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RESEARCH ARTICLE

Adherence to Personal Protective Equipment Against Infectious Diseases Among Healthcare Workers in Arak-Iran

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Abstract:

Background:

Occupational exposure to blood and body secretions poses a significant risk of COVID-19, HIV, HCV, and HBV among healthcare workers (HCWs). Assessment of this exposure is necessary for optimized planning and policy-making measures. This study aimed to assess the exposure to occupational risk factors among emergency HCWs.

Methods:

This cross-sectional study was performed on HCWs working in 3 educational hospitals affiliated with Arak University of Medical Sciences. The study sample included all HCWs working in emergency wards who met inclusion criteria. The data were collected using a valid and reliable researcher-made questionnaire and analyzed through analytical tests in SPSS software.

Results:

The 116 studied HCWs included 97 nurses and 19 physicians and medical specialties. The mean age was 31.06 with 4.7 years of work experience (207.8 hours per month) in working at the patient bedside. The results indicated that needlestick injuries have a significant positive and negative relationship with job history (p=0.001) and month-averaged working hours (p=0.012), respectively. 96.6% stated that wearing gloves is not necessary, 59.9% stated that they do not use protective glasses due to a decrease in their vision, while 50% did not use gowns due to the lack of gowns in the ward. 63.8%, 57.8%, 50%, 63.8%, 56% and 54.3% of the participants expressed shift work, a high number of hospitalized patients in the crowded ward, the need for high-speed working, high working load, an increase in working hours, and low working consent as the most important factors leading to an increment in blood transmitted diseases, respectively.

Conclusion:

It is necessary to design national surveillance systems to report exposed cases and develop measures and strategic plans considering the high effects of exposure to blood and body secretions.

Keywords: Occupational exposure, Blood transmitted diseases, Emergency ward, Physicians, Healthcare workers, Nurses.

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1. INTRODUCTION

Healthcare workers (HCWs) include nurses, physicians, laboratory technicians and other supporting forces who directly or indirectly provide healthcare services for the patients. All these workers are exposed to different levels of hazard during patients' surveillance. These hazards include exposure to disease-causing organisms, such as Coronavirus 2019 (COVID-19), human immunodeficiency virus (HIV), hepatitis C virus (HCV), and hepatitis B virus (HBV) [1 - 3]. However, there are other blood-borne pathogens, such as the Ebola outbreak in 2013-2016 which infected 890 healthcare workers with a 57% death rate [4].

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Occupational exposure to pathogenic factors may occur in different ways, including percutaneous injury (such as penetration of a sharp object or needle into the skin) and mucous membrane exposure (such as eye, nose, and mouth). As an example, 66-95% of hospital exposure to blood transmitted diseases occurs through the skin, highlighting the importance of protection against percutaneous injury [5].

The information on the status of exposure to blood-borne pathogens is outdated globally. A study by the world health organization WHO estimated that 2 million, 0.9 million and 170 000 cases of exposure to HBV, HCV and HIV occurper year, respectively, resulting in a high number of infections in addition to the stress, depression, and management costs [6, 7].

The prevalence of exposure to blood and body secretions has been studied in many countries. For instance, in the United Kingdom and the United States, the annual rate of exposure was reported as 100,000 and 600,000, respectively [8, 9]. Results of a study on the epidemiology of needlestick injuries (NSIs) among HCWs in two German hospitals indicated that 500,000 injuries occur annually in Germany [10]. In the context of COVID-19, although effective vaccines have been developed and countries around the world have started the vaccination, the necessity of adhering to personal protective equipment use has not decreased [3].

Emergency ward is one of the hospital departments with the highest risk of exposure to blood and body secretions and also a high probability of injury by sharp objects [11]. The necessity of working at high speed under high working pressure, fatigue and tension among the workers and dealing with blood and other body secretions have increased the risk of occupational load among the employees of the emergency ward [12].

Healthcare policymakers and planners need up-to-date information regarding the exposure status to design intervention measures. The authors of the current study did not find any research in the literature review that assessed the HCWs' exposure to blood transmitted diseases at the Arak University of Medical Sciences. However, the results of 3 studies on educational hospitals located in Tehran indicated that more than half of the employees have been in contact with blood and body fluids during their work-life period [13].

An important issue that makes this study even more important is that the exposure to blood, body and respiratory secretions is different in different regions due to different social, cultural and economic statuses. In other words, the design of unique national plans by the ministry of health may lead to different results. Therefore, the plans should be designed in a region-specific manner.

