

Epidemiological Aspects of Needle Stick Injuries among Health Care Workers in Razi Hospital Ahvaz, Iran, in 2015

Sahar Geravandi^{a,b}, Seyed Mohammad Alavi^{c,b}, Ahmad Reza Yari^d, Farid Yousefi^{c,b}, Seyed Ahmad Hosseini^e, Seliman Kamaei^b, Mohammad Javad Mohammadi^{f,g*}, Poya Mohamadian Gravand^h

^aDepartment of Nursing, Islamic Azad University, Tehran Medical Sciences Branch, Tehran, Iran.

^bRazi Teaching Hospital, Clinical Research Development Center, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.

^cHealth Research Institute, Infectious and Tropical Diseases Research Center, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.

^dResearch Center for Environmental Pollutants, Qom University of Medical Sciences, Qom, Iran.

^eNutrition & Metabolic Diseases Research Center, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.

^fAbadan School of Medical Sciences, Abadan, Iran.

^gStudent Research Committee, Department of Environmental Health Engineering, School of Public Health and Environmental Technologies Research Center, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.

^hDepartment of Environmental Health Engineering, School of Health, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.

*Correspondence should be addressed to Mr. Mohammad Javad Mohammadi, **Email:** Mohamadi.m@ajums.ac.ir

A-R-T-I-C-L-E-I-N-F-O

Article Notes:

Received: Dec 14, 2015

Received in revised form:
Jun 21, 2016

Accepted: Feb 28, 2016

Available Online: Mar 29,
2016

Keywords:

Needle sticks, Health care workers, Ahvaz, Iran.

A-B-S-T-R-A-C-T

Background & Aims of the Study: Needle stick injuries (NSIs) are one of the most causes that expose health care workers (HCWs) to blood infectious diseases such as hepatitis B, C and HIV. HCWs can reduce the rate of NSIs by performing protective procedures. This study was conducted to evaluate the needle stick exposure among health care workers in Razi hospital, Ahvaz, Iran, in 2015.

Materials & Methods: This descriptive study was conducted on 600 HCWs at Razi Hospital, Ahvaz, Iran. The data collection tool was a questionnaire included health care workers' type of NSIs, ward and their activities. Data were analyzed by descriptive statistics and processed by SPSS version 16.

Results: Results showed that 21.35% of volunteers were male and 78.65% were female. The results indicated that recapping the needles was the most risk factor for NSIs. Based on the findings the most important reasons for NSIs were recapping needles were found in 40.82%, handling needle on tray in 22.45%, suturing in 14.29%, disassembling needle devices in 10.20%, passing needle in 8.16% and transit of disposal needle devices in 4.08% of cases, respectively.

Conclusions According to the findings of our study, it seems that establishment and performs of courses about the prevention of needle stick is very necessary.

Please cite this article as: Geravandi S, Alavi SM, Yari AR, Yousefi F, Hosseini SA, Kamaei S, et al. Epidemiological Aspects of Needle Stick Injuries Among Health Care Workers in Razi Hospital Ahvaz, Iran, in 2015. Arch Hyg Sci 2016;5(2):85-91.

Background

The most hazardous conditions of threatening the nurses' health are the injuries resulting from contaminated cutting equipment during the

operations (1-4). According to the report which was published by WHO, Needle sticks injuries (NSIs) were responsible for the incidence of 66,000 hepatitis B, 16,000 hepatitis C, and 1,000 HIV infections (5-7). NSIs are wounds caused by needles which were used in health-care that one of the common injuries in the teaching hospitals (4, 8). Based on the World Health Organization (WHO) report, in 2002, among 35 million HCWs, 2 million experience percutaneous exposure to NSIs and infectious diseases each year (9). NSIs commonly occur during the recapping needle, passing needle, suturing, drawing blood, handling needle on tray, administering an intravenous drug, needles penetrate during the surgery, overfilled or poorly located safety box, transit disposal needle devices, disassembling needle devices and failure to use an appropriate personal protective equipment (9-14). The NSIs, during processing the treatment patents may occur with freshly contaminated sharps and needles that carry dry blood (15,16). Blood borne infections (BBIs) such as hepatitis B virus (HBV), hepatitis C virus (HCV) and the human immunodeficiency virus (HIV) are the major concern about the NSIs (9,17-20). The most of NSIs between the healthcare professionals were occurring during the surgery with the rate of incidence (23%) (5,21). Also, according to the European Biosafety Network (EBN) report, one million NSIs cases annually occurred in Europe (22). Within the HCWs in regard to the risk of NSIs, nurses, specialties surgery and anesthesia, residents, midwife, operating room technicians, nurse aid and workers tend to show relatively high and doctors, radiology and pediatrics relatively low rates of NSIs (23,24). Based on the results of several studies, nurses are the most common groups among the HCWs who face with NSIs injuries (25-29). Greatest concern among nurses are performing invasive procedures because of the dangerous of transferring BBIs (5,30,31). Cases of NSIs may cure in any environment where sharps are encountered poses a risk (32). Deep

