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Prevalence Of Needlestick Injuries (Nsis) Among Laboratory Personnel In Makkah, Saudi Arabia

Mohammed Ibn Abdullah Ibn Ali Alghamdi[1], Badriah Hafiz Hakami[2], Ibrahim Hassan Dawmari[3], Waleed Qasem Mashlawi[3], Ahmed Mohammed Mabar[3], Ali Omar Qasem Alqasimi[3], Halima Omar Qassim Alqassemi[4], Mashael Middas Abdullrahman Aljahdali[5], Ahmed Hassan Saeed Alzubaidi[6], Khaled Ghurmullah Ali Alghamdi[7], Mutlaq Saeed Ahmed Alghamdi[8], Ali Saeed Hamed Alghamdi[8]

Abstract: *Background: Needlestick injuries (NSIs) are one of the most common health hazards facing healthcare workers(HCWs) worldwide. Objectives: The aims of this study were to determine the prevalence of occupational exposure to NSIs among laboratory personnel working at Makkah hospital, Saudi Arabia. Also, to identify the risk factors associated with NSIs and HBV vaccination status. Method: A descriptive cross-sectional study was conducted among laboratory personnel in the health laboratory in Makkah. Data collection was done using a pretested administered questionnaire.*

Results: A total of 33 (34.4%) participants had been exposed to needlestick injuries during their work in the laboratory. Only 33.3% of needlestick injuries were reported to administrator in the laboratory. The pre[1]valence rate of needlestick injury was significantly higher (65.6%) among those who had an experience of less than 5 years (P< 0.05) and those who had not (41.9%) received training course on biosafety (P< 0.05). About one-third (32.3%) of participants reported that they had been vaccinated against HBV. The vaccination coverage rate against HBV was significantly higher among laboratory personnel who had received a bachelor's degree (P< 0.05), and those who received biosafety training course (P< 0.05).

Conclusions and Recommendations: This study showed relatively higher prevalence rate of NSIs among the laboratory personnel. The rate of non-reported NSIs is also high among laboratory personnel who had needlestick injuries. Low rate of receiving biosafety training courses and low vaccination coverage among laboratory personnel. Therefore, laboratory personnel should be trained on safety measures for handling and disposing of needles and should be encouraged to report NSIs to get the right treatment and counseling. Also, the laboratory should be provided with protective equipment in sufficient quantities to reduce the incidence of NSIs and HBV vaccination should be achieved for laboratory personnel working at the health laboratory in Makkah.

Keywords: *Healthcare workers; Needlestick injury; Laboratory personnel; Vaccination*

Introduction

According to Himmelreich et al. (2013), needlestick injuries (NSIs) are harms brought on by blood collection needles, hypodermic needles, cannulas, and needles used to join components of IV drip systems tainted with bodily secretions or blood. Worldwide, needlestick injuries are a major occupational risk for healthcare workers (HCWs). Healthcare personnel are more likely to become infected with blood-borne infections due to the contaminated needlestick injuries they encounter on a daily basis in healthcare settings (Isara & Ofili, 2012). Healthcare personnel may come into contact with any one of the more than 20 blood-borne pathogens that can infect NSIs if they come into contact with a patient's blood or bodily fluids; the most prevalent ones are the HIV, hepatitis B, and

[1]Specialist-Laboratory, Prince Mashari Hospital in Baljershi, Saudi Arabia.
[2]Specialist- Laboratory, Laboratories and Medical Technology Prince Mohammed Bin Nasser Hospital, Saudi Arabia.
[3]Technician- Laboratory, Laboratories and Medical Technology Prince Mohammed Bin Nasser Hospital, Saudi Arabia.
[4]TECHNICAL LABORATORY, Jazan Specialist Hospital, Saudi Arabia.
[5]Lab specialist, Maternity and Children Hospital, Saudi Arabia.
[6]laboratory technician, Al-Laith General Hospital, Saudi Arabia.
[7]lab specialist, Prince Mashari bin Saud hospital, Saudi Arabia.
[8]Lab Technician, Prince Mishari bin Saud Hospital, Saudi Arabia.

hepatitis C viruses (Cui, Zhu, Zhang, Wang, & Li, 2018; Marusic, Markovic-Denic, Djuric, Protic, & Dubljanin-Raspopovic, 2017).

