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Psychosocial Factors at Work and Blood-Borne Exposure among Nurses

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Abstract

Background: Exposure to human blood and body fluids is a common risk for nurses. Many factors can affect the prevalence and incidence of this occupational hazard. Psychosocial factors at work may be a risk factor for the exposure.

Objective: To assess needle stick, sharp injury and mucus exposure to blood-borne pathogens among nurses in Iran and to determine the association between these exposures and psychosocial factors at work.

Methods: A cross-sectional study was conducted on nurses in a public hospital, Tehran, Iran. 364 nurses received and 339 completed and returned a self-reported questionnaire containing demographic data, history of exposure to blood-borne pathogens at work during previous year and the General Nordic questionnaire for psychological and social factors at work (QPS Nordic 34+ Questionnaire).

Results: Of 339 participants, 197 (58.1%) reported needle-stick injury, 186 (54.6%) reported another type of sharp injury, and 112 (33%) reported a mucous membrane exposure during the previous year. More than half of the participants who had history of exposure, had not reported it. Those with middle or high level of stress had higher crude and adjusted odds than those with lower stress for all kinds of exposure. Adjusted odds ratios for high stress group (ranging from 2.8 to 4.4) were statistically different from 1.

Conclusion: There is a high prevalence of needle-stick and sharp injury and mucous membrane exposure to patients' blood or body fluids among studied nurses. There is a significant association between increasing psychosocial factors at work and exposure to blood-borne pathogens among this group of nurses.

Keywords: Occupational exposure; Blood-borne pathogens; Psychosocial factors; Nurses; Iran

Introduction

Nurses represent a large work force faced with many occupational health hazards including chemical exposures, ergonomic risks, stress, and exposure to blood and body fluids. Exposure to human blood and body fluids poses a risk of blood-borne infections like hepatis

B, hepatitis C and human immunodeficiency virus (HIV).¹

The incidence of exposures to blood-borne pathogens among nurses has been studied in developed countries.^{2,3} Clarke, *et al*, reported needle and other sharp device injuries among nurses in the USA, Canada, the UK and Germany.⁴ Smith reported that 46% of nurses in a Japanese teaching

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hospital had needle-stick or sharp injuries during one year.⁵ Even in these countries, sharp injuries and mucous membrane exposure to blood-borne pathogens remain underreported.^{6,7}

Some studies have evaluated the prevalence or incidence of needle-stick and sharp injuries or mucous membrane exposure to blood or body fluids among health care workers (HCWs) including nurses in developing countries.⁸⁻¹² In a study by Ilhan, *et al*, 79.7% of Turkish nurses reported a needle-stick injury at some point during their work.¹³ Ayranci, *et al*, conducted a research among nurses in Turkey and showed that more than two-thirds (69.1%) of nurses did not report their exposures.¹⁴ Although exposure to blood-borne pathogens among HCWs is an important issue, risk factors for these exposures among nurses have not been fully defined. Some studies have suggested a role for organizational factors,^{2,15} staff education and training,^{14,16,17} and long working hours^{13,17}. In recent years, more attention has been paid to the association between psychosocial factors at work and exposure to blood-borne pathogens among HCWs.^{18,19} However, almost all of these studies have been conducted in developed countries and we know a little about the effect of psychosocial factors at work on exposure to blood-borne pathogens among nurses in developing countries.

In this cross-sectional study, we thus, evaluated the prevalence of needle-stick, sharp injury and mucous membrane exposure to blood or body fluids among Iranian nurses in a teaching hospital and the association between psychosocial factors at work and exposure to blood-borne pathogens in this group of HCWs.

Materials and Methods

The study was conducted in Emam Hospital, the largest general hospital in Tehran,

Iran, with more than 1300 active beds and 600 nurses. Using a simple random sampling method, from the list of all nurses, we selected 364 nurses and asked them to answer a few questions. All participants were asked to fill an informed consent form. We met the participants during their work and asked them to return their answers by the end of the shift. A trained researcher was present to answer any questions related to this study. Those who did not respond were called again during their next two shifts. The research protocol was approved by the Ethics Committee of Tehran University of Medical Sciences.