penetration, high-risk patient and visible blood on the needle are the main factors influencing the risk of NSIs (33,34). The most important complications of NSIs can be mentioned to the costs of treating, blood testing and lost time at work (35). In the United States, the annually treatment of NSIs is costly, estimated to be between \$376-\$2,456 (5,36). Different studies showed that spending much lower costs for hospital hygiene and education of HCWs can be largely avoided the incidence of NSIs (37-41). Training of appropriate resources, using instruments to grasp needles, reduction of the use of sharp devices, avoiding hand-to-hand passing of sharp instruments, load scalpels, decrease of the direct contact with needles, an appropriate disposal and using the useful safety box can decrease the risk of NSIs (5,10,42). In the study conducted by Galougahi in 2010 at Khanevadeh hospital of Tehran, Iran, the evidence showed that most of the common action resulted to exposure NSIs were injections and recapping of needles (43). The results of this study can have a major impact on the management and control of NSIs, preparation of educational bulletins and the knowledge of authorities about this health care problem.

Aims of the study:

This study aimed to determine the epidemiological aspects of Needle Stick Injuries(NSIs) among the health care workers in Razi hospital of Ahvaz, Iran, in 2015.

Materials & Methods

Methods

This cross-sectional study was performed on the staff of operating room, CCU and ICU, emergency, surgery and internal ward because of the higher NSIs cases which have been occurred in these wards at Razi teaching hospital of Ahvaz, Iran, in 2015. In this study was used to determine the prevalence and causes of sharps and cutting objects injuries and performance of the HCWs in Razi Hospital, with 220 beds approximately, March 2015 to

September 2015. Data were taken by the infection control supervisor according to reported cases of NSIs and observation. Data collection forms consisted of Category of HCWs information such as nurses, residents, midwife, operating room technicians, nurse aid, workers and activity information including sources, recapping needle, passing needle, suturing, handling needle on tray, transit disposal needle devices and dissembling needle.

Description of study area

Ahvaz city, the capital of Khuzestan Province, with a population of 1 million approximately and an area of 8152 square kilometers is located between 48° and 49°29' east of the Greenwich meridian and, 31°and 45' minutes north of the equator (44-50). Razi hospital is a tertiary-care one with 220 beds, and is located in the center of Ahvaz, Iran (2). The location of the study is shown in Figure 1.



Figure 1) Location of the study; Razi teaching hospital, in the south west of Ahvaz city, Iran

Statistical Analysis

The coded data were entered in SPSS, version 16. Data analyze were performed using descriptive statistics (frequency, mean and standard deviation for each variable).

Results

This study was conducted of the disease among of more than 650 HCWs who worked in different wards of hospital during 2015. The frequency of the type of HCWs with needle stick is shown in table 1. Based on the results, nurses were identified to be at the highest risk of NSI among all HCW groups (n=22, 44.90%). Totally, the number of NSIs were 49 cases in this hospital during 2015 (Table 1).

Table 1) Frequency cases of NSSIs exposure among HCWs based on the type of occupational

Category of HCWs	Frequency	
	Number	percent
Nurses	22	44.90
Residents	3	6.12
Midwife	3	6.12
Operating room Technicians	6	12.25
Nurse aid	8	16.33
Workers	7	14.28

The number of NSIs among nurses, residents, midwives, operating room technicians, nurse aids, and workers were 22, 3, 3, 6, 8 and 7, respectively, as shown in Figure 2.

