[Environmental Health and Preventive Medicine 10, 33–41, January 2005]

Original Article

Implication of the Prevalence of Needlestick Injuries in a General Hospital in Malaysia and Its Risk in Clinical Practice

Lai Kah LEE[1] and Ismail NOOR HASSIM[2]

[1]*International Medical University, Sesama Centre, Plaza Komanwel, Bukit Jalil, 57000 Kuala Lumpur, Malaysia*
[2]*Faculty of Medicine, National University of Malaysia, Jalan Yaacob Latif, Bandar Tun Razak, 56000 Kuala Lumpur, Malaysia*

Abstract

Objectives: To determine the prevalence of cases and episodes of needlestick injury among three groups of health care workers in the past one-year, the level of knowledge on blood-borne diseases and universal precautions and the practice of universal precautions. Other factors associated with the occurrence of needlestick injuries and the reporting of needlestick injuries were also analysed.

Methods: A cross-sectional study was conducted in May 2003 to study the needlestick injuries among 285 health care workers (doctors, nurses, medical students) in a public teaching hospital in Negeri Sembilan, Malaysia.

Results: The prevalence of needlestick injuries among the respondents was 24.6% involving 71 cases i.e. 48.0% among doctors, 22.4% among medical students, and 18.7% among nurses and the difference was statistically significant ($p<0.001$). There were a total of 174 episodes of needlestick injury. Prevalence of episode of needlestick injuries was highest among doctors (146%), followed by nurses (50.7%) and medical students (29.4%). Cases of needlestick injuries attained lower scores on practice of universal precautions compared to non-cases ($p<0.001$). About 59% of cases of needlestick injury did not report their injuries.

Conclusions: The study showed that needlestick injuries pose a high risk to health care workers and it is underreported most of the time. Many needlestick injuries can be prevented by strictly following the practice of universal precautions.

Key words: needlestick injury, health care workers, prevalence, underreporting, Malaysia

Introduction

Health care workers are exposed to a wide range of hazards in the workplace. Needlestick injuries have been recognized as one of the occupational hazards. Needlestick was the most common source of blood exposure reported (58%), followed by nonintact-skin and mucous membrane contamination (22.7% and 11.2% respectively) and cuts (8%) (1). As the incidence of HIV infection continues to rise, increasing attention to the risks of needlestick injury to health care workers would seem appropriate.

Needlestick injuries are a big problem. In the United States, CDC estimates indicate that 600,000 to 1 million such injuries occur annually. About half of these injuries go unreported (2, 3). In Malaysia, precise national data are not available on the annual number of needlestick and other percutaneous injuries among health care workers. There have also not been many published studies on needlestick injuries in Malaysia. Relatively little attention has been directed to investigating the risks of needlestick injuries.

Any healthcare worker handling sharp devices or equipment such as scalpels, sutures, hypodermic needles, blood collection devices, or phlebotomy devices is at risk of occupational exposure to blood borne pathogens. Certain groups of individuals are at greater risk than others because of the nature of their work. Such is the case with doctors, nurses and medical students where their responsibilities necessarily involve the risk of exposure to patient's blood. This study focused on the risk of exposure among these three groups of health care workers to blood and other body fluid and the reporting of such incidents.

The objectives of this study were to determine the prevalence of needlestick injuries and factors contributing towards these injuries among health care workers in a general hospital.

Received Jan. 22, 2004/Accepted Oct. 18, 2004
Reprint requests to: Lai Kah LEE
Department of Community Medicine, International Medical University, Sesama Centre, Plaza Komanwel, Bukit Jalil, 57000 Kuala Lumpur, Malaysia
TEL: 603-86567228, FAX: 603-86567229
E-mail: laikah@imu.edu.my

We also examined the percentage of underreporting of needlestick injuries and the reasons for it. The hypothesis is that the average length of time in performing procedures in a week is longer in cases of needlestick injuries compared to non-cases, the level of knowledge of blood-borne diseases and universal precautions and the practice of universal precautions are lower among cases compared to non-cases.