Our instrument had three parts: The first part contained demographic data such as age, gender, education, marriage status, type of employment (temporary or permanent), secondary job, shift work (fixed or rotating), and the ward where they were working in (medical or surgical). The second part addressed the history of exposure of the nurses to blood-borne pathogens at work, including needle-stick injury, other kinds of sharp injury, or mucous membrane contact with patients' blood or body fluids during the previous year. Participants were asked about their attendance during their employment in training courses related to exposure to blood-borne pathogens, and about their knowledge about what to do in a case of an exposure to patients' blood or body fluids. The third part was related to psychosocial factors at work as an overall measure of stress at work. We selected the General Nordic Questionnaire for Psychological and Social factors at work (QPS Nordic 34+)²⁰ as the means for the measurement of stress at work and translated it to Persian language to avoid any misunderstanding due to language differences.

The QPS Nordic is a broad instrument that covers essential social and psychological factors at workplace. The questionnaire has built on different conceptual models of

TAKE-HOME MESSAGE

- Nurses represent a large work force facing with many occupational health hazards.
- Exposure to human blood and body fluids is a major occupational risk factor for nurses and increases risk of blood-borne infections.
- Although exposure to blood-borne pathogens among health care workers is an important issue, risk factors for these exposures among nurses have not been fully defined.
- Two-thirds of nurses had exposure to blood-borne pathogens at work during last year.
- More than half of those participants who had history of exposure to blood-borne pathogens at work, had not reported it.
- We found a significant association between increasing psychosocial factors at work and the likelihood of exposure to blood-borne pathogens among this group of nurses.

organizational behavior, job satisfaction, and theories of job stress. The accuracy of the translated version of the questionnaire was checked by back translation of the questionnaire. Then, we asked a group

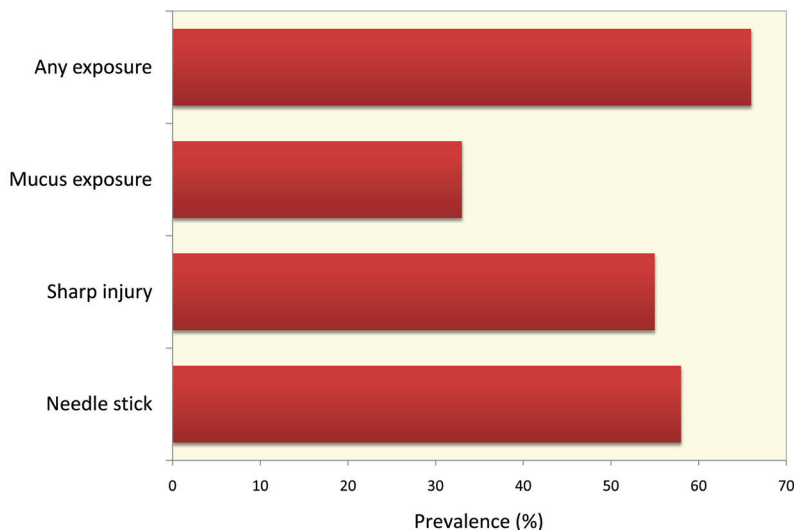


Figure 1: One-year prevalence of exposure to blood-borne pathogens among the studied nurses (n=339).

of nurses in another hospital to fill up the questionnaire and let us know any misunderstanding on questions. Cronbach's alpha and half split reliability were 0.87, and 0.86, respectively. Finally, we asked an expert panel to assess face validity of translated questionnaire. The expert panel contained five experts; one psychologist, one psychiatrist, one occupational medicine specialist, one stress management expert, and one hospital manager. They made the final changes to improve the face validity of the questionnaire.

We divided our participant into two groups—those with and those without exposure. We compared individual and work-related variables between the two groups by univariate analyses. We set four outcomes: 1) history of needle-stick injury, 2) history of exposure to other sharp objects, 3) history of mucous membrane exposure to blood or body fluids, and 4) history of at least one of the three types of exposures. Then we divided our participants based on their answers to the QPS Nordic 34+ questionnaire into three groups—those with “low,” “middle,” and “high” stress. A score <2.5 was considered “low stress,” 2.5–3.5 as “middle stress,” and >3.5 was considered “high stress.”²⁰

Using logistic regressions analysis, we found the ORs and their 95% CI for different levels of stress. Considering the low stress group as the reference group, ORs were calculated for the middle and high stress groups. To control for probable confounders, we adjusted ORs for individual and work-related factors including age, gender, marriage status, education, type of employment, shift work, secondary job, ward, and duration of work as a nurse. A p value <0.05 was considered statistically significant.