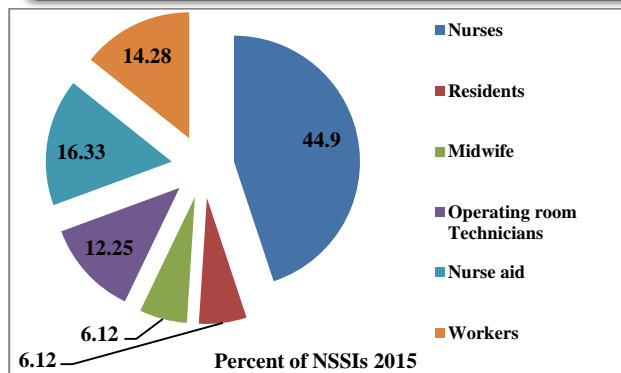


Figure 2) percent of NSSIs versus different HCWs during 2015

The predominant activities at the time of NSIs are presented in table 2. Totally, the 49 respondents who had experienced NSIs in this hospital were recapping needle (n=20), handling needle on tray (n=11), suturing (n=7), disassembling needle devices (n=5), passing needle (n=4) and transit the disposal needle devices (n=2), respectively.

Table 2) The comparison of frequency the event of exposure to NSIs tools

Activity	Frequency	
	Number	percent
Recapping needle	20	40.82
Passing needle	4	8.16
Suturing	7	14.29
Handling needle on a tray	11	22.45
Disassembling needle device	5	10.20
Transit of disposal needle device	2	4.08

Discussion

In this study, we calculated the cases of NSIs among HCWs groups. Razi Hospital is a civil active hospital in the south west of Iran with 220 beds. In recent years, NSIs is considered to be a serious threat to the quality of life and the health of HCWs.

The results of this study showed that the occupational exposure to sharp objects among the nurses during their work was 22(44.90%); they were the most involved HCWs, followed by 8(16.33%) nurse aid, 7(14.28%) workers in section gathering medical waste, 6(12.25%) operating room technicians, 3(6.12%) residents and 3(6.12%) midwife during 2015. In several

studies on the medical staff, the exposure has been reported, As Nassiri and colleagues have reported the prevalence of 76.7% during one year (25). Zeighami and colleagues reported the incidence of 10% (26); Khalooei and colleagues (27) have reported the prevalence in nurses (33%).

In another study, Jaybhaye et al. in 2014 conducted a research to find the relation between the needle stick injuries among the health care workers and tertiary care hospital of India. The results of this study showed that the nurses had the highest rate of NSIs as compared to other HCWs groups (42). Prevalence and response to NSIs among the health care workers in a tertiary care hospital in Delhi area has been performed; and has shown a relationship between the accrued NSIs among nurses. It was also showed that the most occurrence of NSIs among nurses (24). Based on the result of study of Ilhan et al, a long working hours increase the risk of NSSIs in nurses (43).

Result of this study identified the overall nurses were the maximum cases of NSIs between HCWs (n=22, 44.90%). This observation is in agreement with the findings of Gholami et al (7) and Martins et al (35). In a similar work, Smith's study in a Japanese teaching hospital during 2006 showed that 46% of nurses were the most frequent cases of NSIs (51). In another similar work, Askarian et al to estimated the needle stick injuries among the nurses of Fars province, Iran. The result of our study was considerably lower than those in Askarian's study with incidence (49.6%) (52), Prakash and associates to evaluated the epidemiology of needle-stick injuries in Mangalore city, India, during 2012. Based on the results of this study, doctors were the most frequent NSIs (64.7%), followed by waste workers (25.5%) and Nurses (7.8%) (53). Another study reported that the nurses (28.4%) and doctors (21.6%) were the most frequent cases of NSIs (54). This can be explained by the fact that the nurses administer most of the injections and are responsible for

major procedures, which require the use of needles.

Based on the results of this study, total number of NSSIs had experienced in this hospital, n=20, 40.82% were recapping needle, passing needle (n=4, 8.16%), suturing (n=7, 14.29%), handling needle on tray (n=11, 22.45%), transit disposal needle devices (n=2, 4.08%) and disassembling needle devices (n=5, 10.20%), respectively. Similar findings were reported recapping was the majority of the respondents a cured NSSIs (55,56). Also Cheng et al exploited factors affecting the occupational exposure to NSSIs among dentists in Taiwan during 2012. Their result showed that recapping of used syringes is responsible for 28% of NSSIs (57). According to the result of Saleh et al study in Saudi Arabia, needle recapping (26.4%) were the most responsible for NSIs (58). In a similar work, Laishram et al in 2013 evaluate the prevalence of the needle stick injuries among nurses in a tertiary care hospital and their immediate response.

Conclusion

In this study, data showed that the incidence of NSIs in nurses had the most frequent cases between HCWs. The pattern of injuries was associated with over loaded periods of medical practices significantly. Development of effective surveillance systems, dealing with the objects under observation of hospital infection control committee, prevention of injuries, regular reporting of NSIs cases, having a needle stick protocol, and use of devices can decrease the risk of NSIs and the number of affected HCWs. Regular and periodic training of employees with the aim of considering health and safety principles and management of sharp devices is very important.

