



## Occupational exposures to needle stick injuries among health care staff; a review study

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### Abstract

**Introduction:** Infectious diseases have threatened human health throughout the history. One way of transmission of such diseases is exposing to the needle sticks. The present study was carried out aiming to introduce and investigate risk factors related to needle sticks and ways of prevention of infectious diseases related to needle stick among health care staff.

**Methods:** Searching key words including needle sticks, occupational injuries, occupational exposures (OEs) and infectious diseases, the researchers undertook a comprehensive investigation regardless of publication year of the reviewed articles in references including, Medline, CINAHL, Google Scholar, ScienceDirect and Scopus. Then the collected articles were scrutinized and processed.

**Results:** Dealing with needle sticks can transmit more than 20 types of pathogens including Hepatitis B, C and human immunodeficiency virus (HIV). Among health care staff, nurses are more vulnerable compared to others.

**Conclusion:** Exposure to blood and other risky body liquids is a serious risk factor among health care workers. Training medical staff, establishing reporting systems, changing high risk behaviors and vaccination can play an important role in prevention of the infectious diseases.

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### Introduction

Needle stick injuries (NSIs) are lesions coming from needles or a piece of a broken ampoule covered by blood or other body liquids. In most cases, NSI happens in transfusion of blood or its products, sampling and collecting disposals.<sup>1,2</sup>

According to an estimation by the Center for Disease Control and Prevention (CDC), about 385000 individuals from American caring centers get needle stick. Injuries caused by needle sticks are among the most

dangerous occupational harms that threaten health care workers due to transmission of more than 20 types of pathogens. Although, most of the NSIs are preventable today, they are the matter of concern for their accompanied potential danger of transmitting infectious diseases like Hepatitis B, C, acquired immune deficiency syndrome (AIDS) or the same HIV, infection with herpes simplex virus (HSV), cytomegalovirus or parvovirus.<sup>3-7</sup>

Various investigations underline that the

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annual incidence of occupational exposure (OE) to biological factors including Hepatitis B, C and HIV varies from 0.78% to 5.15% individuals per 100 medical staff.<sup>8,9</sup> The examinations and follow-ups for treatment of a serious infection from blood or blood products can cost millions of US dollars. This injury also includes disability costs and losing working opportunities, however, only the prevention of the disease costs 3000 dollars.<sup>10-12</sup> Investigations showed that at least 64% of medical staff were exposed to blood or body liquids at least once in their lives.<sup>13</sup> Nurses account for the major part of the medical staff, therefore the higher rate of exposures can be observed among this group.<sup>14</sup> Working staff in operation rooms, emergency units and laboratories have the highest exposures to the pathogens which frequently threaten their lives.<sup>15</sup> NSIs can cause fear, anxiety and mental stresses among the health staff in addition to imposing high cost burdens on the health systems.<sup>16</sup>

The incidence of communicable diseases caused by blood contaminations and the high rate of the NSIs among health staff, more specifically among nurses, and also the serious damages and the importance of high-risk groups were the motivations to perform this study. Hence, we decided to undertake a study to investigate the OEs to needle sticks among the medical staff to find and introduce risk factors related to needle stick and ways of preventing infectious diseases caused by needle sticks among the health staff.

### Methods

The present study was carried out in 2015 with the aim to identify and review the relevant studies. The researcher used databases including Medline, CINAHL, Google Scholar, ScienceDirect, Scopus and other published resources for their feasibility, comprehensiveness and accessibility regardless of the publication year. The terms needle stick, occupational injuries, OEs and infectious diseases were used as keywords to search the related articles. Then, all the

relevant articles implying the injuries among the health care staff caused by needle sticks were examined.