Materials and Methods

This is a cross-sectional descriptive study carried out in May 2003 till June 2003 to determine the prevalence of needlestick injuries and associated factors among health care workers. There were a total of 433 staff nurses, 140 doctors (medical officers and house officers) in Seremban Hospital and 85 medical students in International Medical University (IMU). Out of these, 150 staff nurses, 50 doctors (28 medical officers and 22 house officers) were selected by stratified random sampling and all the medical students were selected. House officers are newly qualified doctors who will have to undergo further residency training in medical, surgical, orthopaedic, obstetric/gynaecology, paediatric posting. The medical officers selected consisted of staff from internal medicine, paediatrics, psychiatry, general surgery, obstetrics/gynaecology, anaesthesia, orthopaedics, urology, and pathology. They were briefed on the study and informed consent was obtained from all of the subjects.

Hospital Seremban is the state and referral hospital for the state of Negeri Sembilan in Malaysia. It has 800 beds and 20 clinical specialties and various supportive services. It is also an institution for training of medical students from IMU.

The survey research was carried out using a structured questionnaire. The questionnaire used was constructed based on a questionnaire used in a previous study (4). The questionnaires were divided into four parts. The first part consisted of questions on their socio-demographic characteristics and Hepatitis B immunization status. The other parts were on the prevalence study of needlestick injuries where the respondents were asked about their experience in handling needles and the prevalence of needlestick injuries in the past one-year. The respondents were also asked about their knowledge on blood borne diseases and universal precautions. For blood-borne diseases, the questions were about HIV/AIDS, Hepatitis B and Hepatitis C and universal precautions; they were also asked about the different types of body secretions and the role of universal precautions in dealing with the body secretions. The total score for knowledge of blood borne diseases was 40 (40 True/False questions) and for universal precautions was 12 (12 True/False questions). The median scores for both types of knowledge were taken for this study. For practice of universal precautions, there were 10 questions about the practice of universal precautions that should be and should not be done while undertaking procedures in hospitals, according to the guidelines on universal precautions. The total score was 40 and the median score was taken as the result for the study.

The questionnaires were also translated into Bahasa Malaysia in order to make interviewing easier especially among the nurses. The questionnaires were pre-tested among 15 medical students before they were used. Ambiguous questions were revised; sequence of questions and the flow was improved. The questionnaires were administered by using face-to-face interviews to ensure a good response rate and to ensure all questions were answered.

Needlestick injury in this study refers to percutaneous injury caused by a needle or sharp instrument. Case of needlestick injury means number of respondents experiencing needlestick injury. Episode of needlestick injury refers to the number of needlestick injuries occurring in each case. There are occasions where a case may experience more than one episode of needlestick injuries. Prevalence of cases of needlestick injury is the total number of cases of needlestick injuries in one year (2002) divided by the total number of respondents and stated as a percentage. Prevalence of episode of needlestick injury is the total number of episodes of needlestick injuries in one year (2002) divided by total respondents in percentage. Data were entered into a microcomputer and analyzed using SPSS Ver 11.5.

Results

The study was carried out among 285 health care workers comprising 28 medical officers and 22 house officers, 150 staff nurses, and medical students at a public teaching hospital (Table 1). All those selected agreed to the interview, giving a response rate of 100%.

The majority of the respondents were Malay (72.3%), female (83.5%) and their mean age was 31.75±8.92 years. All the doctors were junior doctors (medical officers and house officers) with median durations of service of 4 years and 1 year respectively. The staff nurses' duration of service ranged from 1 year to 34 years. All the medical students were in their final year. 256 respondents (89.8%) had already been vaccinated against Hepatitis B and 58.2% completed the vaccination schedule (Table 1). 29 respondents were not vaccinated and reasons given for non-vaccination were that they already have antibody towards Hepatitis B, did not know their Hepatitis B status, or were busy and had not had time to go for vaccination.

Based on this study, 284 (99.6%) respondents had handled hollow-bore needles in the past one-year. About 149 (52.3%) respondents had used suture needles before. Suture needles were mainly used by doctors (88.0%) and medical students (95.3%) compared to nurses (16.0%). Needles were most commonly used by respondents for blood taking (venepuncture) (91.6%), drip setting (90.9%), and giving parenteral injections (63.2%) (Table 2).

