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Research Article

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Prevalence and Determinants of Needle stick Injury among Nurses

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Abstract: Needle stick injuries pose a serious risk of transmission of fatal diseases to the workers of the Health care. Globally, more of the reported cases of needle stick injuries happen among nurses than other health professionals. Our aim is to explore the prevalence of needle stick injuries and determinants among nurses for better prevention and control. This is a cross-sectional study where we recruited 282 nurses working at King Fahd Hospital in Jeddah city. The validated self-administered questionnaires were distributed by the head nurse to the participating nurses who were in a direct contact with the patients. From questionnaires we investigated demographics, work-related factors, determinants of needle stick injuries and safety measures. Results of our study showed that about 92% of nurses were females and about 80% regularly take care of 10 patients or less. This study reported a lifetime occurrence of needle stick injury among nurses to be 37.6% (95% CI = 31.9% to 43.3%). The syringe needle was the most common item which caused the recent NSIs among the affected nurses (78.3%), followed by intravenous catheter and tapping needle with prevalence of 11.3% and 7.5% respectively. The occurrence of needle stick injury could not be predicted by nurses' characteristics such as years of experience, educational level, hours of working and number of patients on duty. However, training on NSIs prevention, Hepatitis B virus vaccination status and availability of safety box in their work place were significant predictors. We conclude that despite the high level of training, awareness, and availability of safety precautions, more than a third of nurses in the KFGH were affected by needle stick injury. Training on NSIs prevention and availability of safety box in their work place were the major determinants of the needle stick injury in KFGH.

Keywords: Needle stick, Injury, Health workers, Determinants, Prevalence, Nurses

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1. INTRODUCTION

The United States National Institute of Occupational Safety and Health (NIOSH) defines needle stick injuries as "injuries caused by needles such as hypodermic needles, blood collection needles, intravenous (IV) styles and needles used to connect parts of IV delivery systems"[1]. The Center of Disease Control (CDC) reported that Injuries can occur at every stage of the needle use, as 52% occur in the access IV line, transfer/process specimens, pass/transfer equipment, collision with staff or worker, insertion or removal of needles. .During a disassembly phase, about 19% of needle stick injury occurs mainly inactivation of safety feature, recap needle, and during cleans up. About 22% of needle stick injury occurs in transit to disposal, improper disposal when only 10% of these injuries were reported. The determinants of needle stick injury include the design of equipment; the procedure nature, the work conditions, and the experience of the staff have all been reported as influencing factors for its occurrences[2].Needle-stick injuries (NSIs) is an inevitable occupational hazard and is the most common cause of percutaneous injuries that make health care workers at increased risk of infection with blood-borne pathogens. Out of multiple blood-borne pathogens, the potential pathogens which most commonly transmitted to healthcare workers during needle stick injury (NSIs) are hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV) [3]. The risk of infection transmission from the patient to the health care workers (HCW's) after NSI's is 1.8% for hepatitis C, 6-30% for hepatitis B and 0.3% for HIV [4]. Worldwide, about 37.6% of Hepatitis B, 39% of Hepatitis C and 4.4% of HIV in HCW's are due to NSI's [5]. Prospective study was carried out in 2012, were fifty-two ministry of health hospitals in Saudi Arabia were enrolled using the Exposure Prevention Information Network (EPINET ™) to identify the cases exposed to NSI's, and they found that for every 100 occupied bed, the rate of injures was 3.2. The nurses are considered the most health professionals who were prone to needle stick injury (59.4 %), with most injuries usually happen in the patients' wards (34.6%). Moreover, disposable syringes were the cause of NSIs in 47.2% of nurses, most NSIs occurred while using syringes (36.5%), with intramuscular/subcutaneous injections with 25.2% of injuries [6]. A study in Najran 2012 showed that the prevalence of NSI's among nurses was 46.9%. Moreover, most of the injuries occurred during the use of devices (64.5%) and mostly by the suturing needles. The needles were contaminated in 90.6% of cases and the source of the patient were identifiable in (84.4%) of incidents [7]. There were many studies about NSI's in Saudi Arabia specifically in Jeddah city Hospitals. Needle-stick injuries pose a serious risk for transmitting fatal diseases to the health care workers, or to their colleagues unintentionally if needles were not properly used or disposed off, and subsequently it threatens patient safety and results in a significant burden emotionally and economically. Globally, most of the reported cases of needle-stick injuries were among nurses. Despite of the high level of training, awareness, and availability of safety precautions, nurses still have the highest rate of NSIs. This study aimed to identify needle-stick injuries prevalence and determinants among nurses for better prevention and control.

