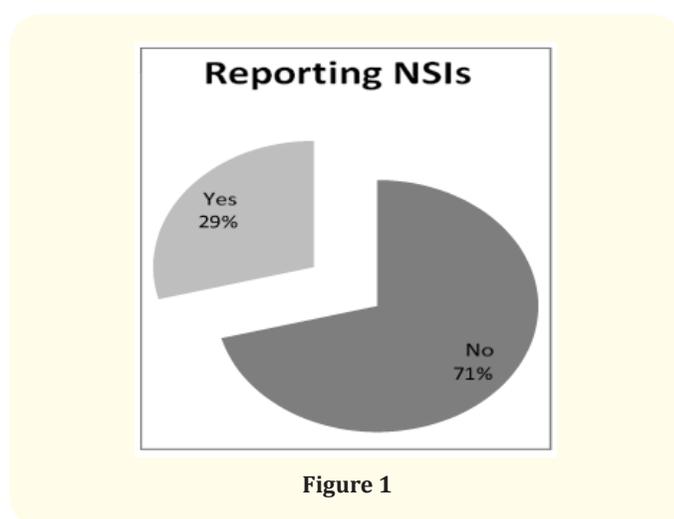
Slightly more than half of the injuries occurred when the devices were used for injecting a patient (54.3%), followed by the procedure of cannulating/starting an intravenous infusion 13.4%, obtaining a body fluid, blood sample, or biopsy 11.4%, other 9.9% and suturing 5.5%.

When nurses were asked to report when the injury occurred, 37.3% reported that injuries occurred during the use of the device whereby the item slipped or the patient jarred the item, followed by 19.2% before using/preparing to use the device (item broke/slipped, etc.), 11.2% while recapping a used needle, 9.4% after use but before disposal and 4.2% after disposal the item was sticking

out of the disposal box. Only 39.6% of the reports stated that an appropriate sharps disposal container was available when the injury occurred. The remaining 60.4% reported the availability of other containers that are not specifically designed for sharps disposal.

**Reporting of NSI incidents**

Underreporting of NSIs to the infection control team (ICT) was prevalent, as evident from Figure 1. 70.9% of the NSI incidents were not reported to the ICT.



**Figure 1**

	n	%
<b>The type of sharp used</b>		
Hollow needle: Needle on disposable syringe	274	59.7
Hollow needle: IV catheter stylet (IV cannula)	36	7.8
Hollow needle: Vacuum tube blood collection holder/needle	27	5.9
Hollow needle: Winged steel needle (butterfly)	17	3.7
Hollow needle: Needle on IV line (IV line connectors)	16	3.5
Hollow needle: Central line catheter needle (cardiac, etc.)	2	0.4
Glass: Medication ampoule	36	7.8
Glass: Vacuum tube (glass)	7	1.5
Glass: Glass slide	2	0.4
Solid sharp: Suture needle	25	5.4
Solid sharp: Lancet (finger or heel sticks)	4	0.9
Solid sharp: Scalpel	4	0.9
Other needle, sharp item or glass item	9	2.0
Total	459	100.0
<b>Sharp was contaminated with blood</b>		
Yes	244	54.6
No	201	40.3
Unknown	1	5.1
Total	447	100.0
<b>Procedure device (sharp) was used for</b>		
Injection	247	54.3
Cannulating/starting an intravenous infusion	61	13.4
Obtaining a body fluid, blood sample, or biopsy	52	11.4
Other	45	9.9
Suturing	25	5.5
Performing a finger stick or heel stick	11	2.4
Flushing an IV line or port with a syringe	9	2.0
Injecting or aspirating with a syringe but not IM, SC	5	1.1
Total	455	100.0
<b>When did the injury occur?</b>		
During use of the device (item slipped, patient jarred item, etc.)	167	37.3
Before using/preparing to use device (item broke/slipped, etc.)	86	19.2
While recapping used needle	50	11.2
After use-before disposal (on way to trash, etc.)	42	9.4
After disposal, item was sticking out of the disposal box	19	4.2
Between steps of a multi-step procedure (passing, etc.)	17	3.8
While putting item into disposal container	16	3.6
Other	14	3.1
Device left on floor, table, bed, or inappropriate place	11	2.5
After disposal, item sticking out of trash bag or other inappropriate waste container	9	2.0
Withdrawing a needle from rubber or other resistant material (rubber stopper, IV port, etc.)	7	1.6
From item left on or near disposal container	6	1.3
Processing of reusable instrument (sorting, cleaning, etc.)	2	0.4
Item pierced side of disposal container	1	0.2
Disassembling device or equipment	1	0.2
Total	448	100.0
<b>Disposal container available</b>		
sharps disposal container	177	39.6
a cardboard container	124	27.7
a plastic container	123	27.5
a re-used box or container	23	5.1
Total	447	100.0

Table 3: Characteristics of NSIs.