### Results

Totally, 35 studies were reviewed. The review showed that the highest rate of injuries due to the OEs happened when recapping needle, during the transfusion of patient's body liquid from syringe to test tube and inappropriate disposal of the used needle.<sup>17</sup> According to the investigations, injection safety has 5 fundamental standards,<sup>10</sup> including: 1. Any type of injection, phlebotomy, using lancet, intravenous injections or infusions must be according to clear cut standards to prevent and control infection 2. Risky behaviors among medical and health staff must be reduced to prevent injuries due to needle sticks 3. Safety level among medical staff when working with needle sticks must be promoted 4. Any hazardous waste materials must be appropriately collected, stored, transported and disposed and 5. Behaviors and social attitudes of clients, doctors and other medical staff in terms of prescription of injection medications must be changed.<sup>18</sup>

Various studies showed that compared to other medical working staff, nurses were likely to be more at risk of OEs.<sup>19-24</sup> Regarding the place of exposures, studies indicated heterogeneous findings possibly due to the difference in hospital systems.<sup>25</sup> In an investigation, it was revealed that the highest OE rates happened in internal diseases unit followed by the surgery unit and operation rooms.<sup>26</sup> The difference may be due to different hospital systems either in terms of equipment safety or staff skills. Based on the studies, the accuracy of the medical staff in prevention of injuries increases with increasing their age and experience.<sup>27</sup> Smith et al. showed that nurses with the age of less than 25 years are more likely to be exposed to NSIs.<sup>28</sup> Moreover, in a study by Ilhan et al., it was indicated that the ages less than or equal to 24 years or a job experience of less than 4 years are of the effective factors of in the

rate of NSIs.<sup>29</sup> Investigations also revealed that most of the NSI incidents happen in the morning shifts; this finding is in agreement with the findings of the studies by Jonaidi Jafari et al.,<sup>30</sup> Khalouei et al.<sup>31</sup> and Ghasemi et al.<sup>32</sup>

In several studies, vaccination was mentioned as a preventive factor of diseases caused by the OEs.<sup>33,34</sup> Therefore, vaccination coverage area varies according to the levels and types of health facilities in different countries. In a research in Uganda, only 6.2% of the participants under study were vaccinated of which, only 34.8% were completely vaccinated. This study mentioned the lack of state facilities as the reason for the low coverage of vaccination and pointed out that most of the participants were vaccinated with the personal expenses.<sup>35</sup> In a study in Poland, 75.7% of the participants were completely vaccinated.<sup>36</sup> The rate of vaccination of the medical staff to NSIs was 72% in the United states, among which 98% had a controlled level of Hepatitis B surface antibody (HBsAb).<sup>37</sup> A high rate of coverage (> 90%) of vaccination was reported in most national studies.<sup>38-41</sup>

### Discussion

According to the investigations, it seems that recording of OEs in health care systems is carried out in a very incomplete way. In most developing countries, most of the injuries from needle sticks in health centers remain neglected. It is estimated that the real rate of injuries from needle sticks is 10 times higher than the reported values.<sup>42</sup> Furthermore, the rate of OEs has been reported to be different in various studies. For instance, Miraki et al. reported the rate of incidence of OEs to be 80.0% among the medical staff in Sanandaj, Iran.<sup>43</sup>

The rate of OEs was 71.1% in a study by Askarian and Malekmakan among the students of medicine in Shiraz, Iran.<sup>44</sup> The rate of OEs in northern Portugal was reported as 64.5% in a study by Martins et al.<sup>7</sup> Wicker et al. indicated that the rate of OEs in Germany was less than 45.0% in all groups of the medical staff.<sup>45</sup>

However, this rate was 88.6% in an Ethiopian study.<sup>46</sup> Moreover, the reason for the lack of reporting OEs varies from one study to another. In a study by Thomas and Murray, only 9% of the participants agreed to have a system for necessary follow-ups after injuries.<sup>47</sup> Other studies mentioned other reasons for the lack of reporting of injuries like, neutrality of reports on the process of disease, lack of knowledge, uncomplicated previous injuries and being busy.<sup>48</sup>

Based on the studies, the higher rate of OEs among nurses was due to the nature and type of duties in nursing. In addition, nurses highlighted presence in caring procedures and also great number of nursing staff compared to the other members of a clinical group.<sup>14,19,24</sup> It seems that the higher rate of OE among the younger staff is due to their low clinical skills compared to the experienced ones. The higher rate of OEs among the staff of the morning work shifts compared to the other shifts can be attributed to the high amount of work and high admissions and visits.<sup>31,32</sup>

### Conclusion

Based on the reviewed studies, formulating and holding educational training and job safety courses for health and clinical staff accompanied by personal protection equipment can be suggested to reduce the rate of incidence of OEs and subsequent diseases due to blood contaminations in hospitals. Moreover, structuring a standard reporting system, changing wrong and useless behaviors and vaccination can play fundamental role in prevention of diseases like Hepatitis B, C and AIDS.

