



Risk analysis of needle stick and sharp object injuries among health care workers in a tertiary care hospital (Saudi Arabia)

Ziad A. Memish, Abdullah M. Assiri ^{*}, Mervat M. Eldalatony ¹, Hanan M. Hathout ², Hend Alzoman, Monabae Undaya

Adult Infectious Diseases Division, King Fahad Medical City, Riyadh, Riyadh 11176, Saudi Arabia

Received 15 December 2012; received in revised form 13 March 2013; accepted 14 March 2013
Available online 4 May 2013

KEYWORDS

Occupational health;
Healthcare workers; Epi-
net; Needle-stick injury

Abstract Objective: To study different risk factors associated with needle stick injury among health care workers of a tertiary care hospital in Saudi Arabia.

Subjects and methodology: Retrospective study involving all reported cases of needle stick and sharp object injury among health care workers through using Epi-net™ access U.K. version 1.3 program in King Saud Medical City (KSMC) during the period (January 2007–December 2011).

Results: During the study period, 477 needle stick and sharp object injuries were reported with peak incidence (13.84%) during 2009. Distribution of needle stick and sharp object injuries according to the location of their occurrence clarified that patient room/ward was the most common place of occurrence of NSSIs 150/477, followed by emergency department 82/477, then the intensive and critical care units 70/477. The study presented that nurses were encountered as the most affected job category and use of items is the most common activity associated with the incidents. Most of the incidents were caused by needles with disposable needle and hands were the most affected body parts.

Conclusion: Needle stick and sharp object injuries represent a major occupational challenge to health care workers. Prevention should be based on different working lines including immunization, education of health care workers and proper engineering control measures.

© 2013 Ministry of Health, Saudi Arabia. Published by Elsevier Ltd. All rights reserved.

^{*} Corresponding author. Tel.: +966 1 212 4256, mobile: +966 50 437 2388; fax: +966 1 212 4255.

E-mail address: abassiri@me.com (A.M. Assiri).

¹ MD of Industrial Medicine and Occupational Health. Menoufia University, Egypt.

² MD of Community Medicine and Environmental Health. Menoufia University, Egypt.

1. Introduction

Needle stick and sharp object injuries (NSSIs) are commonly encountered by people handling needles in the medical setting, such injuries are

an occupational hazard in the medical community. The National Institute for Occupational Safety and Health (NIOSH) USA has defined needle stick injuries as injuries caused by needles such as hypodermic needles, Intravenous (IV) stylets, and needles used to connect parts of IV delivery systems [1].

The frequency of such events has been estimated to be about 600,000–800,000 cases annually in the USA [1], and it is estimated that 100,000 NSSIs occur annually in the UK [2] and 500,000 annually in Germany [3].

Some published studies about NSSIs in Saudi Arabia show that there are a reported 282 cases of NSSIs among health care workers from 11 hospitals in the Eastern province region during the period from 1995 to 1997 [4]. Also, there are a reported 116 cases of NSSIs from Assir central hospital during the period from 1996 to 2000 [5]. Several other reports on sharp object injuries among health care workers have emerged from the Kingdom of Saudi Arabia as that of [6–11].

Among healthcare workers nurses and physicians appear especially at risk [12]. An investigation among American surgeons indicates that almost every surgeon experienced at least one such injury during their training [13].

These events are of concern because of the risk to transmit blood-borne diseases as hepatitis B virus (HBV), the hepatitis C virus (HCV), and the human immunodeficiency virus (HIV) [1]. It is estimated that annually as a consequence there are 66,000 infections with HBV, 16,000 with HCV, and 1000 with HIV worldwide [14].

While the infectiousness of HIV and HCV decreases within a couple of hours, HBV remains stable during desiccation and infectious for more than a week [15], so, Hepatitis B carries the greatest risk of transmission, with 37–62% of exposed workers eventually showing seroconversion and 22–31% showing clinical Hepatitis B infection [16]. Estimates of the risk of a single injury indicate a risk of 300 HBV infections (30% risk), 30 HCV infection (3% risk) and three HIV infections (0.3% risk) per 1000 respective exposures [15].