Every year, around three million healthcare workers (HCWs) encounter blood-borne infections. Of these, exposure to HIV, HBV, or HCV accounts for 2.5% and 40% of cases, respectively, and over 90% of these instances happen in underdeveloped nations (Cui et al., 2018; Shaghaghian, Golkari, Pardis, & Rezayi, 2015).According to estimates made by Goel, Kumar, Lingaiah, and Singh (2017), the chance of transmission for HBV, HCV, and HIV infection after a percutaneous injury is 40%, 3% to 10%, and 0.2% to 0.5%, respectively.

The incidence of NSIs varies from nation to nation and even within a nation. However, due to high levels of poor health settings, a lack of training, the adoption of safer working practices, awareness of the prevalence of HBV, and the unavailability of occupational protective measures like vaccination against HBV, the prevalence of needlestick injuries is higher in developing countries (Cui et al., 2018; Shaghaghian, Golkari, Pardis, & Rezayi, 2015). Additionally, the lack of surveillance and reporting mechanisms in healthcare facilities contributes to the high and underestimated incidence of NSIs in underdeveloped nations (Chalya et al., 2015).

Conducting a study regarding the prevalence of NSIs is very important for intervention and policy to decrease bloodborne infection transmission among laboratory personnel. In Saudi Arabia and Arab countries, a few studies conducted to assess the prevalence of needlestick injuries among laboratory personnel reported prevalence rates of14.6% and 54.8% (Al-Abhar, Moghram, Al-Gunaid, Al Serouri, & Khader,2020; Al Eryani et al., 2019).Therefore, the aim of this study was to determine the prevalence of NSIs among laboratory personnel working at Makkah hospital. Also, to identify the risk factors associated with NSIs and HBV vaccination status.

Methodology

Study design and study area:

This is a descriptive cross-sectional study conducted in laboratories of Makkah hospitals over three months (October - December 2022).

Study population:

The study included laboratory personnel working in the in laboratories of Makkah hospitals

Inclusion and exclusion criteria:

The laboratory personnel who were involved in handling and processing clinical samples were included, while laboratory personnel who were not involved such as administrative staff, were excluded.

Sample size:

All the laboratory personnel who were present and who gave verbal consent were considered as the sample size for the study.

Data collection:

Administered structured questionnaire was used to collect data. The questionnaire was developed based on previously reviewed similar literatures (Al-Abhar, Moghram, Al-Gunaid, Al Serouri, &Khader, 2020; Al Eryani et al., 2019; Goel, Kumar, Lingaiah, & Singh, 2017; Nagi et al., 2017), as well as itwas modified by experts. The questionnaire was pretested, and a pilot testing was conducted with a random sample of 10 laboratory personnel to check its reliability, clarity, time required, acceptability, and missing data. Required changes were made and laboratory personnel who participated in pilot study wereexcluded from the study. The questionnaire included three parts. The first part contained information onsociodemographic characteristics of participants, and the second part included information on the usage and availability of the personal protective equipments (PPE). In the third part, the participants were asked if they had a history of exposure to needlestick injury during their work in the laboratory, and if they werevaccinated against HBV.

Ethical consideration:

Permission for conducting this research was granted by the administrators of health laboratory in Makkah before the study initiation and verbal consent was obtained from eachparticipant after providing a clear explanation about the study's purpose before participation, and

the anonymity of participants was maintained.

Statistical analysis

The Statistical Package for Social Sciences (SPSS) software version 22 was used to enter, clean and analyze the data. Descriptive statistics like frequencies and proportions were used to summarize the data. Chi-square test was used to determine the associations between categorical variables. A p-value of ≤0.05 was regarded as statistically significant.