Results

Of 364 nurses 339 returned the question-

naire (response rate of 93%). More than half of the participants reported needle-stick injury; more than half reported another type of sharp injury during the previous year. One-third of nurses reported a mucous membrane exposure; two-thirds reported any kind of exposure to blood-borne pathogens during the previous year (Fig 1). Almost half (n=176, 52%) of nurses who had exposure to blood-borne pathogens had not reported the accident. Two-hundred and eighty-six (84%) nurses reported that they knew how to prevent the exposure to blood-borne pathogens at work. However, only 95 (28%) nurses reported receiving training at the job and after graduation.

Univariate analyses revealed that there were no statistically significant difference between groups with and without exposure in terms of age, gender, education and marital status (Table 1). Work-related variables such as work at a second job and work on surgical services were not significantly different between these two groups. Univariate analyses did show statistically significant associations between the type of employment, duration of work as a nurse, shift work, and level of stress with the likelihood of exposure to blood-borne pathogens (Table 1). We could not find any statistically significant association between history of training on prevention and the likelihood of exposure to blood-borne pathogens (Table 1).

Using logistic regression analysis, after adjustment for age, gender, marriage, education, type of employment, shift work, secondary job, ward, and duration of work as a nurse, we found an association between psychosocial factors and stress at work with having needle-stick injury, sharp injury, mucus exposure and any kind of exposure to blood-borne pathogens. Considering the low stress group as the reference group, we found an increasing trend in ORs for the middle and high

Table 1: Univariate analysis of demographic and work-related factors. Values are mean±SD or n (%).

	Total (n=339)	With exposure (n=225)	Without exposure (n=114)	p value
Age year	33.6±7.5	33.1±7.2	34.6±8.1	0.08
Duration of Employment	10.1±7.5	9.3±7.0	11.4±8.2	0.02
Gender				
Female	291 (86.1)	191 (88.5)	100 (84.9)	0.37
Male	47 (13.9)	34 (11.5)	13 (15.1)	
Education				
BSc	322 (95.5)	215 (95.6)	107 (95.5)	0.99
MSc	15 (4.5)	10 (4.4)	5 (4.5)	
Marriage				
Married	205 (61.6)	136 (61.3)	69 (62.2)	0.87
Single	128 (38.4)	86 (38.7)	42 (37.8)	
Employment				
Permanent	181 (53.7)	111 (49.8)	70 (61.4)	0.04
Temporary	156 (46.3)	112 (50.2)	44 (38.6)	
Secondary job?				
Yes	47 (13.9)	36 (16)	11 (9.7)	0.12
No	291 (86.1)	189 (84)	102 (90.3)	
Ward				
Surgical	152 (44.8)	96 (42.7)	56 (49.1)	0.26
Medical	187 (55.2)	129 (57.3)	58 (50.9)	
Shift work				
Rotate	203 (59.9)	149 (66.2)	54 (47.4)	<0.001
Fixed	136 (40.1)	76 (33.8)	60 (52.6)	
Training course?				
Yes	74 (27.9)	47 (26.0)	27 (32.1)	0.30
No	191 (72.1)	134 (74.0)	57 (67.9)	
Stress				
Mild	67 (19.8)	37 (16.4)	30 (26.3)	
Moderate	226 (66.7)	149 (66.2)	77 (67.5)	0.01
Severe	46 (13.6)	39 (17.3)	7 (6.1)	

Table 2: Crude and adjusted ORs (95% CI) for middle- and high-stress groups with reference to the low-stress group (n=67)