As of the World Health Organization in the Eastern Mediterranean region (including Saudi Arabia) the estimated number of health care workers exposed annually to at least one percutaneous injury with sharp objects contaminated with HCV is 18,000, with HBV 43,000 and with HIV 170 [14]. While the number of infections among health-care workers attributable to sharp object injuries on the average value for ages 20–65 in the same region of WHO is 310 for HCV infections 2300 for HBV and 1 for HIV infections [14,17].

The specific risk of a single injury depends on a number of factors when the patients harbor the virus of concern. Injuries with a hollow-bore needle, deep penetration, visible blood on the needle, a needle that was located in a deep artery or vein, or with blood from terminally ill patients are known to increase the risk for HIV infection [18,19].

As there is a marked underreporting of needle stick incidents acquired by health care workers in Saudi Arabia like many other countries the study of [20] shows that more than half of dental health care workers experiencing NSSIs did not report those injuries to the appropriate department. The study of [20] shows that the under-reporting rate after a needle stick injury was 67.4% (161/239) and that the major reasons for underreporting after needle stick injuries were the assumption that no blood-borne pathogens existed in the source patient (62.8%), annoyance (17.9%), and no knowledge about the reporting procedure (6.0%).

Also this could be attributed to the fact that a great proportion of health care workers are contractors coming from different countries with different levels of awareness of infection control measures and there is also, a high rate of turnover, so the problem presents a great challenge to the infection control staff in Saudi Arabia and requires further research.

This study was therefore designed in a trial to highlight some issues related to this important problem in Saudi Arabia in an attempt to find more practical solutions for it.

2. Objectives

- To establish a baseline data of needle stick injuries among health care workers in one of the biggest MOH hospitals in Riyadh region (King Saud Medical City) (KSMC) using the Epinet™ access U.K. version 1.3 program.
- To study different risk factors associated with needle stick injury among health care workers of the studied hospital.
- Establish recommendations to prevent needle stick and sharp object injuries among health care workers.
- *N.B.*: EPINET (The Exposure Prevention Information Network).

3. Subjects and methodology

A retrospective study involving all reported cases of needle stick and sharp object injury among

Table 1 Distribution of needle stick incidents by year.

Year	Frequency of recorded needle stick and sharp object injury	No. of occupied hospital beds	Rate of needle stick per 100 occupied hospital beds (%)
2007	98	766	12.79
2008	111	816	13.60
2009	115	831	13.84
2010	90	819	10.99
2011	63	816	7.72
Total	477		

health care workers by using Epinet™ access U.K. version 1.3 program in King Saud Medical City (KSMC) during the period (January 2007–December 2011) was carried out.

KSMC includes three hospitals (general, children, and maternity hospitals) with the mean bed capacity (694, 256, 157 beds over the duration of the study respectively).

3.1. Tools of data collection

EPINet™ is a software package that has been specifically created for the purpose of recording and analyzing occupational exposures to blood borne viruses. The focus of the software is to monitor sharp object injuries, body fluid splashes and the consequences of such exposures. EPINet™ has the capacity to record detailed information about the exposure including the device involved and the procedure and then provide a detailed feedback on which areas are at the highest risk from exposures. Subsequently, this information can be used to identify methods for reducing the frequency of occupational exposures to blood borne viruses. EPINet™ also, has the ability to record the follow-up to these exposures [21].

3.2. Data analysis and interpretation

The collected data of needle stick and sharp object incidents among health care workers during the period of the study in KSMC were analyzed using SPSS Program version 13, then risk analyses were conducted to identify associated significant risk factors.

3.2.1. Calculating the rates of needle stick and sharp object injury per 100 occupied beds

Calculation of the rates of needle stick and sharp object injury was done with the total number of needle stick injuries (NSI) reported during each

year of study as numerator over the number of occupied hospital beds in the same year as denominator.

N.B.: The average daily census of occupied hospital beds for the same year is the relevant number to use in the denominator, since it corrects for unused hospital beds.

3.3. Ethical considerations

To ensure privacy, dignity, and integrity of the participants, names of the health care workers are kept confidential.

Institutional ethics committee clearance for accessing health worker records was taken.

4. Results

Table 1 shows that in the 5 years from January 2007 to December 2011, 477 NSSIs were reported with a maximum rate in 2009 (13.84)% of all reported incidents during the study period.

Distribution of needle stick and sharp object injuries according to the location of their

Table 2 Distribution of needle stick and sharp object injuries by location of injuries.