Results

Table 1 shows the participants' sociodemographic characteristics.

A total of 96 laboratory personnel have participated in this study. The majority (59.4%; 57/96) of them were female and forty (41.7%) of the participants were among the age group of 20 to 29 years. More than half (56.2%; 54/96) of the participants had received a diploma degree, and 36 (37.5%) had more than 10 years of work experience. Only 34 (35.4%) and 31 (32.3%) of laboratory personnel received biosafety training course and vaccination against the hepatitis B virus respectively.

Variable	Laboratory personnel Frequency	(%)
Gender		
Male	**39**	**40.6**
Female	**57**	**59.4**
Age group (year)		
20-29	**40**	**41.7**
30-39	**18**	**18.8**
40-49	**16**	**16.7**
50-59	**18**	**18.8**
>59	**4**	**4.2**
Education		
Diploma	**54**	**56.2**
Bachelor	**24**	**25.0**
Master	**18**	**18.8**
Work experience (years)		
<5	**32**	**33.3**
5-10	**28**	**29.2**
>10	**36**	**37.5**
Received biosafety training		
Yes	**34**	**35.4**
No	**62**	**64.6**
HBV vaccine		
Yes	**31**	**32.3**
No	**65**	**67.7**

Table 2 shows the prevalence of NSIs according to sociodemographic characteristics.

Out of 96 laboratory personnel, thirty-three of them had been exposed to needlestick injury during their work in the laboratory. Thus, the prevalence of NSIs was 34.4%. On the other hand,only 11(33.3%) of those exposed to needlestick injury reported the incidence while majority (22/33; 66.7%) of participants didnot.

The prevalence of NSIs was slightly higher in males (35.9% vs. 33.3%) than in females. A similarNSIs prevalence rate of 50% was found among laboratory personnel in the age group 30 to 39 and thosewith more than 59 years. According to educational level, the highest prevalence rate of 35.2% was in laboratory personnel who had received a diploma degree. Significant higher NSI prevalence rates of 65.6% and 41.9% were found in those who had less than 5 years of work experience (P< 0.05), and thosewho had not received a biosafety training course (P< 0.05), respectively.

Variables	Total Number	Injured		Not injured		P value
		N	(%)	N	(%)	
Gender						
Male	**39**	**14**	**35.9**	**25**	**64.1**	**P=0.79503**
Female	**57**	**19**	**33.3**	**38**	**66.7**	**□2=0.0675**
20-29	**40**	**12**	**30**	**28**	**70**	**P=0.50067□ □2=3.3524**
30-39	**18**	**9**	**50**	**9**	**50**	
40-49	**16**	**4**	**25**	**12**	**75**	
50-59	**18**	**6**	**33.3**	**12**	**66.7**	
>59	**4**	**2**	**50**	**2**	**50**	
Education						
Diploma	**54**	**19**	**35.2**	**35**	**64.8**	**P=□□□□□□ □□ □2=0.0359**
Bachelor	**24**	**8**	**33.3**	**16**	**66.7**	
Master	**18**	**6**	**33.3**	**12**	**66.7**	
Work experience (years)						
<5	**32**	**21**	**65.6**	**11**	**34.4**	**P=□□□□□□ □ □2=22.9077**
5-10	**28**	**8**	**28.6**	**20**	**71.4**	
>10	**36**	**4**	**11.1**	**32**	**88.9**	
Received biosafety training						
Yes	**34**	**7**	**20.6**	**27**	**79.4**	**P=□□□□□□ □□□ □2=4.4358**
No	**62**	**26**	**41.9**	**36**	**58.1**	

Table 3 shows the availability and the use of personal protective equipments by laboratory personnel. A total of 93.8% (90/96), 95.8% (92/96) and 94.8% (91/96) of laboratory personnel were found to wear gloves, laboratory coats, and masks respectively. Eye goggles, eye washers and safety cabinets were less available and used only by 3.13% (3/96), 1.04% (1/96), and 7.3% (7/96) of laboratory personnel,respectively