	Middle stress (n=226)	High stress (n=46)
Needle stick		
Crude	1.30 (0.74–2.28)	3.18 (1.38–7.34)
Adjusted*	1.33 (0.73–2.45)	2.82 (1.17–6.80)
Sharp injury		
Crude	1.49 (0.78–2.84)	5.71 (2.11–15.51)
Adjusted	1.38 (0.68–2.79)	4.37 (1.51–12.62)
Mucous exposure		
Crude	1.73 (0.89–3.35)	2.86 (1.23–6.62)
Adjusted	2.02 (0.97–4.18)	3.15 (1.25–7.92)
Any exposure		
Crude	1.57 (0.90–2.73)	4.52 (1.77–11.5)
Adjusted	1.58 (0.87–2.89)	3.86 (1.46–10.24)

*Adjusted for age, gender, marriage, education, type of employment, shift work, secondary job, ward, and duration of work as a nurse

stress groups for all the four outcomes. All ORs for middle stress group were higher than those for mild stress group; none of them were nonetheless, statistically significant. ORs for the high stress group were significantly higher than those for the middle stress group (Table 2).

Discussion

Of 339 nurses studied, 197 (58%) reported needle-stick injury; 187 (55%) reported sharp device injury in the previous year. Askarian, *et al*, reported a rate of 49.6% (95% CI: 47%–52%) in one year of sharp injuries among nurses in Fars province, Iran,²¹ which is similar to our results. Similarly, Smith reported that rate of 46% in one year for needle-stick and sharp injuries in nurses working at a Japanese teaching hospital.⁵ Clarke, *et al*, reported needle

and other sharp device injuries among nurses in four developed countries. The rates of injury per 1000 full-time nurses per year were 118 in the USA, 177 in Canada, 119 in the UK, and 322 in Germany.⁴ All of the nurses who participated in our study were full-time, so the incidence of needle-stick injury in our study would be around 580 per 1000 full-time nurses per year. This rate is five times the US and UK rates, three times the Canada's rate, and 1.8 times the exposure rate in Germany. Our study revealed that exposure to blood-borne pathogens among nurses in Iran is more common than some developed countries. A reason for the high prevalence of needle-stick injury among nurses is usage of traditional needles and recapping. New safety technologies such as needless systems or retractable syringes are not usually available in the studied hospital and most of other general hospitals in Iran. Needle and sharps containers (safety boxes) are available in many hospital wards in Iran; however, regular use of these containers may differ from one hospital to another.

There are some regulations related to prevention and reporting of needle-stick injuries or exposure to blood-borne pathogens at hospital setting. Based on these regulations nurses should report any exposure or needle-stick injury to Hospital Infectious Committee where one can find a written exposure control plan. Report of exposure will enter exposed personnel in a supportive system which follows the problem and help them to manage the consequences. Weakness of enforcement and knowledge about the issue are two major reasons for weak performance of these regulations.

At the first glance, based on our results, it seems that the prevalence of exposure to blood-borne pathogens among the studied nurses is high, however, this situation can get worse considering under-reporting of the exposure—a very common problem

around the world.

Nagao, *et al*, conducted a research to assess accidental exposure to blood and body fluids in operation room. They revealed that only 22% of exposed staff reported every incident.²² Raghavendran, *et al*, assessed exposure to blood-borne pathogens among nurses and physicians in two UK district general hospitals.²³ They found that only 66% of participants who had history of exposure, had reported it so under-reporting of exposure to blood-borne pathogens is not merely a problem in developing countries.

In our study, although there were occupational health facilities in our hospital to deal with any occupational exposure to blood-borne pathogens, more than half (52%) of the nurses who had exposure at work did not report it to the occupational health facility.

Different studies have tried to find out which personal or organizational factors may affect exposure to blood-borne pathogens at work. Ilhan, *et al*, reported a rate of 79.7% needle-stick injury among Turkish nurses during their work. Younger and less-experienced nurses reported more injury. Working in surgical and intensive care units and long hours of work were other risk factors of the injury in this study.¹³

Nsubuga and Jaakkola assessed needle-stick injuries in Uganda. They concluded that lack of training in needle-stick injuries, working long hours per week, recapping needles and not using gloves are the main risk factors among nurses and midwives.¹⁷

In a study conducted among nurses in China, Wang, *et al*, measured the effect of training in prevention of occupational exposure to blood-borne pathogens. In a quasi-experimental study they observed that the training was associated with a statistically significant reduction in the number of needle-stick and sharp injuries.²⁴

