Occupational Exposure to Sharp Injuries Among Jordanian Health Care Workers

Zeinab Mohammad Hassan, RN, PhD,* and Moayad Abdullah Wahsheh, PhD†

Objectives: (a) Determine the effects of the following variables (sex, age, experience years, hospital sector, occupation group, education level, working area, shift, timing of occurrence of injuries, hospital location) on the number of exposure to sharp injuries (SIs) among Jordanian health care workers (HCWs), (b) determine the number of exposure cases to SIs among subgroups within each selected variable, (c) identify the percentages of HCWs who were exposed to SIs in the last 12 months, and (d) identify the types of devices involved in SIs based on the responses of different occupational groups.

Method: Cross-sectional design was used. Data were collected using a survey that was developed by the Centers for Disease Control and Prevention.

Participants: One thousand sixty-eight HCWs who work in private and public Jordanian hospitals participated in the survey.

Results: The HCWs whose sex; age; experience years; hospital sector, occupation group; education level; working area; shift; timing of occurrence of injuries; hospital location were female, younger than 30 years old, more than 2 years, public, nurses, a bachelor degree, intensive care unit, between 3 PM and 11 PM, their injuries were during use of devises/instruments, the location of the hospital they work in was in the central of Jordan, respectively, exposed more to SIs comparing the subgroups within each other. Eighty-eight (8.2%) of HCWs were not exposed to SIs in the last 12 months, 427 (39.9%) were exposed to only 1 sharp injury, 164 (15.4%) were exposed to 2 SIs, 169 (15.8%) were exposed to 3 SIs, 83 (7.8%) were exposed to 4 SIs, 95 (8.9%) were exposed to 5 SIs, and 42 of HCWs (3.9%) did not designate. Nurses (n = 745, 81%) were the most occupational group involved in SIs, whereas midwives were the least (n = 5, 1%). In addition, used needles for injections were the instruments most involved in SIs (58.7%), whereas surgical dressing set was the least (8.5%).

Conclusions: Occupational exposure to SIs is a significant problem facing Jordanian HCWs, which put them at serious risk of infection from blood-borne pathogens.

(Background)

Health care workers (HCWs) are at risk for occupational exposure to more than 20 blood-borne pathogens like hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV) through contaminated sharp injuries (SIs), such as syringe needles, scalpels, and broken glass.1,2

Worldwide, about 40% of HBV and HCV infections and 2.5% of HIV infections among HCWs are attributable to occupational sharps exposures. No vaccines or immunoglobulin are available for HCV and HIV; on the other hand, HBV can be prevented by vaccines. Therefore, prevention of SIs deserves attention.3,4 According to the World Health Organization (WHO),5 about 3 million of HCWs across the world were exposed to blood-borne pathogens each year; 2 million of those to HBV; 900,000 to HCV; and 170,000 to HIV. These injuries may result in 70,000 HBV; 15,000 HCV; and 500 HIV infections. More than 90% of these infections occur in developing countries.

In developing countries, 40% to 65% of HBV and HCV infections in HCWs were attributable to occupational exposure.6 For example, it was estimated that around 24,004 HBV and 8617 HCV HBV infections occurred each year among Egyptian HCWs as a result of occupational exposure in the health care environment.7 In contrast, the attributable fraction for HCV in developed regions was only 8% to 27%.6

Health care workers in the developing countries are at serious risk of infection from blood-borne pathogens because of the high prevalence of these pathogens and the increased risk of occupational injuries.7,8 Unsafe practices such as careless handling of contaminated needles, unnecessary injections, reuse of inadequately sterilized needles, and improper disposal of hazardous waste can increase the potential risk of occupational transmission of these blood-borne pathogens.9

Several risk factors (ie, invasive procedures and longer procedures) which result in higher blood loss are associated with increasing occupational exposures to SIs.10 As confirmed by Pettit et al11; the number of SIs increases or decreases based on the work location such as operating rooms, patient rooms, and emergency units. Furthermore, fatigue resulting from working extended hours may contribute to a higher risk of SIs.12,13

The costs of SIs include the direct costs associated with the initial and follow-up treatments of exposed HCWs. These costs are estimated to range from $500 to $3000 depending on the type of the provided treatment.14 In addition, the costs that are harder to estimate include the emotional costs associated with fear and anxiety from worrying about the possible consequences of an exposure, direct and indirect costs associated with drug toxicities as well as lost time from work, and the social costs associated with an HIV or HCV. The negative influence of HIV or HCV in advance stage of the disease includes the possible loss of workers’ services for taking care of other patients and increasing the economic burden of the medical care.