Another issue that shows the importance of this study more than before is that these viral infections are preventable, and the transmission risk of these infections among HCWs may decrease upon adherence to personal protective equipment. Moreover, hospitals are different in terms of being educational or not, patient referral rate, type of diseases, and the number of employees. In this regard, the present study was performed to evaluate the adherence to personal protective equipment for the prevention of COVID-19 and other diseases among the healthcare workers.

2. MATERIALS AND METHODS

2.1. Study Population and Sampling

This cross-sectional study was carried out on HCWs of emergency wards of 3 educational hospitals (Valiasr, Amirkabir, and Amiralmomenin) affiliated with Arak University of Medical Sciences. The sample size included all physicians and emergency medicine residents as well as all nurses working in the emergency wards with different university grades (*e.g.*, diploma, bachelor, master of sciences, medical doctor). Accordingly, the study population included 128 subjects, of which 116 participated in the study.

2.2. Inclusion Criteria

Inclusion criteria included employment in the emergency ward, no history of drug, cigarettes, and alcohol addiction, lack of mental disorders, having at least one year of work experience in the emergency ward, while the excluding criteria included personal inclination to quit the study.

2.3. Data Collection Tool

The data collecting tool was a questionnaire that encompassed two sections. The first part addressed demographic data such as age, gender, work history, type of job, and educational degree, whereas the second part was related to occupational exposure history, including the type of exposure, the tool involved in the exposure, frequency of exposure, the cause of exposure, and the performance of HCWs after the exposure.

2.4. Ethical Considerations

This study was performed after being approved by the research deputy of Arak University of Medical Sciences and also the studied hospitals. All the participants completed a consent form. All the data have been collected anonymously and kept confidential.

2.5. Analysis

The data were analyzed by descriptive and analytical tests, such as Pearson correlational test, and implemented in SPSS software.

3. RESULTS

The mean age of the participants was 31.06. Most of them were female (65.5%), nurse (83%), married (44.8%), and with a bachelor degree (73%). Their average work experience was 4.7 years with monthly mean work hours of 207 h. More than 50% of the participants worked in rotational shifts. About half of the participants stated no history of needlestick injuries (48.3%). Also, 38.3% of the participants reported one and two cases of needlestick injuries. The results indicated that 44.8% of the participants worked in two places (*i.e.*, they were working in a private hospital in addition to public hospitals). 70.7% of the participants were educated on the principles of preventing blood, body and respiratory diseases in the last 6 months. Moreover, 96% of them have been vaccinated against Hepatitis B, and 87% of them have had antibody testing after vaccination. 44% of the participants have been exposed to

blood and body secretions, 76%, 13%, and 11% of which occurred through the skin, mucous membrane, and unhealthy skin, respectively. Needle contact was the cause of 91% of occupational exposures, which could result in irrecoverable injuries (Table **1**).

Pearson correlation test between demographic variables and occupational exposure indicated only the work history (P=0.001) and work hours (P=0.012) to be significantly correlated with occupational exposure as its relationships with other demographic variables were not found to be significant (P>0.05) (Table **2**).

Although, most of the participants (96.6%) stated that it is not necessary to wear gloves during patient care, the lack of gloves was found to be the main cause of exposure. Moreover, 79.3% of the participants stated that they forget to wear gloves, while 83.6% of them expressed that they do not come in contact with the secretions due to their high skills in patient care. Based on the opinion of 85.3% of the participants, the number of infectious patients is low in the ward giving rise to a low risk of contamination. 76.7% stated that the use of gloves is not practiced as a rule in the ward. Concerning the use of the mask in the ward, none of the reasons was found to be statistically significant (Table **3**).

Table 1. Sociodemographic characteristics of participants.

Variables	Number (Percent)		Variables	Number (Percent)	
Age	Highest	55	Shift work	Fixed	19 (16.4)
	Lowest	21		Rotated	97 (83.6)
	Mean	31.06 (6.8)	Work history	Highest	13
Gender	Male	40 (34.5)		Lowest	1
				Mean	4.7 (SD=3.05)
	Female	76 (65.5)	Monthly work hours	Highest	290
Marital Status	Single	44 (37.9)		Lowest	100
	Married	52 (44.8)		Mean	207.8 (40.2)
	Spouse Died	9 (7.8)	Frequency of exposure with needle stick	No contact	56 (48.3)
	Divorced	11 (9.5)		1 time	45 (38.8)
Education Level	B.S.	85 (73.3)		2-3 times	9 (8.7)
	M.S.	12 (10.3)		More than 3	6 (5.2)
	M.D or Ph.D.	19 (16.6)			
Major	Nurse	97 (83.6)			
	Physician	19 (16.40)			

Table 2. Correlation between job exposure with blood, body and respiratory secretions and work history and monthly work hours.