Location	Frequency	(%)
Patient room/ward	150	31.4
Treatment/procedure room	19	4.0
Clinical laboratories	22	4.6
Mortuary/pathology	12	2.5
Labor and delivery room	8	1.7
Emergency Dept. (A&E)	82	17.2
Intensive/critical care unit	70	14.7
Operating theater/recovery	55	11.5
Outpatient clinic/office	14	2.9
Blood bank	3	0.6
Dialysis facility	15	3.1
Other, describe	27	5.7
Total	477	100.0

Table 3 Distribution of needle stick and sharp object injuries by job category.

Job category	Frequency	Percent (%)
Consultant/registrar (all grades)	26	5.5
Dentist/dental hygienist/dental nurse	22	4.6
Domestic/porter	18	3.8
Senior house officer/house officer	25	5.2
Nurse	308	64.6
Nursing student	24	5.0
Other attendant	53	11.1
Total	476	100.0

N.B.: The data concerning distribution of needle stick and sharp object injuries by job category are missing in one record.

Table 4 Distribution of incidents according to identification of source.

Identification of source	Frequency	(%)
Yes	349	73.2
Unknown	128	26.8
Total	477	100.0

occurrence clarified that patient room/ward was the most common place of occurrence of NSSIs, followed by emergency department, then the intensive and critical care units (Table 2).

Table 3 shows the frequency and percent distribution of NSSIs related to the respective job categories. Nurses were encountered as the most affected job category.

Most of the incidents occur during the use of items (Table 5).

Most of the incidents are caused by syringes with disposable needles (Table 6).

Table 7 shows the part of the body mostly affected during incidents, and it was found that hands are the most affected body parts.

70.4% of injured health care workers was wearing a single pair of gloves at time of incidents, and by analyzing the relationship between glove use during incident and job category 22.2% of injured domestic workers and porters were not wearing gloves at the time of incidents followed by nursing students and nurses (20.8% and 19.6%, respectively) (Table 8).

5. Discussions

Analysis of needle stick and sharp object injury incidents during the period of study from January 2007 to December 2011 represented that 477 NSSIs were reported with a peak distribution in 2009 (13.8 per 100 occupied hospital bed) (Table 1).

Most of the reported needle stick injuries during the period of study took place in the patient room (Table 2) which is consistent with the finding of other studies [8,22]. While other studies found that areas of the hospital with the highest activities such as operating room and intensive care units had the highest number of sharp object injuries [5] the proportion of sharp object injuries pertaining to each clinical specialty differed across various studies which may be attributed to the type of sharp devices used and the variation in clinical practices between different health care settings.

In this study nurses have been reported to be the major occupational group (64.6%, Table 3) which was consistent with the findings of many studies published locally and internationally [5, 8, 22, 23] which may be explained by the fact that nurses are responsible for most of blood sampling and other IV access procedure in the hospital.

Table 5 Distribution of activities leading to incidents.

Type of activity	Frequency	(%)
Before use of item	1	0.2
While putting the item into the disposal container	18	3.8
Item pierced side of disposal container	13	2.7
Device left on floor, table, bed or other inappropriate place	14	2.9
During use of item	221	46.4
Between steps of a multi-step procedure	12	2.5
While recapping a used needle	35	7.4
Withdrawing a needle from rubber or other resistance	11	2.3
Other, describe	151	31.7
Total	476	100.0

N.B.: The data concerning distribution of activities leading to incidents are missing in one record.

Table 6 Types of needles involved during incidents.

Needle type	Frequency	Percent (%)
Syringe, disposable with needle	233	64.1
Needle, unattached hypodermic	2	0.5
Needle, arterial catheter introducer	4	1.1
Needle, central line catheter introducer	1	0.3
Needle, other vascular catheter	2	0.5
Syringe, prefilled cartridge	8	2.2
Needle, unknown type	7	1.9
Needle, describe	31	8.5
Syringe, blood gas	16	4.4
Syringe, other type	7	1.9
Needle on IV tubing	20	5.5
Needle, winged steel	6	1.6
IV catheter stylet	24	6.6
Needle/holder vacuum tube blood collection	3	0.8
Total	364	100.0

N.B.: The data concerning types of needles involved during incidents are missing in 113 incidents' records.

Table 7 Distribution of needle stick and sharp object injuries by part of the body affected.