Occupational Safety and Health Administration mandated that HCWs should have in place a system that includes written protocols for prompting reports, evaluating the hospital system, counseling HCWs who exposed to SIs, treating the affected HCWs, and following-up of occupational exposures that may place HCWs at risk for blood-borne pathogen infections. In addition, health care settings also must establish plans for controlling the exposures to SIs and complying with reporting the incidences.15

The operational definition of the SIs in this study is any contact with infected body fluid through needles and sharp
instruments. Potentially infected fluids are blood and other fluids which visibly contained blood such as cerebrospinal, pleural, peritoneal, pericardial, amniotic fluids, semen, and vaginal secretions. The researchers defined exposure as “injuries that caused skin penetration by sharp devise that contaminated by blood.”

**SIGNIFICANCE**

Prevention of SIs and other blood exposures is an important step in the track of preventing the transmission of blood-borne viruses among HCWs. Based on available data from the Jordanian Ministry of Health, the total number of all Jordanian HCWs work in Ministry of Health and private sectors; however, accurate national data are not available on the annual number of SIs among Jordanian HCWs. Furthermore, the use of safety devices which was used to decrease the incidence of SIs in many Jordanian health care settings is not available. Epidemiologic data on SIs including both the circumstances associated with occupational transmission of blood-borne viruses and predictors for reporting SIs are essential for targeting and evaluating interventions at the national level.

**RESEARCH QUESTIONS**

The primary questions are the following:

1. What are the effects of the following variables (sex, age, experience years, hospital sector, occupation group, education level, working area, shift, timing of occurrence of injuries, hospital location) on the number of exposure to SIs among Jordanian HCWs?
2. How many exposure cases to SIs are among subgroups within each selected variable?
3. What are the percentages of HCWs who were exposed to SIs in the last 12 months?
4. What are the types of devices involved in SIs based on the responses of different occupational groups?

**METHODOLOGY**

**Sample**

A cross-sectional study with multistages cluster sampling was used in this study. The target population for this study consisted of HCWs who work in the Ministry of Health and private sectors in Jordan. Based on the updated statistics published by the Jordanian Ministry of Health, the total number of all Jordanian hospitals was 87, whereas the total number of HCWs who work in Ministry of Health and private sectors was 25,082. The distribution of those HCWs was 7488 registered nurses; 11,815 physicians; 4319 dentists; and 1460 midwives.16

The selected sample was consisted of 2000 subjects (ie, 950 registered nurses, 380 physicians, 40 dentists, 150 midwives, 280 laboratory workers, and 200 dialysis workers) who are working in 30 hospitals. These hospitals include the following units: (a) coronary care units, (b) intensive care units, (c) surgical intensive care unit, (d) intermediate care unit, (e) cerebral vascular accident care unit, and (f) neonatal intensive care unit.

Assuming an $\alpha$ of 0.05, medium effective size, with the power 90%, a convenience national sample of HCWs was drawn using a field visit with cross-validation among the 4 teams. Permissions to conduct the study were obtained from the Institutional Review Board of the researchers’ university, Jordanian Ministry of Health, the directors of the selected hospitals, the head nurses, and each subject who agreed to participate in the study.

Survey of Health Care Personnel on Occupational Exposure to Blood and Body Fluids

**Data Collection Process**

Four teams collected the data between December of 2006 and January of 2007. A standardized survey “Survey of Health Care Personnel on Occupational Exposure to Blood and Body Fluids” which was published by the CDC18 was used in this study. This survey was divided into 2 sections: the first one assessed reporting occupational exposures to SIs and blood-borne viruses (eg, number of exposures, the unit in which the incidence was occurred, and type of injury), and the second one addressed HCWs experience with the care system after reporting an exposure. The researchers of this study added the third section to address the demographic characteristics of Jordanian HCWs (eg, age, sex, occupation, and experience years).