Footnotes

Acknowledgments:

The authors would like to thank student research committee, Ahvaz Jundishapur University of Medical Sciences for providing financial supported by grant: (94s147) of this research.

Funding/Support:

This work was financially supported by grant: (94s147) from Vice- Chancellor for research affairs of Ahvaz Jundishapur University of Medical Sciences.

Conflict of Interest:

The authors declare no conflict of interest.

References

1. Saeidimehr S, Geravandi S, Rahim F, Yosefi F, Salmanzadeh S, Foruozandeh H, et al. Nosocomial Infection Rates During One Year in Naft Grand Hospital, Ahvaz, Iran. *Jundishapur J Health Sci* 2015;7(4):e30124.
2. Salmanzadeh S, Yousefi F, Ahmadi F, Geravandi S, Moien M, Mohammadi MJ, et al. Evaluation of Nosocomial Infections in a Teaching Hospital. *Avicenna J Clin Microbiol Infect* 2015;2(3).
3. Ker K, Edwards PJ, Felix LM, Blackhall K, Roberts I. Caffeine for the prevention of injuries and errors in shift workers. *Cochrane Database Syst Rev* 2010; (5):CD008508.
4. van der Molen HF, Stocks SJ, Frings-Dresen MH. Exploring Study Designs for Evaluation of Interventions Aimed to Reduce Occupational Diseases and Injuries. *Safe Health Work* 2015;7(1):83-85.
5. Makary MA, Al-Attar A, Holzmüller CG, Sexton JB, Syin D, Gilson MM, et al. Needlestick injuries among surgeons in training. *N Engl J Med* 2007;356(26):2693-9.
6. Werner BG, Grady GF. Accidental hepatitis-B-surface-antigen-positive inoculations: use of e antigen to estimate infectivity. *Ann Intern Med* 1982;97(3):367-9.
7. Muralidhar S, Singh PK, Jain R, Malhotra M, Bala M. Needle stick injuries among health care workers in a tertiary care hospital of India. *Indian J Med Res* 2010;131:405-10.
8. 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.
9. Laishram J, Keisam A, Phesao E, Tarao M, Laloo V, Devi H. Prevalence of needle stick injuries among nurses in a tertiary care hospital and their immediate response. *Int J Med Public Health* 2013;3(4):257-260.
10. Centers for Disease Control and Prevention. Use of blunt-tip suture needles to decrease percutaneous

injuries to surgical personnel. *Safe Health Inform Bulletin* 2007;132.

11. Ayas NT, Barger LK, Cade BE, Hashimoto DM, Rosner B, Cronin JW, et al. Extended work duration and the risk of self-reported percutaneous injuries in interns. *JAMA* 2006;296(9):1055-62.

12. Mohammad Nejad E, Sfandbud M, Ehsani S, Deljo R. Occupational exposure to needle stick among nurses. *Iran J Infect Trop Dis Trop Med* 2009;45(14):47-51.

13. Mohammadnejad S, Esfandbod M. Needle stick Injuries Reporting among Nurses. *Iran J Infect Dis Trop Med* 2010;15(48):49-54.

14. Ghasemzadeh I, Kazerooni M, Davoodian P, Hamedy Y, Sadeghi P. Sharp Injuries Among Medical Students. *Glob J Health Sci* 2015;7(5):320-5.

15. Ehsani SR, Mohammadnejad E, Hadizadeh MR, Mozaffari J, Ranjbaran S, Deljo R, et al. Epidemiology of Needle Sticks and Sharp Injuries Among Nurses in an Iranian Teaching Hospital. *Arch Clin Infect Dis* 2012;8(1):27-30.

16. Bijani B. Epidemiology and risk factors of needle stick injuries. *J Shahid Beheshti Sch Nurs Midwif* 2013;22(78):1-9. (Full Text in Persian)

17. Alavi SM, Sharifi M. Percutaneous Injuries and Transmission of HIV Among Cases Referred for Post Exposure Prophylaxis to Razi Hospital in Ahvaz, a City in the Southwest Iran. *Jundishapur J Microbiol* 2013;6(10): e8266.

18. Beekmann SE, Henderson DK. Protection of healthcare workers from bloodborne pathogens. *Curr Opin Infect Dis* 2005;18(4):331-6.

19. Lee JM, Botteman MF. Needlestick injuries in the United States: epidemiologic, economic, and quality of life issues. *AAOHN J* 2005;53(3):117-33.