According to the present study, continuous training programs to improve the occupational skills of the health staff, an appropriate health record system for medical staff, complete vaccination, safe equipment to carry out risky cares and reporting OEs seem to be necessary.

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### Authors' Contribution

All of the authors contributed equally.

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### References

1. Adib-Hajbaghery M, Lotfi MS. Behavior of healthcare workers after injuries from sharp instruments. *Trauma Mon* 2013; 18(2): 75-80. DOI: 10.5812/traumamon.12779
2. Nouhi E, Khoshnood Z, Sayyed Aadel M. Needle stick and sharp object injuries among nursing and midwifery students of Kerman University of Medical Sciences, 2007. *Iran J Nurs Res* 2010; 5(18): 18-23. [In Persian].
3. 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.
4. Zeighami R, Azimian J, Haghi M, Kaboodi B, Bijani B, Haghi M. A comparison between the risk of needle stick injuries among nurses in emergency wards and nurses in other wards of hospitals. *Modern Care* 2014; 10(4): 272-8. [In Persian].
5. Costigliola V, Frid A, Letondeur C, Strauss K. Needlestick injuries in European nurses in diabetes. *Diabetes Metab* 2012; 38(Suppl 1): S9-14. DOI: 10.1016/S1262-3636(12)70976-X
6. Cho E, Lee H, Choi M, Park SH, Yoo IY, Aiken LH. Factors associated with needlestick and sharp injuries among hospital nurses: A cross-sectional questionnaire survey. *Int J Nurs Stud* 2013; 50(8): 1025-32. DOI: 10.1016/j.ijnurstu.2012.07.009
7. Martins A, Coelho AC, Vieira M, Matos M, Pinto ML. Age and years in practice as factors associated with needlestick and sharps injuries among health care workers in a Portuguese hospital. *Accid Anal Prev* 2012; 47: 11-5. DOI: 10.1016/j.aap.2012.01.011
8. Elder A, Paterson C. Sharps injuries in UK health care: A review of injury rates, viral transmission and potential efficacy of safety devices. *Occup Med (Lond)* 2006; 56(8): 566-74. DOI: 10.1093/occmed/kql122
9. MacCannell T, Laramie AK, Goma A, Perz JF. Occupational exposure of health care personnel to hepatitis B and hepatitis C: Prevention and surveillance strategies. *Clin Liver Dis* 2010; 14(1): 23-36. DOI: 10.1016/j.cld.2009.11.001
10. Dement JM, Epling C, Ostbye T, Pompeii LA, Hunt DL. Blood and body fluid exposure risks among health care workers: Results from the Duke Health and Safety Surveillance System. *Am J Ind Med* 2004; 46(6): 637-48. DOI: 10.1002/ajim.20106
11. Siddique K, Mirza S, Tauqir SF, Anwar I, Malik AZ. Knowledge attitude and practices regarding needle stick injuries amongst healthcare providers. *Pak J Surg* 2008; 24(4): 243-8.
12. Michielsen PP, Francque SM, van Dongen JL. Viral hepatitis and hepatocellular carcinoma. *World J Surg Oncol* 2005; 3: 27. DOI: 10.1186/1477-7819-3-27
13. Slater K, Whitby M, McLaws ML. Prevention of needlestick injuries: the need for strategic marketing to address health care worker misperceptions. *Am J Infect Control* 2007; 35(8): 560-2. DOI: 10.1016/j.ajic.2006.12.007
14. 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. DOI: 10.1097/01.jom.0000052961.59271.9d
15. Salehi AS, Garner P. Occupational injury history and universal precautions awareness: A survey in Kabul hospital staff. *BMC Infect Dis* 2010; 10: 19. DOI: 10.1186/1471-2334-10-19
16. Hadadi A, Afhami SH, Kharbaksh M, Hajabdoulbaghi M, Rasoolinejad M, Emadi H, et al. Epidemiological determinants of occupational exposure to HIV, HBV and HCV in health care workers. *Tehran Univ Med J.* 2007; 65(9): 59-66. [In Persian].
17. Wicker S, Stirn AV, Rabenau HF, von Gierke L, Wutzler S, Stephan C. Needlestick injuries: Causes, preventability and psychological impact. *Infection* 2014; 42(3): 549-52. DOI: 10.1007/s15010-014-0598-0
18. Manchikanti L, Malla Y, Wargo BW, Fellows B. Infection control practices (Safe injection and medication vial utilization) for interventional techniques: are they based on relative risk management or evidence? *Pain Physician* 2011; 14(5): 425-34.
19. Jahan S. Epidemiology of needlestick injuries among health care workers in a secondary care hospital in Saudi Arabia. *Ann Saudi Med* 2005; 25(3): 233-8.
20. Watterson L. Monitoring sharps injuries: EPINet surveillance results. *Nurs Stand* 2004; 19(3): 33-8. DOI: 10.7748/ns2004.09.19.3.33.c3701
21. Nakhle Ahmadi H, Khazaei T. Assessing the performance and knowledge of the medical staff of Imam Reza and Vali-asr hospitals in Birjand on the injuries resulting from needle stick. *Modern Care* 2007; 4(1): 41-6. [In Persian].
22. Alamgir H, Cvitkovich Y, Astrakianakis G, Yu S, Yassi A. Needlestick and other potential blood and