2. METHODS

This is an analytical cross-sectional study and we included nurses with a minimum of six-month working experience in KFGH in Jeddah. The study was carried out in King Fahad General Hospital that serves as a referral center for all primary care, secondary care and even private health care facilities in Jeddah city. Recently 12 primary health care centers were linked to the hospital. KFGH has different departments that are: Medicine, Surgery, ICU, ER, ENT, Dental, Physiotherapy and Extended care. Sample size was estimated to be 282 staff nurses. It was calculated using the Raosoft sample size calculator, with the assumption from904 total number of nurses, 50%is assumed proportion of NSIs among nurse,, 5% margin of error and 95% confidence interval. We used stratified random sampling technique in the selection of included nurses. A validated Self-administered Questionnaire was adapted from previous study with some modification, and permission was obtained for these modifications from the original authors [8].The questionnaire consisted of 5 parts. The first section contains questions about socio demographic of nurses including age, sex, marital status, and educational level. Second part, comprised questions about work related information such as department, years of experience, working hours, and number of patients. The third part investigates the determinants of the recent needle stick injury including the frequency, the time, causes, type of procedure and contamination of the needle. The fourth part focuses on the injury after-care, while the fifth section is about the safety measures. Self-administered questionnaire was distributed and collected from September 2018 to November 2018. First, we approached the morning duty head nurses of each department in order to facilitate our data collection. Then, the head nurses delivered the message of the study to the participating nurses. After that, we distributed the paper copy of questionnaire to those who are willing to participate in the questionnaire then completed questionnaires were retrieved from the head nurse. We reassured the nurses that all the information will be confidential and consent was taken. The author described the aim and objectives of the study for the head nurses in hospital departments to convey the study message in proper way to the nurses. We asked them to provide written consents from nurses who were willing to participate. No names were required to assure confidentiality of data and all information were kept confidential only for this study purposes. We obtained the approval of the research committee at the Joint Program of Family Medicine and relevant permission from the Ministry of Health, King Fahad General Hospital, and respective hospital nursing departments.

3. STATISTICAL ANALYSIS

The data were entered and analyzed using Statistical Package of Social Science SPSS, version 23. The descriptive statistics such as frequencies, percentages were calculated to summarize nominal and ordinal data, while mean, median and standard deviation or the range to describe numerical variables. Chi-squared test was used to evaluate the association between the nominal variable and the occurrence of needle stick injury, while the means of age, years of experience between groups of injury were compared using independent sample T-test. Any P-value < 0.05 was considered as an indication for a statistically significant association or difference.

4. RESULTS

The total number of recruited nurses in this study was 282

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and 259of them were females (about 92%). A half of all nurses were distributed equally on medical and surgical wards as their current working department. The majority of the nurses were married (62.8%) and (61.3%) of them had bachelor degree in nursing (table 1). About 91% of the nurses work in shifts of 8-9 hours per day, while only 3.2% work for 12 hours. When nurses were asked about the number of they care for during duty time, 79.8% of them take care of 10 patients or less per duty time, while only 14.5% said that they take care of more than 10 patients (table 2).

Table 1. Background characteristics of the nurses (n = 282)

Variables	Frequency	Percentage (%)
Gender		
Male	23	8.2
Female	259	91.8
Marital status		
Married	177	62.8
Single	102	36.2
Widowed	2	0.7
Separated	1	0.4
Educational level		
Diploma	90	31.9
Graduate (Bachelor)	173	61.3
Post Graduate	19	6.7
What is your current Working section /department?		
Emergency Unit	44	15.6
Operation Room	32	11.3
Intensive Care Unit	30	10.6
Cardiac Care Unit	32	11.3
Medical Ward	47	16.7
Surgical Ward	38	13.5
OPD	2	0.7
Wound Management	4	1.4
Dialysis center	14	5.0
other	39	13.8