Variables		Pearson correlation test	
		P	R
Job exposure	Work history	0.001	0.036
	Work hours	0.012	0.025

Table 3. Distribution of research units in relation to using gloves and masks during patient care.

Variables	Questions	Agreement		Disagreement	
		Frequency	Percent	Frequency	Percent
Use gloves during patient care	Wearing gloves is not necessary	4	3.4	112	96.6
	Blood sampling with gloves is difficult	59	50.9	57	49.1
	I'm sensitive to gloves	61	52.6	55	47.4
	I forget to wear gloves	24	20.7	92	79.3
	Due to my great skill, I do not come into contact with blood and secretions	19	16.4	97	83.6
	The number of infectious patients admitted to the ward is low and the possibility of infection is low	17	14.7	99	85.3
	There are no gloves to use in the ward	76	65.5	40	34.5
	Gloves the size of my hands are not available in the section	40	34.5	76	65.5
	This method is not implemented as a rule in the ward	27	23.3	89	76.7
	Due to workload, I do not have enough time to wear gloves	43	37.1	73	62.9

(Table 3) contd.....

Variables	Questions	Agreement		Disagreement	
		Frequency	Percent	Frequency	Percent
Use a mask while caring for a patient	It is not necessary to wear a mask	3.4	4	96.6	112
	I forget to wear a mask	46.6	54	53.4	62
	It is difficult to breathe while wearing a mask	28.4	33	71.6	83
	Due to my high skill, I do not come into contact with blood and secretions	14.7	17	85.3	99
	The number of infectious patients admitted to the ward is low and the possibility of infection is low	24.1	28	75.9	88
	Wearing a mask does not make me look good	17	14.7	85.3	99
	I feel uncomfortable after moisturizing the mask	28.4	33	71.6	83
	The pressure caused by the mask creates an unpleasant feeling	14.7	17	85.3	99
	Masks tear quickly	18.1	21	81.9	95
	There is no mask to use in the ward	11.2	13	88.8	103
	This method is not implemented as a rule in the ward	25	29	75	87
	Communication with the patient becomes difficult	10.3	12	89.7	104
	Due to workload, I do not have enough time to wear a mask	36	31	69	80

Table 4. Distribution of research units in relation to using protecting glasses and gown during patient care and using needle cap after injection.

Variables	Barriers	Agreement		Disagreement	
		Frequency	Percent	Frequency	Percent
Wear protecting glasses while caring for the patient	It is not necessary to wear glasses	29	25	87	75
	Wearing glasses makes it difficult to see	59	50.9	57	49.1
	Due to my great skill, I do not come into contact with blood and secretions	25	23.3	89	76.7
	The number of infectious patients admitted to the ward is low and the possibility of infection is low	39	33.9	77	66.4
	My own glasses do the same thing	41	35.3	75	64.7
	Wearing glasses does not make me look good	26	22.4	90	77.6
	I forget to use glasses	50	43.1	66	56.9
	There are no glasses for use in the ward	66	56.9	50	43.1
	There is a common glass for all health workers	74	63.8	42	36.2
	This method is not implemented as a rule in the ward	41	35.3	75	64.7
Using gown while patient care	It is not necessary to wear a gown	26	22.4	90	77.6
	It is difficult to perform these actions while wearing a gown	24	20.7	92	79.3
	I forget to wear a gown	24	20.7	92	79.3
	Due to my high skill, I do not come into contact with blood and secretions	13	11.2	103	88.8
	The number of infected patients admitted to the ward is low and the possibility of infection is low	25	21.6	91	78.4
	By wearing a gown, my appearance is not favorable	11	9.5	105	90.5
	Gown is not available for use in the ward	76	65.5	40	34.5
	Gown available in the ward cannot be used due to its size or uncertainty about its cleanliness	30	25.9	86	74.1
	This method is not implemented as a rule in the ward	31	26.7	85	73.3
	Due to workload, I do not have enough time to wear a gown	53	45.7	63	54.3
Placing the cap after using needle	Placing needle cap is a safety measure for reducing risks	21	18.1	95	81.9
	I forget to put the needle cap	2	1.7	114	98.3
	Needle container is not available	0	0	116	100
	This method is not implemented as a rule in the ward	0	0	116	100

Table 5. Distribution of the study units in terms of the principles of blood, body and respiratory secretions.