- body fluid exposures among health care workers in British Columbia, Canada. *Am J Infect Control* 2008; 36(1): 12-21. DOI: 10.1016/j.ajic.2007.03.005
23. Yoshikawa T, Wada K, Lee JJ, Mitsuda T, Kidouchi K, Kurosu H, et al. Incidence rate of needlestick and sharps injuries in 67 Japanese hospitals: A national surveillance study. *PLoS One* 2013; 8(10): e77524. DOI: 10.1371/journal.pone.0077524
24. Peng B, Tully PJ, Boss K, Hiller JE. Sharps injury and body fluid exposure among health care workers in an Australian tertiary hospital. *Asia Pac J Public Health* 2008; 20(2): 139-47. DOI: 10.1177/1010539507312235
25. Poorolajal J, Haddadi A, Asasi N, Mohammad K. Frequency of occupational exposure to blood or other potentially infectious materials and related factors in healthcare workers in Hamadan-2003. *Iran J Infect Dis Trop Med* 2004; 9(27): 79-87. [In Persian].
26. Ng LN, Lim HL, Chan YH, Bin BD. Analysis of sharps injury occurrences at a hospital in Singapore. *Int J Nurs Pract* 2002; 8(5): 274-81. DOI: 10.1046/j.1440-172X.2002.00377.x
27. Taghavi R, Tavakoli Tabasi K, Mohamadi S, Kor K. Frequency of work injuries of needle stick among personnel in Sina Hospital in 2011. *J Neyshabur Univ Med Sci* 2015; 2(5): 22-8. [In Persian].
28. 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. DOI: 10.1016/j.jhin.2006.03.021
29. Ilhan MN, Durukan E, Aras E, Turkcuoglu S, Aygun R. Long working hours increase the risk of sharp and needlestick injury in nurses: The need for new policy implication. *J Adv Nurs* 2006; 56(5): 563-8. DOI: 10.1111/j.1365-2648.2006.04041.x
30. Jonaidi Jafari NA, Shasti M, Izadi M, Ranjbar R, Ghasemi M. Evaluation of frequency of exposure to medical sharp devices among nurses of a university hospital. *J Mil Med.* 2008; 10 (2): 119-28. [In Persian].
31. Khalouei A, Iranpour A, Hamzehnezhadi S, Rahmanian K. Study on epidemiology of needle stick injury among nursing personnel of Kerman university hospitals. Kerman, Iran in (2006-2007). *J Jahrom Univ Med Sci* 2010; 7(3): 43-51. [In Persian]
32. Ghasemi A, Eatamad E, Pour Mohammad Jan N, Bashiri J, Habibzadeh S. Effect of needle stick injuries associated factors on two group of nurses and service workers in hospitals of Ardabil. *Iran J Infect Dis Trop Med* 2009; 14 (46): 27-32. [In Persian].
33. Butsashvili M, Kamkamidze G, Kajaia M, Morse DL, Triner W, DeHovitz J, et al. Occupational exposure to body fluids among health care workers in Georgia. *Occupational Medicine* 2012; 62(8): 620-6. DOI: 10.1093/occmed/kqs121
34. Kuruuzum Z, Yapar N, Avkan-Oguz V, Aslan H, Ozbek OA, Cakir N, et al. Risk of infection in health care workers following occupational exposure to a noninfectious or unknown source. *Am J Infect Control* 2008; 36(10): e27-e31. DOI: 10.1016/j.ajic.2008.05.012