Table 2. Distribution of the work characteristics of the Participating nurses

Variables	Frequency	Percentage (%)
Do you work in shifts?		
yes	256	90.8
no	26	9.2
How many hours do work in the hospital per day?		
8 or 9 hours	256	90.8
12 hours	9	3.2
other	17	6.0
How many patients do you care for during duty time?		
Less than 5 patients	91	32.3
5 -10 patients	134	47.5
more than 10 patients	41	14.5
other	16	5.7

Regarding the safety standards available at workplace, the nurses' responses confirmed the availability of safety measures in their workplaces. About 98% of the nurses reported the availability of protocol and safety guidelines for reporting the needle sticks in their hospital. Additionally, approximately 93% reported the presence of safety box and needle safe devices in their workplaces (table 3). The personal safety precautions were highly followed by nurses, since almost all nurses except 6 of them said they regularly use personal protective equipment. Regarding safety training they received, about 93% and 89% of them reported that they received training on needle stick safety and prevention and on needle safe devices respectively. About 93% of the nurses knew about the needle safe devices and 88% always use needle safe devices (table 4).

Table 3. Safety determinants at workplace		
Variables	**Frequency**	**Percentage (%)**
Was there protocol for reporting the needle sticks in your hospital?		
Yes	276	97.9
No	6	2.1
Were safety guidelines available at your working environment?		
Yes	274	97.2
No	8	2.8
Was safety box available at your workplace?		
Yes	262	92.9
No	20	7.1
Do you have needle safe devices in your hospital?		
Yes	263	93.3
No	19	6.7

Table 4. Factors related to personal safety precautions		
Variables	**Frequency**	**Percentage (%)**
Do you regularly apply standard precautions?		
Yes	280	99.3
No	2	0.7
Do you regularly use personal protective equipment?		
Yes	276	97.9
No	6	2.1
If you use personal protective equipment, how often do you use?		
Always	252	89.4
Sometimes	29	10.3
Occasionally	1	0.4
Have you received any form of training on needle stick safety and prevention?		
Yes	261	92.6
No	21	7.4
Have you ever vaccinated against hepatitis b virus?		
Yes	267	94.7
No	15	5.3
Do you know about the needle safe devices?		
Yes	262	92.9
No	20	7.1
Have you ever been trained on using needle safe devices?		
Yes	252	89.4
No	30	10.6
How often do you use the needle safe devices?		
Always	249	88.3
Sometimes	19	6.7
Occasionally	14	5.0

This study reported a lifetime occurrence of needle stick injury among nurses to be 37.6% (95% CI = 31.9% to 43.3%). However, we found 1.8% have been previously exposed to needle stick injury more than two times. The syringe needle was the most common items that caused the recent NSIs among the affected nurses (78.3%), followed by intravenous catheter and tapping needle with prevalence of 11.3 and 7.5%, respectively. The majority of the nurses (56.6%) reported this injury to the infection control department. Eighty five percent of the injuries were reported immediately to the authority concerned in the hospital, while 3.3% reported in the following days after the injury. The most common reason for non-reporting was that needles have not been yet used in patient (56.6%), followed by the patients who had no infectious disease and nurse being busy at that time in 15% and 11.7% respectively. About 36% of the injuries occurred in the morning shift and similar percentage occur in the evening shift. Approximately, 46.2% of the injured nurses did not receive medical care after injury (table 5).

Table 5. The prevalence of needle stick injury and associated factors		
Variables	**Frequency**	**Percent (%)**
Have you ever experienced / faced needle stick injuries at your work place? (n=282)		
Yes	106	37.6
No	176	62.4
How many times have you been injured by needles stick?		
No injury	176	62.4
Once	76	27.0
Twice	25	8.9
3 times or more	5	1.8
What type of items caused the recent injury? (n= 106)		
Syringe needle	83	78.3
Angiocath needle	1	0.9
Intravenous Catheter	12	11.3
Tapping needle	8	7.5
Suture needle	1	0.9
Other	1	0.9
Have you ever reported the injury to infection prevention and control department? (n=106)		
Yes	60	56.6
No	46	43.4
If you reported the injury, when did you report the injury? (n=60)		
Immediately after the injury	51	85.0
Late before going off duty	1	1.7
The following days	2	3.3
Others	6	10.0
Why didn't you report the injury? (n=60)		
Needles that injured me was never used in a patient	35	58.3
I was too busy at that time	7	19.7
Sharp object was used on patient did not have infectious diseases of concern	9	15.0
I did not know that I needed to report the event	3	5.0
I did not know how to report	1	1.66
Other causes	5	8.3
Did you receive medical care after injury? (n=106)		
Yes	57	53.8
No	49	46.2
Determine the time in which your recent needle stick injury occurred? (n=106)		
Morning shift	38	35.8
Evening shift	36	34.0
Night shift	32	30.2