Before starting the fieldwork, each team standardized its data collection procedure through training sessions followed by a field visit with cross-validation among the 4 teams.

**Data Analyses**

Data analyses were performed using the Statistical Package for Social Sciences (SPSS, version 15, SPSS Inc, Chicago, Ill). Means, SDs, and frequencies related to Survey of Health care Personnel on Occupational Exposure to Blood and Body Fluids were used to answer the study questions.

**RESULTS**

**Exposure to Sharp Injuries**

Table 1 includes an overview of survey respondents about the occurrence of at least 1 sharp injury within 12 months. Out
One thousand sixty-eight Jordanian HCWs were asked about the number of SIs they were exposed to in the last 12 months (Table 2). Table 3 presented types of devices involved in SIs based on the responses of different occupational groups. Nurses (n = 710, 80.8%) is the most occupational group whereas midwives was the least (n = 5, 0.6%). In addition, used needles for injections were the instruments most involved in SIs among Jordanian HCWs (58.7%), whereas surgical dressing set was the least (8.5%).

### DISCUSSION

The literature showed that 385,000 needlesticks and other SIs are sustained in each year by HCWs who work in hospitals; an average of 1000 SIs per day. An correlation was found between the frequency of injections and the prevalence of each of HBV, HCV, and HIV in a population. The study conducted by Vishnu-Priya and Lee indicated that over two thirds of the general population reported receiving injections at least 1 injection in each 6 months, averaging 4 injections per year. Reeler indicated that people in general prefer injections more than any other form of therapy because they believe that injections are fast-acting and highly effective.

In many low income countries, such as Jordan, the high demanding and popularity of using injections derive from the nations’ belief that injections are more effective than any other form of therapy.
in particular nurses, should pay more attention when they start dealing with used needles.

Therefore, there is a need for providing Jordanian HCWs information about blood-borne pathogens. A study carried out by Hassan et al\textsuperscript{27} showed that two thirds of Jordanian HCWs expressed that they did not have adequate and current training in issues related to 1 of blood-borne pathogens that results from SIs (ie, hepatitis infections). Health care workers indicated an interest in receiving information and training about hepatitis A, B, and C (83\%, 71\%, and 80\%, respectively).

Other example from the developing counties about nation beliefs related to injections is Ghana, a country in Africa. The finding of Van Staa and Hardon's study\textsuperscript{29} showed that 80\% to 90\% of Ghanaian patients who visited a health center received 1 or more injections per visit; additionally, similar findings have been reported in Uganda and Indonesia. According to Reeler,\textsuperscript{30} HCWs are increasingly compelled to provide patients the injections they need to maintain their credibility in the society.

In Jordan, a study conducted by Al-Sheyyab et al\textsuperscript{31} found that the rate of hepatitis B antigen among multitransfused patients was 3.5\%, whereas hepatitis C antibodies was found in 40.5\% (58 out of 143) of the participants. On the basis of published statistics by Jordanian Ministry of Health in 2006,\textsuperscript{27} the incidence rate for hepatitis B was 0.446/100,000 population, in contrary, hepatitis B antigen prevalence rates in Palestine were 29.4\%, 17\%, 22.5\%, and 9.6\% among kidney transplants, hemodialysis, blood transfusion dependent patients, and non-transfused HCWs, respectively.\textsuperscript{32}

To overcome this problem, Jordanian Ministry of Health in 2006\textsuperscript{27} encouraged people to obtain vaccine of hepatitis B for their infant in the first year of age. As a result, the percentage of vaccination was increased from 36\% in 1995 to 98\% in 2006. In addition, a study which was done by Al-Omari and Al-Dwairi\textsuperscript{33} indicated that 36\% (40/110) of general dental practitioners were vaccinated in Jordan against hepatitis B.

### The Occurrence of SIs Among HCWs Stratified by Some Selected Variables

This study showed that the rates of SIs are influenced by the years of employment. This finding is contradicted with the finding reported by Abu-Gad and Al-Turki\textsuperscript{34}; more frequent SIs occurred in the early years of employment.

The current study indicated that nurses are at greatest risk for SIs than any other subgroup HCWs. This finding is concurrent with what Sencan et al\textsuperscript{35} found; exposures to SIs were most frequent among Turkish nurses-midwives (57\%). Some investigators (Vincent, Taylor-Adams, and Stanhope\textsuperscript{36}) found very little consideration of personal safety among HCWs. This finding leads to pay more attention to the safety of HCWs besides patients' safety as a priority in training programs.