Table 3 shows that 112 (39.3%) out of 285 respondents reported various exposures to either blood or body fluid in the past one-year. The exposures among doctors were the highest with 63.6% of house officers and 60.7% of medical officers reporting previous exposure followed by medical students (42.4%). Exposures among nurses were 30.0%. The difference among the 3 groups is statistically significant ($p<0.05$). Exposure to hollow-bore needles is the commonest (23.5%), followed by mucocutaneous exposure (18.2%), open-skin exposure (7.7%) and exposure to sharp objects (e.g. suture needles, scalpel and others) (6.7%).

The overall prevalence of cases of needlestick injuries was

Table 1 Socio-demographic characteristics and Hepatitis B immunization status of respondents

Job category	Medical officer	House officer	Staff nurse	Medical student	Total
	n (%)	n (%)	n (%)	n (%)	n (%)
Number	28 (9.8)	22 (7.7)	150 (52.6)	85 (29.8)	285 (100.0)
Age (mean)	30.39±5.39	26.14±2.10	36.97±9.03	24.45±1.53	31.75±8.92
Gender					
Male	12 (42.9)	5 (22.7)	150	30 (35.3)	47 (16.5)
Female	16 (57.1)	17 (57.1)	(100.0)	55 (64.7)	238 (83.5)
Ethnic Group					
Malay	8 (28.6)	16 (72.7)	129 (86.0)	53 (62.4)	206 (72.3)
Chinese	9 (32.1)	3 (13.6)	6 (4.0)	25 (29.4)	43 (15.1)
Indian	10 (35.7)	3 (13.6)	12 (8.0)	6 (7.1)	31 (10.9)
Others	1 (3.6)	0 (0.0)	3 (2.0)	1 (1.1)	5 (1.7)
Median duration of working/studying (years)	4.0	1.0	12.0	5.0	5.0±7.8
Mean duration of working/studying (years)	4.7±0.8	1.1±0.1	12.9±0.7	5.0±0.01	8.81±7.8
Received Hep B vaccine					
Yes	26 (92.9)	21 (95.5)	129 (86.0)	80 (94.1)	256 (89.8)
No	2 (7.1)	1 (4.5)	21 (14.0)	5 (5.9)	29 (10.2)
Immunization status					
Complete (3 doses)	15 (57.7)	13 (61.9)	72 (55.8)	49 (61.2)	149 (58.2)
Not complete	11 (42.3)	8 (38.1)	57 (44.2)	31 (38.8)	107 (41.8)

n=number of subjects.

Table 2 Needle handling and types of procedures performed by respondents

Procedures performed	Number (%)				
	Medical officer (n=28)	House officer (n=22)	Staff nurse (n=150)	Medical student (n=85)	Total (n=285)
Using hollow-bore needles	27 (96.4)	22 (100.0)	150 (100.0)	85 (100.0)	284 (99.6)
Using suture needles	25 (89.3)	19 (86.4)	24 (16.0)	81 (95.3)	149 (52.3)
Blood taking (venepuncture)	26 (92.9)	21 (95.5)	130 (86.7)	84 (98.8)	261 (91.6)
Setting drip	26 (92.9)	187 (77.3)	134 (89.3)	82 (96.5)	259 (90.9)
Parenteral injections	12 (42.9)	7 (31.8)	104 (69.3)	57 (67.1)	180 (63.2)
Suturing	24 (85.7)	18 (81.8)	21 (14.0)	75 (88.2)	138 (48.4)
Performing minor procedures	22 (78.6)	15 (68.2)	4 (2.7)	40 (47.1)	81 (28.4)
Assisting in surgery in OT	10 (35.7)	15 (68.2)	18 (12.0)	66 (77.6)	109 (38.2)
Performing surgery in OT	9 (32.1)	7 (31.8)	0 (0)	3 (3.5)	19 (6.7)
Others	1 (3.6)	0 (0.0)	2 (1.3)	3 (3.5)	6 (2.1)

Table 3 Prevalence of types of exposure to patient blood or body fluid in the past 12 months according to job category

Exposures	Number (%)				
	Medical officer (n=28)	House officer (n=22)	Staff nurse (n=150)	Medical student (n=85)	Total (n=285)
Patient's blood or body fluid*	17 (60.7)	14 (63.6)	45 (30.0)	36 (42.4)	112 (39.3)
Hollow-bore needle injuries	10 (35.7)	11 (50.0)	27 (18.0)	19 (22.35)	67 (23.5)
Sharp object injuries	7 (25.0)	5 (22.7)	5 (3.3)	2 (2.4)	19 (6.7)
Mucocutaneous exposures	5 (17.9)	6 (27.3)	25 (16.6)	16 (18.8)	52 (18.2)
Contact through non-intact skin	5 (17.9)	2 (9.1)	9 (6.0)	6 (7.1)	22 (7.7)

* Numbers do not tally as respondents may choose more than one answer in the various types of exposures to blood or body fluid.