Part affected	Frequency (No.)	Percent (%)
Hand	378	95.5
Arms	9	2.3
Lower limb	8	2.0
Face	1	0.3
Total	396	100.0

N.B.: The data concerning distribution of needle stick and sharp object injuries by part of the body affected are missing in 81 incidents' records.

In 26% of incidents, the source of injury was unknown (Table 4) which was most probably due to problems related to the disposal of sharp items after using. Non identification of the source occurred in 20% of incidents in another study [23].

Most of the incidents occur during the use of sharp items (Table 5), this finding is similar to other reported data which demonstrate 55% of injuries occur during the use of devices which may be due to a malpractice in handling sharp instruments [22]. This percentage is higher than that of another study which found that 35% of staff was in the process of using devices as establishing a venous access and during indirect patient care activities due to disposal related malpractices [8]. Another study reported needle recapping (26.4%), careless disposal of sharp instruments (16.9%), and blood extraction (11.5%) were responsible for more than 50% of sharp object injuries which could be easily prevented by health education [5].

Most of the reported injuries occur due to disposable syringes with needles (Table 6) and this is consistent with other studies that reported similar findings [6,9].

Table 8 Relationship between glove use during incident and job category.

Job categories	Glove use						Total
	Single pair of gloves		Double pair of gloves		No gloves		
	No.	%	No.	%	No.	%	
Consultant/registrar (all grades)	14	53.8	10	38.5	2	7.7	26
Dentist/dental hygienist/dental nurse	17	72.3	4	18.2	1	4.5	22
Domestic/porter	12	66.7	2	11.1	4	22.2	18
SHO/HO	20	80	5	20	0	0	25
Medical student	3	100	0	0	0	0	3
Nurse	216	70.6	30	9.8	60	19.6	306
Nursing student	17	70.8	2	8.3	5	20.8	24
Other attendant	33	68.8	10	20.8	5	10.4	48
Total	332	70.3	63	13.3	77	16.3	472

Ninety five percent of injuries occur in the hand (Table 7). Similar published data report that the thumb, index and middle fingers of the non-dominant hand were the most common anatomic sites involved in all reported NSSIs, affecting 174 (48%) of the injured employees [8].

Sixteen percent of the injured health care workers did not wear protective gloves at the time of incident most of them were nurses (Table 8). This percent is similar to that reported by EPINET 2009 but with a difference that domestic/porter was the most non-compliant group.

6. Conclusion

Needle stick and sharp object injuries represent a major occupational challenge to health care workers. Important risk factors for such injuries include being a nurse, working in patient room, and using a disposable syringe with a needle. Educational program addressing such issues together with the observation of sharp object handling and use practices, and proper engineering control measures is an important intervention to control such incidents.

7. Recommendations

- Periodic training of health care workers on the proper work procedures to avoid mistakes that may lead to avoidable incidents.
- Safely manage sharp wastes. This includes collecting contaminated sharp wastes immediately after use (without recapping the needle), and using puncture-proof sharp containers that will not leak liquids.
- Use engineering controls, such as auto disposable syringes, needle-less devices, and retractable or sheathed needles.
- Provide personal protective equipment, such as gloves, gowns, masks etc.
- Train and inform workers on the risks of transmission of blood borne pathogens and on safe practices to combat transmission.