Generally, the safety standards in the facility were significantly associated with less NSIs among nurses. Out of all the nurses who reported absence of protocol or guidelines regarding the needle sticks in their hospital have NSIs only 36% of the nurses who reported the presence of such protocol or guidelines have NSIs. In addition, the availability of safety box was significant determinant of NSI's occurrence among nurses, since they were 5 times less likely to be injured in facility with safety box compared to those work in facility without safety box ($p<0.001$). The nurses who received any form of training on needle stick safety and prevention were twice less likely to be injured than those who did not receive training ($p<0.001$). Similarly, the nurses who were vaccinated against Hepatitis B virus were 26.6 times less likely to be injured than those who were not vaccinated (0.001). About 95% of nurses who reported the unavailability of needle safe device in the hospital were injured in comparison to only 33.5% of those who reported the availability of this device with statistically significant difference. The results of binary logistic regression showed that only few variables were significant predictors of the occurrence of needle stick injury. The significant predictors were nurses training on NSIs prevention, Hepatitis B virus vaccination status and availability of safety box in their workplace. Nurses work in workplace that do not containing needle safety box were 5.3 times more likely to be injured compared to those working in facility with safety box ($p<0.013$). The nurses who did not receive any form of training on needle stick safety and prevention were 6.7 times more likely to be injured than those who received training ($p<0.1$). Similarly, the nurses who were not vaccinated against Hepatitis B virus were 11.4 times more likely to be injured than those who were vaccinated ($p<0.01$). Cox & Snell R square and Nagelkerke R square were 16% and 22% respectively which may be interpretedas16% or 22% of variation in the occurrence of NSIs and could be explained by this model (table 6).

Table 6. Findings of binary logistic regression for the predictors of occurrence of NSIs among nurses

Predictor Questions	Reference group	Odds ratio	p value	Cox & Snell R Square	Nagelkerke R Square
Have you ever received any form of training on needle stick safety and prevention measures?	Yes	6.747	0.002	0.16	0.22
Have you ever been vaccinated against Hepatitis B virus?	Yes	11.358	0.030		
Was safety box available at your workplace?	Yes	5.288	0.013		
Constant		.203	0.000		