24.9% (71 cases) i.e. 48.0% among doctors, 22.4% among medical students, and 18.7% among nurses (Table 4). There were a total of 174 episodes of needlestick injuries with episode ranging from 1 to 13 episodes. The overall prevalence of episode of needlestick injuries is 61.1% (Table 4). Prevalence of episode of needlestick injuries was highest among doctors (146%), followed by nurses (50.7%) and medical students (29.4%) (Table 4). Out of the 174 episodes of needlestick injuries, 131 (75.3%) episodes were due to hollow-bore needles. The prevalence of episode of hollow-bore needlestick injuries is 46.0%.

The median time spent doing procedures on patients (e.g. taking blood, setting drips, giving parenteral injections, suturing, minor procedures, assisting in surgery) in a week for all respondents was 110.0 minutes (ranging from 0 to 2100 minutes per week—0 minutes because some respondents do not perform any procedures). When compared according to job categories, median time spent doing procedures for doctors were

Table 4 Summary of prevalence and reporting of cases and episodes of needlestick injuries according to job category

Exposures	Number (%)				
	Medical officer (n=28)	House officer (n=22)	Staff nurse (n=150)	Medical student (n=85)	Total (n=285)
Cases of needlestick injuries					
Total no. of cases of needlestick injuries	12	12	28	19	71
Prevalence of cases	42.9	54.5	18.7	22.4	24.9
No. (%) of cases reported	3 (25.0)	4 (33.3)	12 (42.9)	10 (52.6)	29 (40.8)
Episodes of needlestick injuries					
Total no. of episodes of needlestick injuries	41	32	76	25	174
Prevalence of episodes	146.4	145.4	50.7	29.4	61.1
No. (%) of episodes reported	5 (12.2)	8 (25.0)	15 (19.7)	11 (44.0)	39 (22.4)

Table 5 Episode of needlestick injuries according to procedures performed and stages of blood taking

	Number of episodes (%)				
	Medical officer (n=28)	House officer (n=22)	Staff nurse (n=150)	Medical students (n=85)	Total (n=285)
Procedures					
Taking blood	25 (89.3)	20 (90.9)	51 (34.0)	21 (24.8)	117 (41.1)
Setting drip	0 (0.0)	2 (9.1)	6 (4.0)	3 (3.5)	11 (3.9)
Parenteral injections	0 (0.0)	0 (0.0)	7 (4.7)	0 (0.0)	7 (2.5)
Suturing	12 (42.9)	3 (13.6)	0 (0.0)	0 (0.0)	15 (5.3)
Performing minor procedures	6 (21.4)	1 (4.5)	2 (1.3)	0 (0.0)	9 (3.2)
Assisting in surgery	2 (7.1)	2 (9.1)	2 (1.3)	0 (0.0)	6 (2.1)
Others (glucometer)	0 (0.0)	0 (0.0)	8 (5.3)	1 (1.2)	9 (3.2)
Stages of blood taking					
Removing needle cap	2 (7.14)	2 (9.1)	20 (13.3)	2 (2.4)	26 (9.1)
Inserting needle into vein	2 (7.14)	2 (9.1)	0 (0.0)	5 (5.9)	9 (3.2)
Putting blood sample into the tube	2 (7.14)	2 (9.1)	1 (0.7)	1 (1.2)	6 (2.1)
Recapping needle	14 (50.0)	14 (63.6)	21 (14.0)	8 (9.4)	57 (20.0)
Removing needle	0 (0.0)	1 (4.5)	5 (3.3)	1 (1.2)	7 (2.5)
Throwing needle	1 (3.6)	1 (4.5)	3 (2.0)	2 (2.4)	7 (2.5)
Others	1 (3.6)	1 (4.5)	1 (0.7)	2 (2.4)	5 (1.8)

147.5 minutes, nurses 100.0 minutes and medical students 100.0 minutes. Doctors (medical officers and house officers) spent significantly more time doing procedures compared to staff nurses and medical students ($p<0.05$).