Personal protective equipment (PPE)	Total	
	N	(%)
Gloves	90	93.8
Lab coats	92	95.8

Masks	91	94.8
Eye Goggles	3	3.13
Eye washer	1	1.04
Safety cabinet	7	7.3

In regard to vaccination status, only 32.3% (31/96) of participants reported that they had been vaccinated against HBV. The vaccination coverage rate against HBV was significantly higher among laboratory personnel who had received a bachelor's degree (48.4%), and those who received the biosafetytraining (74.2%,)(Table 4).

Variables	**Vaccinated**		**Not Vaccinated**		**P value**
	N	(%)	N	(%)	
Education					
Diploma	7	22.6	47	72.3	P=0.000018□ □2=21.8256
Bachelor	15	48.4	9	13.8	
Master	9	29.0	9	13.8	
Work experience (years)					
<5	7	22.6	25	38.5	P=□□□□□□□□ □2=4.1971
5-10	8	25.8	20	30.8	
>10	16	51.6	20	30.8	
Received biosafety training course					
Yes	23	74.2	11	16.9	P=0.00001□ □2=30.098
No	8	25.8	54	83.1	

Discussion

Every year, around three million healthcare workers (HCWs) encounter blood-borne infections. Of these, exposure to HIV, HBV, and HCV accounts for 2.5% and 40% of cases, respectively, and over 90% of these instances happen in underdeveloped nations. (Cui, Zhu, Zhang, Wang, & Li, 2018; Goel, Kumar, Lingaiah, &Singh, 2017).

According to the current study, 33/96, or 34.4% of laboratory professionals experienced a needlestick injury while doing their duties. This outcome was consistent with earlier research from Yemen (37.5%), Ghana (33.6%), India (34%) (Nagi et al., 2017), and Ghana (Kumah et al., 2020).Higher prevalence rates, however, were reported from Iran (76%) (Jahangiri, Rostamabadi, Hoboubi, Tadayon, & Soleimani, 2016), Yemen (54.8%) (Al Eryani et al., 2019), and India (68.3%) (Archana Lakshmi, Raja, Meriton Stanly, Paul, & Gladius Jennifer, 2018). Conversely, Yemen (14.6%) and Ethiopia (13.2%) reported lower results (Al-Abhar, Moghram, Al-Gunaid, Al Serouri, & Khader, 2020, (Dilie, Amare, & Gualu, 2017).

This relatively high prevalence rate of NSI found in the current study could be explained by less work experience, lack of training on occupational health and infection prevention and lack of adequate and/or proper personal protective devices(Al-Abhar, Moghram, Al-Gunaid, Al Serouri, & Khader, 2020; Alwabr, 2018; Kebede & Gerensea, 2018). In addition, in developing countries, the prevalence of NSIs is higher and underestimated, and it varies between countries and even can vary within a country. The possible reasons for these variations could be due to differences in awareness, degree of exposure to needles, and methodological differences among studies. Moreover, the prevalencecan vary from facility to facility depending on standards, workload overload, overcrowding, type of profession, level of skills, and accessibility and use of resources(Kebede & Gerensea, 2018; Kumah et al.,2020).

In this study, a significant high NSIs prevalence rates of 65.6% and 41.9% were found among those who had less than 5 years of work experience(P<. □□□□□□), and those who had not received training courses on biosafety(P<. □□□□□□). These findings were in agreement with previous studies(Al-Abhar, Moghram, Al-Gunaid, Al Serouri, & Khader, 2020; Al Eryani et al., 2019), and disagreedwith other studies (Kebede & Gerensea, 2018).However, this finding could be explained by the long duration of services and experience and training on biosafety are important and helpful in enhancing awareness and improving attitudes and protective practices of laboratory personnel towards NSI(Khabour, Al Ali, & Mahallawi, 2018; Zhang, Gu, Cui, Stallones, & Xiang, 2015).Therefore, the implementation of universal infection prevention measures and biosafety training of laboratory personnel is crucial in reducing the exposure to NSIs(Al-Abhar, Moghram, Al-Gunaid, Al Serouri, & Khader, 2020; Kebede & Gerensea, 2018; Rajpal, Garg, Bano, & Singh, 2021; Zhang, Gu, Cui, Stallones, & Xiang, 2015).