35. Ziraba AK, Bwogi J, Namale A, Wainaina CW, Mayanja-Kizza H. Sero-prevalence and risk factors for hepatitis B virus infection among health care workers in a tertiary hospital in Uganda. *BMC Infect Dis* 2010; 10: 191. DOI: 10.1186/1471-2334-10-191
36. Serafinska S, Smolinski P, Gladysz A. Critical evaluation of reporting on postexposure skin damage incidents and its consequences for Polish health workers. *Med Pr* 2006; 57(5): 439-50. [In Polish].
37. Gershon RR, Sherman M, Mitchell C, Vlahov D, Erwin MJ, Lears MK, et al. Prevalence and risk factors for bloodborne exposure and infection in correctional healthcare workers. *Infect Control Hosp Epidemiol* 2007; 28(1): 24-30. DOI: 10.1086/510813
38. Nejadghaderi M, Safizadeh H, Khanjani N. The knowledge and practice of medical staff about needle injuries in Rafsanjan's Ali-ebne-Abitaleb Hospital, Iran. *J Health Dev* 2012; 1(1): 1-10. [In Persian].
39. Moradi A, Mostafavi E, Moradi A. The prevalence and causes of needle stick injuries among the primary health care workers of Bahar city, Hamadan Province. *Iran Occup Health* 2010; 7(2): 39-42. [In Persian].
40. Heidari M, Shahbazi S. Prevalence of needle sticks exposure in operation room's staff of Borujen and Lordegan hospitals - 2010-2011 *Community Health* 2011; 5(2): 32-37. [In Persian].
41. Ghorbani GA. Prevalence of occupational blood transmitted viral infection in health care workers after needle stick and sharp injury. *Kowsar Med J* 2010; 14(4): 223-8. [In Persian].
42. Frijstein G, Hortensius J, Zaaijer HL. Needlestick injuries and infectious patients in a major academic medical centre from 2003 to 2010. *Neth J Med* 2011; 69(10): 465-8.
43. Miraki P, Bidarpoor F, Rostami S, Khairollahi S, Rahmani K. Occupational exposures and factors affecting its prevalence in Besat Hospital of Sanandaj in 2014. *J Rafsanjan Univ Med Sci* 2015; 14(7): 535-48. [In Persian].
44. 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.
45. 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. DOI: 10.1007/s00420-007-0219-7
46. Aynalem TF, Dejenie HT. Assessment of prevalence and determinants of occupational exposure to HIV infection among healthcare workers in selected health institutions in Debre Berhan Town, North Shoa Zone, Amhara Region, Ethiopia, 2014. *AIDS Res Treat* 2014; 2014: 731848. DOI:

10.1155/2014/731848

**47.** Thomas WJ, Murray JR. The incidence and reporting rates of needle-stick injury amongst UK surgeons. *Ann R Coll Surg Engl* 2009; 91(1): 12-7. DOI:

10.1308/003588409X359213

**48.** Mohammadnejad S, Esfandbod M. Needle stick injuries reporting among nurses. *Iran J Infect Dis Trop Med* 2010; 15(48): 49-54. [In Persian].