Overall, the prevalence of episode of needlestick injuries occurred most commonly during venepunctures (41.1%), followed by suturing (5.3%) and setting drips (3.9%). Prevalence of episode of needlestick injuries during suturing was more common among medical officers (42.9%) compared to the other categories of health care workers (Table 5). Episodes of needlestick injuries happen most commonly when the needle is recapped after blood taking (20.0%) and also while removing needle cap (9.1%) (Table 5). The highest prevalence of injury occurred during the Medical posting (17.5%) followed by the Obstetrics and Gynaecology posting (14.7%), Paediatrics posting (13.3%) and the Surgical posting (9.8%). However, the prevalence of episode for doctors (46.0%) and medical students (12.9%) is highest in the Obstetric and Gynaecology posting.

Out of the 71 cases of needlestick injury, 44 (62.0%) of them wore gloves while doing procedures on patients. The other 27 cases (38.0%) did not wear gloves and gave reasons such as uncomfortable wearing gloves (14.1%), in a hurry (11.3%), unnecessary because patient was not a blood-borne pathogen carrier (4.2%), not able to palpate the pulses (4.2%), lazy (1.4%), allergic to rubber gloves (1.4%), no more gloves and no suitable size (1.4%).

Out of the 71 cases of needlestick injury that had been exposed at least once, only 29 cases (40.8%) reported the injury. Only 22.4% of the 174 episodes of needlestick injuries were reported by these reporting respondents (Table 4). The reports were made to the Sister-in-charge of ward (18 cases), Head of Department (5 cases), nurses (4 cases), specialist (1 case) and House Officer (1 case). The rate of reporting of cases of needlestick injuries for medical officers is 25.0%, house officers 33.3%, for nurses is 42.9% and for medical students is 52.6% (Table 4). The difference in the reporting rates between the different groups of health care workers was statistically significant ($p=0.0007$).

Reasons for making the reports were because they were worried about long-term consequences (75.9%), because it is the hospital policy/rules requiring all needlestick injuries to be reported (55.2%), wanted further investigations to be done (48.3%), sense of responsibility to report (37.9%) and felt that the incidence was important to them (31.0%). For those who did not report, the reasons given were because the patient's blood and body fluid could not be contaminated (31.0%), the incidence was not important (21.5%), worried about future consequences if known by administration (16.7%), did not know

Table 6 Reasons for reporting and not reporting exposures according to job category

	Number of cases (%)				
	Medical officer	House officer	Staff nurse	Medical student	Total
Reasons for not reporting					
Source thought not to be infectious	5 (55.6)	2 (25.0)	6 (37.5)	0 (0.0)	13 (31.0)
Incidence was not important	3 (33.3)	1 (12.5)	1 (6.3)	4 (44.4)	9 (21.5)
Worried about future consequences	2 (22.2)	1 (12.5)	1 (6.3)	3 (33.3)	7 (16.7)
Did not know who to report	1 (11.1)	2 (25.0)	0 (0.0)	1 (11.1)	4 (9.5)
Too complicated	1 (11.1)	2 (25.0)	1 (6.3)	0 (0.0)	4 (9.5)
Embarrassed	1 (11.1)	1 (12.5)	0 (0.0)	1 (11.1)	3 (7.1)
Did not know needlestick injuries reportable	0 (0.0)	2 (25.0)	0 (0.0)	1 (11.1)	3 (7.1)
No of respondents*	9	8	16	9	42
Reasons for reporting					
Worried about future consequences	3 (100.0)	2 (50.0)	7 (58.3)	10 (100.0)	22 (75.9)
Hospital policy	1 (33.0)	1 (25.0)	9 (75.0)	5 (50.0)	16 (55.2)
To seek further investigations	1 (33.3)	2 (50.0)	7 (58.3)	4 (40.0)	14 (48.3)
Responsibility	1 (33.3)	0 (0.0)	7 (58.3)	3 (30.0)	11 (37.9)
Incidence was important	0 (0.0)	2 (50.0)	6 (50.0)	1 (10.0)	9 (31.0)
No or respondents*	3	4	12	10	29

* More than one reason per respondent was allowed.

who to report to (9.5%), too complicated and too many forms to fill when reporting (9.5%), or embarrassed (7.1) (Table 6).