One of the findings of the current study showed that the SIs was influenced by departments (Table 1). The highest number of SIs occurred in the first place in intensive care unit (35\%), then in emergency department (23\%), and in the third place, was in medical surgical floor (14\%). This result is contradicted with what Sencan et al\textsuperscript{31} reported; operating theatre was the major location of incidents (56\%), followed by intensive care units (67\%), with the lowest rates occurring in the laboratories (27\%). The occurrence of SIs in each of operating rooms, patient rooms, and emergency units is confirmed by other studies.\textsuperscript{33} Some observational studies have recorded that 7\% to 50\% of HCWs were exposed to blood in operating rooms, and 2\% to 15\% of exposures were needlestick or cut with sharp objects.\textsuperscript{34,35}

In addition, the professional literature\textsuperscript{36} showed that 72.1\% of medical students in Washington had sustained at least 1 SI that occurred in the operating room. The researchers believe that the incidence rate of SIs in operation room is the highest as a result of the limited space of work for HCWs, working under stress, and dealing with surgical procedures which could require long duration and experience for use.

Another study\textsuperscript{37} has reported that medical and surgical staff suffered from a similar exposure to SIs rate as other HCWs, although some other researchers such as Abu-Gad and Al-Turki\textsuperscript{34} reported higher exposure to SIs rate in surgical departments. The findings of current study consistent with the findings of other studies\textsuperscript{37,38}; in which patient wards (ie, medical surgical ward, and pediatric ward) are not the major location of SIs.

In addition, the findings of the current study showed that the incidence of SIs increased among rotating shifts HCWs (Table 1). The number of SIs in the afternoon and night shift (3 PM–11 PM) was 456 (51\%) incidents compared with 145 (16\%) incidents in the morning shift. This finding is concurrent with the finding which was found by Fransen et al\textsuperscript{39}; rotating shift workers whose rotation included night work still retained an almost 2-fold increased risk to SIs compared with daytime. Fatigue and alertness at work could be the reasons for increasing mistakes during performing occupational tasks and thus sustaining SIs.

### TABLE 2. Number and Percent of HCWs Who Were Exposed to Sharp Injuries in the Last 12 Months

<table>
<thead>
<tr>
<th>Number of Sharp Injuries Cases During the Last 12 Months</th>
<th>Number and Percent of HCWs Who Were Exposed to Sharp Injuries n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>88 (8.2%)</td>
</tr>
<tr>
<td>1</td>
<td>427 (39.9%)</td>
</tr>
<tr>
<td>2</td>
<td>164 (15.4)</td>
</tr>
<tr>
<td>3</td>
<td>169 (15.8%)</td>
</tr>
<tr>
<td>4</td>
<td>83 (7.8%)</td>
</tr>
<tr>
<td>5</td>
<td>95 (8.9%)</td>
</tr>
<tr>
<td>Missing cases</td>
<td>42 (3.9%)</td>
</tr>
<tr>
<td>Total (without missing cases)</td>
<td>1026 (96.1%)</td>
</tr>
<tr>
<td>Total (with missing cases)</td>
<td>1068 (100%)</td>
</tr>
</tbody>
</table>