5. DISCUSSION

Health workers have an occupational hazard of acquiring blood-transmitted infections, particularly nurses who are routinely deal with injections, venipuncture and intravenous fluid administration in hospitals, nurseries and sometimes during home care [1]. Among 20 infections transmitted by blood, infections such as HIV or hepatitis B and hepatitis C viruses are the main infections of concern. In 2002, the WHO reported that 2 million health care workers experienced percutaneous exposure for communicable diseases [2]. In the United States, about 600,000 to 800,000 needles stick injuries reported annually and 100,000 in UK [4]. In Germany it was estimated that 500,000 needle stick injuries occur every year among health workers [4]. Additionally, contaminated needles become a biological hazard for public in many developing countries since no proper disposal is implemented by health authorities [5]. The majority of health workers who were subjected to needle stick injuries were nurses. A study found that 65% of needle stick injuries occurred in nurses [9]. In Malaysia, the highest occurrence of needle stick injury was among nurses in comparison to other health workers [10]. A study conducted in Eastern province of Saudi Arabia and found that 67.4% of the injured healthcare workers were nurses [11]. The proportion of injured nurses among all healthcare workers was 45.1% in a surveillance data collected from King Khalid University Hospital, Riyadh, Saudi Arabia[12].In our study about, 98% of the nurses reported the availability of protocol and safety guidelines for reporting the needle sticks in their hospital. Similarly, 96.5% of Malaysian health workers were found aware of presence of universal precaution guidelines [10]. Furthermore, about 62% of Jordanian nurses were found aware of universal precaution guidelines [13].In the present study; approximately 93% reported the presence of safety box and needle safety devices in their workplaces. A study among Malaysian health workers reported that only 52.5% of health workers aware about needle safe devices [10]. However, about 64% of Jordanian nurses aware of needle safety devices [13]..Among Malaysian health workers, the compliance with personal safety precautions among health workers were ranged from 66.1% in item "Should needles be recapped/bent after use? "to 98.3% in item of "Do you use gloves during phlebotomy?" [10].And in our ,the personal safety precautions were highly followed by nurses, since almost all nurses except 6 of them said that they regularly use personal protective equipment. The present study reported a lifetime occurrence of needle stick injury among nurses to be 37.6% (CI = 31.9% to 43.3%) with 1.8% have been previously exposed to needle stick injury more than two times. In contrast, a study among Egyptian nurses reported 72.9% prevalence of needle stick injury in Zagazig University hospitals. This can be attributed to the educational nature of Zagazig university hospital where usually training of students and general practitioners are practiced [6]. Furthermore, a study conducted in Jordan found 75.5% prevalence of needle stick injury among nurses in both public and private hospitals [13]. A high prevalence of 74% was reported by among health workers in Armed Force Hospital, Saudi Arabia [7]. The low prevalence reported in our study can be attributed to the high training among nurses, since 93% and 89% of them received training on needle stick safety and prevention and on needle safe devices respectively. A study found only 57% of Jordanian nurses attended a training program about infection control, which reflected the reported high prevalence of needle stick injury where 75.5% have experienced the injury [13]. On contrast, low prevalence of needle stick injury (29%) was reported among Australian nurses [14].A large-scale study, conducted in 21 health facilities in Saudi Arabia, found 66.4% of needle stick injuries occurred among nurses in comparison to only 7.8% of them in physicians [15]. A prevalence of 37% was reported by Bekele et al. as needle stick occurrence among healthcare workers in Ethiopia [8]. A lower overall prevalence of 23.5% and 24.9% among Malaysian health workers reported by Rampal et al. and Lee and Hassim, respectively [10,16]. A study found a high prevalence of 74% among health workers in Nepal hospitals [17], and this could be attributed to the deteriorated health system in Nepal [18].The syringe needle was the most common items that caused the recent NSIs among the affected nurses (78.3%) followed by intravenous catheter and tapping needle with prevalence of 11.3 and 7.5%, respectively. Hashmi et al. found the most common items were injections (17.9%) followed by drawing samples (17.2%) among health workers in Saudi Arabia [15]. Ahmed found needle recapping was the most common item that caused the recent injury among the Egyptian nurses with percentage of 62.9%, followed by injections and sample drawing in 56% and 43.2% of the nurses, respectively [6]. About 53% of injuries among Jordanian nurses happened during needle recapping, followed by collision with coworker (13%) and during waste collection (10%) [13]. Syringe needles constituted 69.8% of needle stick injury found by Bekele1et al. [8]. Similar results reported among nurses, in Eastern province of Saudi Arabia, where the most common items were injections (52.6%) followed by needle disposal [11].In our study the majority of nurses (56.6%) reported the injury occurred at the department of infection control and 85% of them reported immediately after the injury, while 3.3% reported the following days after the injury. However, 46.2% of the injured nurses did not receive medical care after injury, which means 10% of the nurse was not followed by the hospital authority to receive the required post-exposure care. A lower reporting rate found in Malaysian health worker's with 30.9% of reported needle stick injury to the health authority [10]. About 53% of Jordanian nurses reported to the authorities about the injury [13].