## Discussion

In our study, 41.5% of nurses working at emergency departments across university hospitals in Egypt have reported at least one NSI during the past three months; this is equivalent to a rate of 5 needle sticks per nurse annually. This result was however higher than some other research conducted on nurses in the USA (0.8 NSI events/nurse/year) [7], Japan (0.75 NSI events/nurse/year) [8] and Australia (0.2 NSI events/nurse/year) [9]. As such, our rate is very similar to that of a previously published study in Egypt that was carried across several health care facilities (government hospitals, primary care units, and private health care facilities), with 37.6% of nurses reporting a NSI in the past three months [5]. Such findings indicate a high risk of NSIs and blood borne infections among HCWs in Egypt, specifically among nurses who have continuously shown to be the most vulnerable group across regional and international studies [4,9-16].

The rate of NSIs is further burdened by the fact that sharp injuries have shown to be underreported by an estimated 30 - 96%, suggesting that the actual rates of NSIs is in fact much higher [17]. Underreporting of sharp injuries is a result of multifaceted factors that influence an individual's judgment of whether one should report an injury when it happens. These factors include but are not limited to, not having the time to report an injury (too many forms to fill), the fear of losing one's job (consequence of reporting), embarrassment, the lack of motivation to report an injury especially when no action/feedback is received, the lack of post exposure prevention when injuries as such occur, thinking it was a minor injury, and in some cases the lack of knowledge that such injuries need to be reported. In our sample, only 29% of NSI incidents were reported to the infection control team. For the reasons stated, there is an essential need for continued education and the establishment of an efficient and simplified reporting procedure.

Needle on disposable syringe were the most common sharps device that caused injury, accounting for 59.7% of the NSIs. This is in line with rates reported in other parts of the world [3]. Following injuries caused by disposable syringes, the IV catheter stylet (7.8%) and vacuum tube blood collection holder/needle (5.9%) were the next two prevalent sharp devices causing injuries among our sample. The prevalence of these two devices indicates that the efforts conducted by the WHO in recommending the exclusive use of safety syringes is not enough to eliminate/reduce all NSIs, but in fact all devices causing NSIs need to be investigated and preventive measures need to be tailored according to each device. Moreover, the most common procedure reported to cause injury was injection (54.3%), followed by cannulating/ starting an intravenous infusion (13.4%) and injuries most commonly occurred during the use of the device (37.3%), before using/preparing to use the device (19.2%) and while recapping a used needle (11.2%).

Our findings have raised our attention to a few interesting points. First, it is evident from our data that discrepancies exist between the numbers reported by nurses regarding the sharp devices

causing an injury and what procedures caused the injuries. For instance, one would expect that the percentage of NSIs caused due to a needle on disposable syringe would be equivalent to the percentage reporting an injury occurring during an injection (59.7% and 54.3%). Similarly, the cumulative percentage of NSIs caused due to IV catheter stylet, needle on IV line and winged steel needle would be equivalent to the percentage reporting an injury occurring during cannulating/starting an intravenous infusion (15% and 13.4%). These discrepancies indicate that not all sharps are being used for their particular procedures, increasing their risk of injuries occurring.

The second issue involves the fact that the majority of the nurses have received safety training (84.2%), and the risk for NSIs among those trained in the past year was significantly protective. However, although all nurses at some point (in the past year or previously) have been trained to never recap a used needle, a considerable number of injuries reported still occurred during the recapping of a used needle (11.2%).

Lastly, for the prevention of bloodborne infections, hospitals should abide to strict policies regarding vaccines, providing pre and post exposure prophylaxis for blood borne injuries. Although the majority of our sample (59.8%) has received a full dose of hepatitis B vaccine, there remains an approximate 40% that has either not received a full dose or not received any vaccine at all. Moreover, an even larger number has reported that they either don't have HIV post-exposure prophylaxis available to them (67.2%) or don't know if that even exists (12.0%).

A limitation in our study lies within the approach of our data collection; self-reporting and the collection of data retrospectively (past three months). This introduces recall bias and thus could highly be associated with under-reporting. Yet, this is unlikely to affect our results since it is a limitation of many similar studies that this study has been compared to, and is probably less bias than many studies in the literature that report recalling events in the past year instead of a shorter time frame of three months.

## Conclusion

It is clear that there are major defects within our healthcare systems regarding the safe use of sharp devices. Without appropriate assessments of the burden of sharp injuries, directed prevention efforts, availability of pre and post-exposure prophylaxis for blood borne injuries, extensive trainings and educational programs for HCW, NSIs will remain a major challenge with consequences out-reaching hospitals, health care systems, societies as well as insurance companies worldwide.

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## Conflict of Interest

None.

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