Similarly, Yang, *et al*, assessed the ef-

fect of a training program on prevention of needle-stick and sharp injuries among nursing students in Taiwan. They reported a significant reduction in injuries and an increase in the rate the reported injuries.²⁵

In our study, univariate analyses showed a significant association between years of work as a nurse and exposure to blood-borne pathogens. Longer duration of employment as a nurse was associated with a lower risk of exposure. Also there was a relation between the type of employment and exposure to blood-borne pathogens. Permanent nurses were at lower risk than temporary nurses. We did not find any associations between gender, education, marriage status, having secondary job or work in surgical units and exposure to blood-borne pathogens (Table 1).

Almost all nursing schools in Iran provide some courses on the safety at work and needle-stick injury prevention. Moreover, many nurses participate in annual seminars and conferences which mainly present some information on the prevention of exposure to blood-borne pathogens at work. Nevertheless, our results showed that these activities have so far not been effective to prevent needle-stick or sharp injuries.

Our results showed that there is no significant association between training and exposure to blood-borne pathogens among Iranian nurses which is in contrary to what was found by Wang and Yang.^{24,25} Some reasons for this discrepancy may be the quality of training courses. Wang and Yang evaluated the effect of a training course that had been designed for their studies, while in our study, the training courses were not specifically designed to cover the studied nurses, thus we cannot comment on the quality of these training courses. Another reason could be the time between the training course and the period of our study. Some of our participants had attended in a training course many years

before. Probably, the effect of a training course will decrease over time, so periodic training may be needed.

Clark, *et al*, evaluated the effect of organizational factors on needle-stick injuries among nurses. They reported a significant association between low nurse staffing, low resource adequacy, low nurse manager leadership and high emotional exhaustion with the reported needle-stick injuries.¹⁵ Smith, *et al*, found a relation between safety climate and needle-stick injury in Japan.¹⁹ He concluded that a supportive workplace and having minimal conflict at work were correlated with lower risk of needle-stick injury.

We found an association between psychosocial factors at work and exposure to blood-borne pathogens among this group of nurses. ORs for middle stress group were higher than those for mild stress group; ORs for high stress group were higher than those for middle stress group. Increasing trend of crude and adjusted ORs for middle and high stress groups compared to low stress group at all four outcomes brings this theory to our minds that there could be a relationship between psychosocial factors at work and exposure to blood-borne pathogens.

Our study was cross-sectional and because of the nature of this type of study, we could not realize that which one of these factors (psychosocial factors at work or exposure to blood borne pathogens) affects the other ones. This study was conducted in one public hospital in Tehran and this is a limitation for our study which may make some questions related to generalizability of the findings. All hospitals in Iran are under the supervision of Ministry of Health with the same regulations and safety measures. All nurses were graduated from nursing schools in Iran which are very similar in curriculum. The high prevalence of needle-stick injury, under-reporting and high stress work place are

three common problems in hospitals. Nevertheless, the nature of the problem may vary between hospitals or in different types of health care services. Another limitation of our study was that there was not an effective registry in our hospital to register needle-stick injury or other kinds of exposure to blood-borne pathogens, so we had to ask the participants about their exposures at work during the last year and this would cause recall bias.

In conclusion, our results showed a high prevalence rates of needle-stick injury and sharp injury and mucous membrane exposure to patients' blood or body fluids among the studied nurses. More than half of those participants who had history of exposure, had not reported it. Furthermore, there was a significant association between increasing psychosocial factors at work and exposure to blood-borne pathogens among this group of nurses. Our hypothesis is therefore is that reduction of psychosocial factors at work may lead to a decrease in exposure to patients' blood or body fluids.

Based on our findings, the main recommendations are: 1) more emphasis on periodic training of nurses about regulations, safety at work and reporting of their exposures to sharp injuries and blood and body fluids; 2) investment on producing and usage of needleless systems and safety technologies will provide a lot of long-term benefits for health care system; and 3) controlling the main sources of nurses' stress at work, such as nursing shortage and low income.

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Conflicts of Interest: None declared.

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