Reporting sharp injuries is important as it leads to sharing of the cases and subsequent prevention of those accidents. Proper work environment might decrease the number of sharp injuries. Safe disposal boxes should be provided in all patient rooms and clinical settings. In the present study, the highest prevalence of needle stick injury occurred in medical ward (22.6%) followed by surgical ward and emergency unit respectively with percentages 17.9% and 13.2 respectively. A study conducted among healthcare workers in Najran region and found medical ward is the most prevalent department where half of the injuries happen, followed by 13.6% in Emergency department [15]. Similar results among nurses from Eastern province in Saudi Arabia with most common departments were medical ward followed by surgical ward with 30.5% and 24.7%, respectively [11].In a study, it was found that the highest prevalence of needle stick injury among health workers 51.9% in medical ward, followed by 16% in labor room [10]. In an Egyptian study conducted in Zagazig university hospital, no nurse reported the authority about needle stick injury[6]. Abozead et al. found that the highest percentage of needle stick injury was in the emergency department [13]. Bekele et al. found that the highest proportion (31.7%) of injury occurs in emergency department among healthcare workers in Ethiopia [8]. We found the most common reason for this delay in reporting was injury by sterile needle. Other reasons include patients had no infectious disease of the concern and being busy at that time in 15% and 11.7%, respectively. The most common reasons for non-reporting were non awareness about the necessity of reporting or being too busy at the time of injury [13].The present study found gender, level of education and working department were not significantly associated with occurrence of needle stick injury. Similar findings were reported when gender, ethnicity, job category, and educational level were not significantly associated with occurrence of needle stick injury among health workers [10]. A study found gender not significantly associated with needle injury [6,19]. In Egyptian study conducted in Zagazig university hospital, bachelor graduated nurses had less needle injury than diploma holds nurses (6). We found nurses who were vaccinated against Hepatitis B virus were 26.6 times less likely to be injured than those who were not vaccinated, which could be attributed to the high awareness among those nurses. The findings of independent sample t-test (table 8), on comparing means of age between nurses who experienced needle stick injury and those who did not show non-significant differences (p= 0.07). Similar findings were reported as years of service were not significantly associated with occurrence of needle stick injury among health workers [10], however age was significantly differed among groups. Different results reported by Egyptian study conducted in Zagazig university hospital, where years of experience were negatively associated with occurrence of needle stick injury among nurses[6]. Ali found the years of experience and place of work were significantly associated with needle stick injury [20]. The results of our regression model showed significant predictors of needle stick injury were nurses training on NSIs prevention, hepatitis B virus vaccination status and availability of safety box in their workplace. Nurses who work in workplace without needle safety box were 5.3 times more likely to be injured compared to those working in facility with safety box. The effect of hepatitis B vaccination can be a function of nurses' compliance with guidelines and self-appreciation.

6. CONCLUSION

Despite the high level of training, awareness, and availability of safety precautions, more than a third of nurses in the KFGH affected by needle stick injury. The occurrence of needle stick injury could not be predicted by nurses' characteristics such as years of experience, educational level, hours of working and number of patients in the duty. Training on NSIs prevention and availability of safety box in their workplace were the major determinants of the needle stick injury in KFGH. Infection control programs should focus in quality of training and provision of needles safety boxes.

7. AUTHORS CONTRIBUTION STATEMENT

Dr. Arwa conceptualized the study plan, gathered and analyzed the data with regard to this study. Dr. Sulafa gave necessary input towards the designing and conduction of the study. Dr. Naif supervised and contributed significantly to the writing of the manuscript. All authors discussed the methodology and results and contributed to the final manuscript.

8. CONFLICT OF INTEREST

Conflict of interest declared none.

9. REFERENCES

1. Ishimaru T, Wada K, Smith DR. A consensus for occupational health management of healthcare workers infected with human immunodeficiency virus, hepatitis B virus, and / or hepatitis C virus. J Occup Health. 2017;59(3):304–8. DOI: 10.1539/joh.16-0275-op
2. 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(6):482–90. DOI: 10.1002/ajim.20230
3. Wankar A, Saini MM, Jain K, Sharma D CM. Needle Stick Injury: Inevitable or Avertable. Glob J Med Res. 2018;18(6). Available from: https://medicalresearchjournal.org/index.php/GJMR/article/view/1616
4. Hofmann F, Kralj N BM. Needle stick injuries in health care-frequency, causes und preventive strategies. Gesundheitswesen. 2002;64(5):259–66. Available from: https://europepmc.org/abstract/med/12007067
5. Patwary MA, O'Hare WT, Sarker MH. Assessment of occupational and environmental safety associated with medical waste disposal in developing countries: A qualitative approach. Saf Sci. 2011;49(8–9):1200–7. DOI: 10.1016/j.ssci.2011.04.001
6. AS A. Needle Stick and Sharp Injuries among Nurses at Zagazig University Hospitals, Sharkia Governorate, Egypt. Middle East J Appl Sci. 2014;4(4):1205–11. Available from: http://www.curresweb.com/mejas/mejas/2014/1205-1211.pdf
7. Alam M. Knowledge, Attitude and Practices among