References

- [1] National Institute for Occupational Safety and Health (NIOSH). Preventing needle stick injuries in health care settings. Cincinnati: Department of Health and Human Services, DHHS (NIOSH) Publication; 1999.
- [2] Hofmann FKN, Beie M. Needle stick injuries in health care – frequency, causes and preventive strategies. *Gesundheitswesen* 2002;64:259–66.
- [3] O'Connor MB. Needle stick injury advices in the UK and Ireland. *J Hosp Infect* 2009;71(2):185–6.
- [4] Abu-Gad HA, Al-Turki KA. Some epidemiological aspects of needle stick injuries among the hospital health care workers: Eastern province, Saudi Arabia. *Eur J Epidemiol* 2001;17(5):401–7.
- [5] Saleh Al Ghamdi, Tarik Al-Azraqi, Cornelius Bello, Hanan Gutierrez, Mary Hyde, Munira Abdullah. Needle stick and sharps injuries at Asir Central Hospital, Abha, Saudi Arabia. *Ann Saudi Med* 2003:23.
- [6] Shanks NJ, Al-kalai D. Occupation risk of needle stick injuries among health care personnel in Saudi Arabia. *J Hosp Infect* 1995;29(3):221–6.
- [7] Kennedy M, O'Reilly D, Mah MW. The use of a quality improvement approach to reduce needle stick injuries in a Saudi Arabian hospital. *Clin Perform Qual Health Care* 1998;6(2):79–83.
- [8] Memish ZA, Almuneef M, Dillon J. Epidemiology of needle stick and sharps injuries in a tertiary care center in Saudi Arabia. *Am J Infect Control* 2002;30(4):234–41.
- [9] Jahan S. Epidemiology of needle stick injuries among health care workers in a secondary care hospitals in Saudi Arabia. *Ann Saudi Med* 2005;25(3):233–8.
- [10] Paul T. Self-reported needle stick injuries in dental health care workers at Armed Forces Hospital Riyadh, Saudi Arabia. *Mil Med* 2000;165(3):208–10.
- [11] Balkhy Hanan H, El Beltagy Kamel E, El-Saed Aiman, Sallah Mahmoud, Jagger Janine. Benchmarking of percutaneous injuries at a teaching tertiary care center in Saudi Arabia relative to United States hospitals participating in the Exposure Prevention Information Network. *Am J Infect Control* 2011;39(7):560–5.
- [12] Chalupa S, Markkanen PK, Galligan CJ, Quinn MM. Needle stick and sharps injury prevention: are we reaching our goals?'. *AAACN Viewpoint* 2008, http://findarticles.com/p/articles/mi_qa4022/is_200803/ai_n25419744/pg_2/?tag=content;col1.
- [13] Makary MA et al. Needlestick injuries among surgeons in training. *N Engl J Med* 2007;356(26):2693–9.
- [14] Prüss-Üstün A, Rapiti E, Hutin Y. Estimation of the global burden of disease attributable to contaminated sharps injuries among health-care workers. *Am J Ind Med* 2005;48:482–90.
- [15] Sarrazin U, Brodt HR, Sarrazin C, Zeuzem S. Prophylaxe gegenüber HBV, HCV und HIV nach beruflicher exposition. *Dtsch Arztebl* 2005;102:A2234–9 [in German].
- [16] Werner BG, Grady GF. Accidental hepatitis-B-surface-antigen-positive inoculations: use of e antigen to estimate infectivity. *Ann Intern Med* 1982;97:367–9.
- [17] World Health Organization (WHO). Environmental Burden of disease from sharp injuries to health care workers 2003; Series, No.3 edited by Annette Prüss.
- [18] Centers for Disease Control and Prevention (CDC). Updated US Public Health Service guidelines for the management of occupational exposures to HBV, HCV, and HIV and recommendations for Post exposure prophylaxis *MMWR* 2001; (50RR11):1–42.
- [19] Cardo DM, Culver KH, Ciesielski C, Srivastava PU, Marcus R, Abiteboul D, et al. A case-control study of HIV seroconversion in health-care workers after percutaneous exposure. *N Engl J Med* 1997;337:1485–90.
- [20] Kim OS, Jeong JS, Kim KM, Choi JS, Jeong IS, Park ES, Yoon SW, Jung SY, Jin HY, Chung YK, Lim KC. Underreporting rate and related factors after needle stick injuries among healthcare workers in small- or medium-sized hospitals. *Korean J Nosocomial Infect Control* 2011;16(1):29–36 [Korean].

- [21] Jannine Jagger M.P.H. Exposure prevention information network data reports. University of Virginia: International Health Care Worker Safety Center. EPINet (1999).
- [22] El-Hazmi Malak M, Al-Majid Fahad M. Needle stick and sharps injuries among health care workers: a 5-year surveillance in a teaching center in Saudi Arabia. *Biomed Res* 2008;19(2):133–40.
- [23] Chakravarthy M, Singh S, Arora A, Sengupta S, Munshi N. The Epinet data of four Indian hospitals on incidence of exposure of healthcare workers to blood and body fluid: a multicentric prospective analysis. *Indian J Med Sci* [serial online] 2010;64:540–51 [cited April 30, 2012].

Available online at www.sciencedirect.com

SciVerse ScienceDirect