20. Thomas WJC, Murray JRD. The incidence and reporting rates of needle-stick injury amongst UK surgeons. *Ann R Coll Surg Engl* 2009;91(1):12-17.

21. 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.

22. Mischke C, Verbeek JH, Saarto A, Lavoie MC, Pahwa M, Ijaz S. Gloves, extra gloves or special types of gloves for preventing percutaneous exposure injuries in healthcare personnel. *Cochrane Database Syst Rev* 2014;3.

23. Wicker S, Jung J, Allwinn R, Gottschalk R, Rabenau HF. Prevalence and prevention of needlestick injuries among health care workers in a German university hospital. *Int Arch Occup Environ Health* 2008;81(3):347-54.

24. Jayanth ST, Kirupakaran H, Brahmadathan KN, Gnanaraj L, Kang G. Needle stick injuries in a tertiary care hospital. *Indian J Med Microbiol* 2009;27(1):44-7.

25. Memish ZA, Assiri AM, Eldalatomy MM, Hathout HM, Alzoman H, Undaya M. Risk analysis of needle stick and sharp object injuries among health care workers in a tertiary care hospital (Saudi Arabia). *J Epidemiol Glob Health* 2013;3(3):123-9.

26. Cheraghi MA, Nejad EM, Begjani J, Rabirad N, Ehsani SR, Kaji MA. Knowledge and attitudes of nurses regarding HIV/AIDS (Tehran-2010). *Iran J Clin Infect Dis* 2011;6(3):121-3.

27. Denis MA, Ecochard R, Bernadet A, Forissier MF, Porst JM, Robert O, et al. Risk of occupational blood exposure in a cohort of 24,000 hospital healthcare workers: Position and environment analysis over three years. *J Occup Environ Med* 2003;45(3):283-8.

28. Esmaeil MN, Sirous J, Mahmood M, Jamaloddin B, SeyyedehRoghayyeh E, Narmela R. Hepatitis B virus antibody levels in high-risk health care workers. *Hepatitis Mon* 2011;2011(8):662-3.

29. Rampal L, Zakaria R, Sook LW, Zain AM. 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.

30. Centers for Disease Control and Prevention. Bloodborne infectious diseases: HIV/AIDS, Hepatitis B, Hepatitis C: Emergency Needlestick Information. 2010.

31. Wicker S, Gottschalk R, Rabenau HF. Risk of needlestick injuries from an occupational medicine and virological viewpoint. *Dtsch Arztebl.* 2007;104(45):3102-7.

32. Bhardwaj A, Sivapathasundaram N, Yusof M, Minghat A, Swe K, Sinha N. The Prevalence of Accidental needle Stick Injury and their reporting among healthcare Workers in orthopaedic Wards in General hospital Melaka, Malaysia. *Malays Orthop J* 2014;8(2):6-13.

33. Gonzalez JS, Hendriksen ES, Collins EM, Durán RE, Safren SA. Latinos and HIV/AIDS: examining factors related to disparity and identifying opportunities for psychosocial intervention research. *AIDS Behav* 2009;13(3):582-602.

34. Cardo DM, Culver DH, Ciesielski CA, 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(21):1485-90.

35. Kim OS, Jeong JS, Kim KM, Choi JS, Jeong IS, Park ES, et al. Underreporting rate and related factors after needlestick injuries among healthcare workers in small-or medium-sized hospitals. *Korean J Nosocomial Infect Control* 2011;16(1):29-36.

36. Chambers A, Mustard CA, Etches J. Trends in needlestick injury incidence following regulatory change in Ontario, Canada (2004-2012): an observational study. *BMC Health Serv Res* 2015;15(1):127.