Health Care Workers on Needle-Stick Injuries. Ann Saudi Med. 2002;22(5–6):396–9.
DOI: 10.5144/0256-4947.2002.396

8. Bekele T, Gebremariam A, Kaso M, Ahmed K. Factors Associated with Occupational Needle Stick and Sharps Injuries among Hospital Healthcare Workers in Bale Zone, Southeast Ethiopia. PLoS One. 2015;10(10):e0140382.
DOI: 10.1371/journal.pone.0140382
9. Shah SF, Bener A, Al-Kaabi S, Al Khal AL, Samson S. The epidemiology of needle stick injuries among health care workers in a newly developed country. Saf Sci. 2006;44(5):387–94.
DOI: 10.1016/j.ssci.2005.11.002
10. Rampal L, Zakaria R, Sook LW ZA. Needle stick and sharps injuries and factors associated among health care workers in a Malaysian hospital. Eur J Soc Sci. 2010;13(3):354–62. Available from: https://www.researchgate.net/profile/Lekhraj_Rampal/publication/235607171_Needle_Stick_and_Sharps_Injuries_and_Factors_Associated_Among_Health_Care_Workers_in_a_Malaysian_Hospital/links/0046351c672ac03d28000000.pdf
11. Abu-Gad HA A-TK. 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. Available from: https://link.springer.com/article/10.1023/A:1013793301772
12. El-Hazmi MM A-MF. 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). Available from: http://www.biomedres.info/biomedical-research/needle-stick-and-sharps-injuries-among-health-care-workersa-5year-surveillance-in-a-teaching-center-in-saudi-arabia.html
13. Abozead SE-S, Abuhasheesh M, Nawafleh H, Kawafha MM, Al-Tarawneh O. Knowledge and Practices of Jordanian Nurses on Needlestick Injuries. Infect Dis Clin Pract. 2015;23(1):21–5.
DOI: 10.1097/ipc.0000000000000159
14. Knight VM, Bodsworth NJ. Perceptions and practice of universal blood and body fluid precautions by registered nurses at a major Sydney teaching hospital. J Adv Nurs. 1998;27(4):746–51.
DOI: 10.1046/j.1365-2648.1998.00600.x
15. Hashmi A. Prevalence of Needle-stick and Sharps Injuries among Healthcare Workers, Najran, Saudi Arabia. Epidemiol Open Access. 2012;02(02).
DOI: 10.4172/2161-1165.1000117
16. Lee LK, Hassim IN. Implication of the prevalence of needlestick injuries in a general hospital in Malaysia and its risk in clinical practice. Environ Health Prev Med. 2005;10(1):33–41.
DOI: 10.1265/ehpm.10.33
17. Gurubacharya D, Mathura K KD. Knowledge, attitude and practices among health care workers on needle-stick injuries. Kathmandu Univ Med J. 2003;1(2):91–4. Available from: http://t.kumj.com.np/issue/2/91-94.pdf
18. Rai Sk, Rai G, Hirai K, Abe A, Ohno Y. The Health System in Nepal. An Introduction. Environ Health Prev Med. 2001;6(1):1–8. DOI: 10.1265/ehpm.2001.1
19. Hadadi A, Afhami S, Karbakhsh M EN. Occupational exposure to body fluids among healthcare workers: a report from Iran. Singapore Med J. 2008;49(6):492. Available from: http://www.smj.org.sg/sites/default/files/4906/4906a11.pdf
20. Ali E. Prevalence of Needle Sticks and Sharp Injuries among Nurses in ElmakNemir University Hospital.. University of Shendi Faculty of graduate studies and scientific research; 2014. Available from: http://repository.ush.sd:8080/xmlui/bitstream/handle/123456789/114/Combine Result 1 Copy.pdf?sequence=1&isAllowed=y