Disagreement		Agreement		Barriers
Percent	**Frequency**	**Percent**	**Frequency**	
36.2	**42**	**63.8**	**74**	**Shift work**
52.2	49	57.8	67	High number of hospitalized patients and crowded ward
50	58	50	58	Need to quickly perform the tasks of the ward
36.2	42	63.8	74	High workload in the ward
44	50	56	65	Increase working hours
89.7	104	10.3	12	Inadequate physical structure of the ward
93.1	108	6.9	8	Low work history
45.7	53	54.3	63	Low work consent

More than 50% of the participants (59.9%) agreed on experiencing visual discomfort due to the use of the glasses. The lack of glasses in the ward (56.9%) and its deficiency (63.8%) were other reasons declared by the HCWs to explain why they do not wear glasses. Although 77.6% of the participants knew that it is necessary to wear gowns, they reported wearing them hardly as they were satisfied with the simple medical clothes. However, 65% of the participants complained regarding the lack of gowns in the ward and 45% of them avoided wearing gowns due to the high workload. Other reasons, such as no need to wear gown, difficulty in doing the tasks while wearing gown, forgetting to wear gown, having high skills and high volumes of works, were also mentioned as a justification for not using gowns (Table **3**).

The participants stated that shift work (63.8%), a high number of hospitalized patients and crowding in the ward (57.8%), need for high speed in doing the ward tasks (50%), heavy workload (63.8%), increase in the work hours (56%), and low work consent (54.3) are barriers to effective prevention of blood, body and respiratory transmitted diseases (Tables **4** and **5**).

4. DISCUSSION

In addition to occupational and psychological issues in the workplace, such as work pressure, low motivation, and high volume of work, this study assessed the status of adherence to physical measures, such as using gloves, face masks, protective glasses, and gowns that may help in decreasing exposure to blood, body and respiratory secretions. Studies and global guidelines indicate that the main elements of standard protection against blood- and respiratory-borne pathogens in the health care setting are washing hands after contact with patients, using obstructive protective devices, such as gloves, gowns, and facial protection, and minimal contact with sharp objects and their proper disposal after use [14]. These measures are effective against blood and respiratory diseases when all HCWs adhere to the standards. For this purpose, it is necessary to develop a system in hospitals to report job exposures quickly and provide counseling and treatment services as well as a correct evaluation of the status. This healthcare data should be collected at the hospital level individually. Moreover, studies on contact, incidence, prevalence and risk assessment should be performed. All of these measures are effective for the constant commitment of the management and leadership of the hospital. As the consumption of medical equipment has increased during the COVID-19 outbreak, HCWs who are assigned to taking care of COVID-19 patients should prioritize taking these measures. Another major point is that HCWs may forget or underestimate the necessity of washing hands in spite of using gloves.

Ippolito *et al*. indicated that due to the high working load and long shifts without breaks, adherence to safety procedures is very difficult [15]. The situation gets worse when, in addition to these conditions, access to personal protective equipment is limited among HCWs. So it has been indicated that, due to low access to these equipments, the incidence of COVID-19 cases has increased severely in various countries [16]. However, the results of this study indicate that HCWs with longer experience in clinical services have a lower risk of needlestick injuries. On the other hand, those with a high work pressure may have a higher risk of needlestick injuries. However, another study in Iran has stated no relationship between demographic variables (*i.e*., age, gender, marital status, work experience, history of training received on needlestick injuries, vaccination status, years of professional life, education level, and the employment status) and needlestick injuries [17]. The study by Ghanei-Gheshlagh *et al*. indicated that HCWs with a history of needlestick injury were younger with lower work history. They also stated that the possibility of needlestick injuries is higher in the morning shifts, which can be attributed to the high workload of nurses, low human resources, and fatigue. These results are in line with the current study [18].

A study by Abareshi *et al*. indicated that needlestick injuries increase among nurses due to the high workload and carelessness, thus necessitating the development of a regular schedule to lower the work pressure. The authors also indicated that occupational exposure has a significant relationship with work history, education, and university grade, which is in line with the current study [19].