In many previous studies, syringe needles were identified as the major source of NSIs(Kumah et al., 2020; Zhang, Gu, Cui, Stallones, & Xiang, 2015), and the reasons which may be accounted for NSIs were recapping of used needles, improper handling, and poor disposal of needles by HCWs(Kumah et al.,2020; Rajpal, Garg, Bano, & Singh, 2021). Therefore, in order to decrease the incidence of NSIs, sharp devices with safety engineering controls such as auto-disposable syringes, needle-free devices, and bluntimmediately after use needles were introduced. These devices are help in reduce the risk of NSIs and arewidely used in North America and Europe and they are required by law in some countries such as the USA(Alfulayw, Al-Otaibi, & Alqahtani, 2021).Implementation and the use of sharp devices with safety engineering controls should be considered, and laboratory personnel should be properly trained on how to use these devices, how safely handle sharp equipment, and dispose of used sharp, and needlerecapping should be avoided(Alfulayw, Al-Otaibi, & Alqahtani, 2021).

In this study majority (66.7%; 22/33) of laboratory personnel who were exposed to needlestick injury during their work did not report the incidence of NSIs, while only one-third (33.3%; 11/33) were reported the incidence of NSIs. In the current study, the reason for not reporting might be because laboratory personnel did not know who and where to report needlestick injuries due to lack of reporting system. Consequently, in developing countries, the prevalence of NSIs is high and underreported(Goel, Kumar, Lingaiah, & Singh, 2017; Kumah et al., 2020). Furthermore, according to Chalya et al. (2015), this finding suggests that post-exposure prophylaxis (PEP) benefits are not well understood. Additionally, this data confirms the false perception (Alfulayw, Al-Otaibi, & Alqahtani, 2021; Chalya et al., 2015; Kumah et al., 2020) that there is a very minimal probability of infection transmission after needlestick injury.This conclusion, however, conflicted with another study that indicated a high (68.1%) reporting rate and was in line with other developing nations (AlDakhil, Yenugadhati, Al-Seraihi, & Al-Zoughool, 2019; Kumah et al., 2020; Rajpal, Garg, Bano, & Singh, 2021 To get treatment, prophylaxis, and guidance, it is crucial that all laboratory staff disclose any needlestick injuries sustained at work (Alfulayw, Al-Otaibi, & Alqahtani, 2021; Rajpal, Garg, Bano, & Singh, 2021).The reporting system is crucial for healthcare professionals' occupational health exposure policies and responses. As a result, healthcare institutions should encourage reporting and establish reporting systems (Mursy & Mohamed, 2019).

In this study more than ninety percent of laboratory personnel were found to wear gloves, laboratory coats, and masks. These findings were in accordance with a previous study(Afridi, Kumar, & Sayani, 2013; Al Eryani et al., 2019; Alfulayw, Al-Otaibi, & Alqahtani, 2021; Kebede & Gerensea, 2018) anddiffer from other studies in which a low proportion of laboratory personnel used such personal protective devices (PPE)(Afridi, Kumar, & Sayani, 2013; Alfulayw et al., 2021).The reasons for did not wear PPE couldbe attributed to the unavailability of the safety devices, overcrowding in health institution, and overlook to wear the protective devices(Alwabr, 2018).