### TABLE 3. Types of Devices Involved in Sharp Injuries Based on Responses of Different Occupational Groups (n = 879)

<table>
<thead>
<tr>
<th>Occupation/Device</th>
<th>Nurses</th>
<th>Physicians</th>
<th>Dentists</th>
<th>Laboratory Workers</th>
<th>Dialysis Workers</th>
<th>Midwives</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV Cannula</td>
<td>131</td>
<td>3</td>
<td>0</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td>141 (16%)</td>
</tr>
<tr>
<td>Suture needles</td>
<td>101</td>
<td>25</td>
<td>4</td>
<td>3</td>
<td>14</td>
<td>0</td>
<td>147 (16.1%)</td>
</tr>
<tr>
<td>Used needles for injections</td>
<td>418</td>
<td>28</td>
<td>19</td>
<td>35</td>
<td>11</td>
<td>5</td>
<td>516 (58.7%)</td>
</tr>
<tr>
<td>Surgical dressing set</td>
<td>60</td>
<td>10</td>
<td>1</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>75 (8.5%)</td>
</tr>
<tr>
<td>Total (%)</td>
<td>710 (80.8%)</td>
<td>66 (7.5%)</td>
<td>24 (2.7%)</td>
<td>46 (5.2%)</td>
<td>28 (3.2%)</td>
<td>5 (0.6%)</td>
<td>879 (100%)</td>
</tr>
</tbody>
</table>
Rotating shifts may lead to decreased alertness at work. The time during which the HCWs are awake in evening and night shifts (ie, 11 PM–7 AM and 11 PM–7 AM) is extended to 20 to 22 hours as opposed to 8 to 9 hours for the morning shift (7 AM–3 PM). The study conducted by Gold et al. showed that the nurses who work in rotating shifts had more sleep/wake cycle disruption than their colleagues on non-rotating shifts. This finding contradicts with Macias et al. who found that HCWs’ SIs exposure rate did not vary based on the time of shift (day or night), whereas the rate increased during the first hour and the last 2 hours of a shift.

Regarding the number and percentage of participants in the current study who were exposed to SIs, 427 (39.9%) of them were exposed to only 1 sharp injury. This finding is higher than what Lorentz et al. found in their study; 803 participants (29.7%) had at least 1 needlestick injury. On the other hand, Lee et al. indicated that 313 (78.3%) out of 400 respondents reported experiencing at least 1 sharp injury. Another finding of the current study is that 511 of HCWs (47.9%) were exposed to 2 SIs or more in a year. Overall, 938 of HCWs in the current study (87.8%) were exposed to either at least 1 SI or at the most 5 SIs in the last 12 months (Table 2). The researchers believe that an exposure to 1 accident of SIs could put HCWs at risk for blood-borne pathogens (ie, the higher the number of exposures, the higher the possibility that the contracting of blood-borne pathogens such as HIV and hepatitis B and C virus will occur).

**RECOMMENDATIONS**

Used needles for injections are the most devices involved in SIs. The researchers recommend that the adoption of safety-engineered sharp devices must become a priority for occupational safety and infection control professional groups in Jordan. All health care settings in Jordan must use safety IV catheters with protective features that cover the needle after use and safety winged steel needles. These devises could prevent most of SIs.

Furthermore, Jordanian health care settings must clarify the importance of prevention and management of SIs to all HCWs, train them how to use and deal with the instruments and devices in a safe manner, and take into consideration the type of devices (eg, injections) that may reduce the risk of SIs. In addition, the academic institutions should play a role to educate and teach HCWs the principles and practices of safety, bring theoretical information to the clinical settings, convey the seriousness of SIs, teach the strategies which help the avoidance of SIs, and conduct research after the occurrence of SIs.

The results of this study suggest that there is a need to provide formal and obligatory infection control courses for new HCWs who have experience more than 2 years in the clinical field. Appropriate sharps disposal containers should be placed in each patient room and procedure area.

By law, effective SIs and blood-borne pathogen exposure control program must be written and communicated to all workers in all settings and uniformly supported and enforced by leaders. Varghese et al. suggested that all health care settings should have protocols that include how HCWs document and report the following information in the records after the occurrence of SIs: (a) name and data of the source of injury, (b) time and date of exposure, (c) nature of exposure (ie, nonintact skin, mucosal, or percutaneous), (d) for percutaneous injuries, a description of the injury (depth of wound, solid versus hollow needle, sharp, etc), (e) the exposed body site, (f) infective status of the source if it is documented, (g) circumstances under which the exposure incident occurred, and (h) previous testing and immune status of the exposed HCWs.

**LIMITATIONS**

One of the major limitations of this study is that reporting bias could have played a role because data have been collected based on self-reports. In addition, the researchers did not control other possible confounding factors which might influence the occurrence of SIs such as changes in the type of patients and resources in the health care settings and disease. It is difficult to assess the true size of the problem because information has not been gathered on the frequency of SIs among Jordanian HCWs who work in other settings (eg, long-term care, home health care, private offices).

**ACKNOWLEDGMENTS**

The authors thank all the HCWs who completed the questionnaire.

**REFERENCES**