Mbaisi *et al*. conducted a study on HCWs of a provincial hospital in Kenya and indicated that 25% of HCWs had contact with blood and body secretions during the last 12 months; 19% of these cases were through skin injuries, and 7.2% came into contact with blood and other body fluids. In this study, the most number of injuries were found to occur among nurses (more than 50%), in which more amateur nurses were at higher risk [20]. These results are in agreement with the current study.

A study by Taghavi *et al*. reported that the majority of

needlestick injuries and occupational exposures occur in the morning shift among the young (20-30 years old) HCWs with 10-15 years of work experience. In other words, there is a significant positive relationship between demographic variables and the incidence rate of occupational exposures [21], which is in line with the current study. To decrease needlestick injuries, and also exposure to blood, body and respiratory secretions, it is necessary to use high-safety tools, reduce HCWs' work hours and hire new human resources. To ensure HCWs' health and well-being, necessary tests such as HBV, HCV, and HIV, as well as other required liver tests, should be performed at regular intervals.

The results indicate that the HCWs are not inclined to use protective glasses, and it has not been practiced as a rule in emergency wards. Overall, many problems have been reported with using personal protective equipment. A study by Neuwirth *et al*. indicated that employees with different socio-economic backgrounds have different adherence to personal protective measures [3]. Thus, educational programs for the HCWs to teach them the correct use of devices in order to prevent the transmission of diseases are necessary. The prerequisite to promoting the culture of protective behaviors is to increase knowledge, attitude and practice towards COVID-19 and other respiratory transmitted diseases [22, 23]. Another step is decreasing inappropriate admission and hospitalization in hospitals to moderate workload and pressure on HCWs [24]. Hospital managers can perform an important role in increasing hospital performance through efficient, effective and productive use of human, consumable and capital resources, promoting resource mobilization and optimal resource allocation [25].

5. LIMITATIONS

As data have been collected through questioning and not obtained from computerized systems, there may be some sort of error and bias. However, the HCWs who participated were asked to answer honestly as the results could improve their work status. Moreover, the questionnaires have been kept anonymous and completed freely. Finally, the absolute participation of the 3 educational hospitals may cause selection bias. All this makes the generalizability of data to private and non-governmental hospitals difficult. These types of hospitals need separate studies.

CONCLUSION

Lack of motivation among HCWs, especially nurses, has worsened the adherence to protective measures. Leading systems should design and administer plans to decrease occupational exposures. On the other hand, hospital management should strive to provide high-safety equipment. Educational programs on infection control and prevention of occupational exposures are among other necessary measures. HCWs should be given the opportunity to check their antibody titers for HBV, HCV, HIV, and perform other necessary tests. Regarding the negative effects of exposure to blood, body, and respiratory secretions, it is necessary to design systems at the hospital and national levels for the surveillance of suspected contacts, their reporting, and the required supervision for health policy-making.

AUTHORS' CONTRIBUTIONS

Conceptualization was done by M.H. and K.Gh. Data curation was carried out by A.J., M.H, A.K.H., F.D. and N.B. Formal analysis was conducted by K.Gh., F.D. and N.B. Investigation was done by K.Gh., F.D. and N.B. Methodology was selected by S.A., M.H. and K.Gh. Project administration was done by A.J., M.H, A.K.H., F.D. and N.B., and supervision has been carried out by S.A., M.H. and K.Gh. M.H. and S.A. wrote the original draft, and S.A., M.H. and K.Gh reviewed and edited the manuscript. All authors read and agreed to the published version of the manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study was approved by the ethical committee of Arak University of Medical Sciences with the ethical code number IR.ARAKMU.REC.1398.002.

HUMAN AND ANIMAL RIGHTS

No animals were used for studies that are the basis of this research. All the human procedures used were in accordance with. the ethical standards of the committee responsible for human experimentation (institutional and national), and with the Helsinki Declaration of 1975, as revised in 2013.

CONSENT FOR PUBLICATION

All the participants completed a consent form.

STANDARDS OF REPORTING

STROBE guidelines and methodologies were followed in this study.

AVAILABILITY OF DATA AND MATERIALS

The data supporting the findings of the article are available from the corresponding author [S.A] upon reasonable request.

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CONFLICT OF INTEREST

Dr. Saeed Amini is the Editorial Board Member of The Open Public Health Journal.

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