37. Jagger J, Puro V, De Carli G. Occupational Transmission of Hepatitis C Virus—Reply. *JAMA* 2002;288(12):1469-71.
38. Sarrazin U, Brodt H, Sarrazin C, Zeuzem S. Prophylaxe gegenüber HBV, HCV und HIV nach beruflicher Exposition. *Dtsch Arztebl* 2005;102(33):1784.
39. Mohammadi N, Allami A, Malek Mohammadi R. Percutaneous exposure incidents in nurses: Knowledge, practice and exposure to hepatitis B infection: Percutaneous exposure incidents in nurses. *Hepatitis Mon* 2011;11(3):186.
40. Zhang X, Gu Y, Cui M, Stallones L, Xiang H. Needlestick and Sharps Injuries Among Nurses at a Teaching Hospital in China. *Workplace Health Saf* 2015;63(5):219-25.
41. Ehsani SR, Mohammadnejad E, Hadizadeh MR, Mozaffari J, Ranjbaran S, Deljo R, et al. Epidemiology of Needle Sticks and Sharp Injuries Among Nurses in an Iranian Teaching Hospital. *Arch Clin Infect Dis* 2013;8(1):27-30.
42. Jaybhave D, Dahire P, Nagaonkar A, Vedpathak V, Deo D, Kawalkar U. Needle stick injuries among health care workers in tertiary care hospital in tertiary care hospital of rural India. *Int J Med Sci Public Health* 2014;3(1):49-52.
43. Galougahi MH. Evaluation of needle stick injuries among nurses of Khanevadeh Hospital in Tehran. *Iran J Nurs Midwifery Res* 2010;15(4):172-7.
44. Geravandi S, Goudarzi G, Vosoughi M, Javad Mohammadi M, Salmanzadeh S, Zallaghi E. Relationship between Particulate matter less than 10 microns exposures and health effects on humans in Ahvaz, Iran. *Arch Hyg Sci* 2015;4(2).
45. Goudarzi G, Geravandi S, Mohammadi MJ, Salmanzadeh S, Vosoughi M, Sahebalzamani M. The relationship between air pollution exposure and chronic obstructive pulmonary disease in Ahvaz, Iran. *Chronic Dis J* 2015;3(1):14-20.
46. Geravandi S, Neisi A, Goudarzi G, Vosoughi Niri M, Mohammadi M. Estimation of Cardiovascular and Respiratory Deaths Related to Ozone Exposure in Ahvaz, During 2011. *J Rafsanjan Univ Med Sci* 2015;13(11):1073-82. (Full Text in Persian)
47. Geravandi S, Goudarzi G, Mohammadi MJ, Taghavirad SS, Salmanzadeh S. Sulfur and Nitrogen Dioxide Exposure and the Incidence of Health Endpoints in Ahvaz, Iran. *Health Scope* 2015;4(2): e24318.
48. Goudarzi G, Mohammadi MJ, Godini H, Tobeh Khak M, Seyed Daryanoosh M, Dobaradaran S. An Association Between Air Quality and COPD in Ahvaz, Iran. *Jundishapur J Chronic Dis Care* 2015;4(1):1-6.
49. Goudarzi G, Geravandi S, Foruozaeh H, Babaei AA, Alavi N, Niri MV, et al. Cardiovascular and respiratory mortality attributed to ground-level ozone in Ahvaz, Iran. *Environ Monit Assess* 2015;187(8):1-9.
50. Geravandi S, Goudarzi G, Babaei AA, Takdastan A, Mohammadi MJ, Niri MV, et al. Health Endpoint Attributed to Sulfur Dioxide Air Pollutants. *Jundishapur J Health Sci* 2015;7(3):e29377.
51. Smith DR, Mihashi M, Adachi Y, Nakashima Y, Ishitake T. Epidemiology of needlestick and sharps injuries among nurses in a Japanese teaching hospital. *J Hosp Infect* 2006;64(1):44-9.
52. Askarian M, Shaghaghian S, McLaws ML. Needlestick injuries among nurses of Fars province, Iran. *Ann Epidemiol* 2007;17(12):988-92.
53. Prakash K, Patel K. Epidemiology of needle-stick injuries in Mangalore. *J Evol Med Dent Sci* 2012;1(3):128.
54. Rais N, Jamil HM. Prevalence of needle stick injuries among health care providers. *Int J Endors Health Sci Res* 2013;1(2):73-9.
55. Askarian M, Malekmakan L. The prevalence of needle stick injuries in medical, dental, nursing and midwifery students at the university teaching hospitals of Shiraz, Iran. *Indian J Med Sci* 2006;60(6):227-32.
56. Manzoor I, Daud S, Hashmi NR, Sardar H, Babar MS, Rahman A, et al. Needle stick injuries in nurses at a tertiary health care facility. *J Ayub Med Coll Abbottabad* 2010;22(3):174-8.
57. Cheng HC, Su CY, Yen AM, Huang CF. Factors affecting occupational exposure to needlestick and sharps injuries among dentists in Taiwan: a nationwide survey. *PloS one* 2012;7(4):e34911.
58. Ghamdi SA, Al-Azraqi T, Bello C, Gutierrez H, Hyde M, Abdullah M. Needlestick and sharps injuries at Asir Central Hospital, Abha, Saudi Arabia. *Ann Saudi Med* 2003;23:405.