It was estimated that healthcare workers who don't use PPE during their work are at higher risk ofacquiring needlestick injury and subsequent infection with blood-borne pathogens in comparison with those who use personal protective equipment)Beyene & Yirsaw, 2014; Kebede & Gerensea, 2018; Velvzhi,Senthil, Sucilathangam, & Revathy, 2016). Thus, laboratory personnel should adhere to standard precautions such as wearing gloves and other protective equipment(Alfulayw, Al-Otaibi, & Alqahtani, 2021). Similar to other studies, other protective equipments such as safety cabinets, goggles, and eye washers were less available(Al-Abhar, Moghram, Al-Gunaid, Al Serouri, & Khader, 2020; Al Eryani et al., 2019).Therefore, laboratories should be provided with protective equipment in sufficient quantities in order to reduce the incidence of NSIs(Alfulayw, Al-Otaibi, & Alqahtani, 2021; Arafa, Mohamed, & Anwar,2016).

All susceptible, at-risk groups are currently advised to receive the commercially available HBsAg vaccine (HBV vaccine) for pre-exposure prophylaxis against HBV, while HBIG (specific hepatitis B immune globulin) is advised for post-exposure prophylaxis (Zhao, Zhou, & Zhou, 2020).The HBV vaccine offers protection against hepatitis B for at least 20 years and is up to 95% effective if all doses in the immunization series are obtained (3 or 4 shots given at various times) .Persons exposed to HBV percutaneously or by contamination of mucosal surfaces should immediately receive both HBV vaccine and HBIG administered simultaneously at different

sites to provide passively acquired immunity and active acquired immunity(Arafa, Mohamed, & Anwar, 2016; Overturf, 2000). However, in developing countries, although HBV is endemic most HCWs are not vaccinated(Tatsilong et al., 2016).

In this study, only 32.3% (31/96) of the participants had beenvaccinated against HBV at the time of the study, while 67.7%(65/96) had never been vaccinated. Similar results were found in earlier studies of healthcare workers by Mursy et al. in Sudan (Mursy & Mohamed, 2019) and Al Eryani et al. from Yemen (Al Eryani et al., 2019). These findings contrast with those of studies conducted in Ethiopia by Kebedeet al. (Kebede & Gerensea, 2018) and in Yemen by Al-Abhar et al. (Al-Abhar, Moghram, Al-Gunaid, Al Serouri, & Khader, 2020) and in Yemen by Al-Abhar et al. (Al-Abhar, Kebede et al., 2019), which reported higher vaccination rates of 76.5% and 74,4%, respectively**.**

However, this lower HBV vaccination rate reported in this study could be explained by the lack of awareness about occupational safety measures such as vaccination against HBV and post-exposure prophylaxis(Badawi, Atif, & Mustafa, 2018; Chalya et al., 2015). In addition, this could be due to that HBV vaccination is not routinely provided to HCWs in Yemen.Therefore, HBV vaccination should be achieved for laboratory personnel working at health laboratory in Makkah. However, this study showed significant HBV vaccination rate among those who had received a bachelor's degree (P<0.000018), and those who received biosafety training(P<.0.00001). Similar result was reported by Al-Abhar et al in Yemen(Al-Abhar et al., 2020).This could reflect that knowledge and training courses on biosafety are helpful in increasing awareness as wellas improving attitudes towards vaccination(Barbieri, Feitosa, Ramos, & Teixeira, 2019).

Conclusions and Recommendations

The prevalence of NSIs was found to be comparatively greater among laboratory professionals in this investigation. Laboratory workers who have experienced needlestick injuries have a high likelihood of underreporting needlestick injuries (NSIs). Additionally, there is a poor vaccination coverage rate and a low percentage of biosafety training courses being offered in laboratories. As a result, safety engineering controls should be taken into consideration while teaching laboratory staff how to handle and dispose of needles and other sharp objects. In order to treat and consult on NSIs, laboratory staff should be encouraged to report them. Additionally, adequate protective equipment should be provided to the lab to lower the incidence of NSIs. Finally, laboratory staff at the Makkah health laboratory should be vaccinated against HBV.

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