A total of 97.9% (279) respondents have received education on blood-borne diseases and 89.1% (254) have received education on universal precautions. Most of the respondents (83.5%) received their education on blood-borne diseases through formal lectures and books (78.1%). For universal precautions, the most quoted source of knowledge was other health care personnel (71.7%) followed by formal lectures (71.3%) and books (64.7%). However, very low percentage (47.7%) of medical students received their knowledge of universal precautions from formal lectures compared to doctors (81.8%) and nurses (80.7%).

The mean score for knowledge of blood-borne diseases is 34.48±2.95 (score range from 23 to 40). Medical officers obtained the highest mean score (36.22) compared to house officers (34.23), medical students (35.20) and nurses (33.78). The difference is statistically significant (p=0.0001). Non-Malay (Chinese, Indian and other ethnic groups) had a significantly higher mean score for knowledge of blood-borne diseases (35.05) compared with Malay (34.25) (p=0.039) and male obtained a higher score compared to female (p=0.037). The mean score for knowledge of universal precautions is 8.10±1.58 (score range from 4 to 12). There is no difference in the score when compared according to job category, gender and ethnic group (Table 7).

Respondents were asked how often they practice universal precautions. The result shows that the majority of respondents have the correct practices in universal precautions. However, there are still respondents who have the wrong practices such as recapping needle after use, bending needle after use, detaching needle from syringe after taking blood to transfer the blood from syringe to containers and throwing used needles and syringe into the normal dustbin. The mean score for practice of universal precautions among the respondents was 34.66±3.33. The score ranged from 23 to 40. Only 20 (7.0%) of the respondents obtained a full score of 40.

Doctors have more cases of needlestick injuries compared to nurses and medical students (p=0.001). Median duration for performing procedures seems to be longer for cases of needlestick injuries (120.0 minutes per week) compared to non-cases (100.0 minutes per week). However, the difference was not statistically significant (p=0.104) (Table 8). Most of the cases of needlestick injury have received education on blood-borne

Table 7 Score for knowledge of blood-borne diseases and universal precautions according to job category, gender and ethnic group

	Number	Mean score	Median score	p-value
		Blood-borne diseases		
Total	279	34.48±2.95	35.00	
Job category				
Medical officer	27	36.22±2.19	36.00	0.001
House officer	22	34.23±2.99	34.50	
Staff nurse	147	33.78±3.15	34.00	
Medical student	83	35.20±2.38	36.00	
Gender				
Male	46	35.33±2.41	36.00	0.037
Female	233	34.31±3.02	35.00	
Ethnic group				
Malay	201	34.25±3.01	34.00	0.039
Non-Malay	78	35.05±2.74	36.00	
		Universal precautions		
Total	254	8.10±1.58	8.00	
Job category				
Medical officer	27	8.37±1.93	8.00	0.100
House officer	17	8.88±1.32	8.00	
Staff nurse	145	7.93±1.47	8.00	
Medical student	65	8.17±1.68	8.00	
Gender				
Male	38	8.18±	8.00	0.650
Female	216	8.09±	8.00	
Ethnic group				
Malay	187	8.06±	8.00	0.977
Non-Malay	67	8.21±	8.00	

Table 8 Relationship between cases of needlestick injuries and influencing factors

Influencing factors	Cases	Non-cases	p-value
Job category			
Medical officer (n=28)	12	16	
House officer (n=22)	12	10	0.001*
Staff nurse (n=150)	28	122	
Medical student (n=85)	19	66	
Gender			
Male (n=47)	13	34	0.589
Female (n=238)	58	180	
Ethnic group			
Malay (n=206)	51	155	0.854
Non-Malay (n=79)	20	59	
Median duration for procedures (minute/ week)	120.0	100.0	0.104
Median score for knowledge of blood-borne diseases	35.0	35.0	0.447
Median score for knowledge of universal precautions	8.0	8.0	0.166
Median score for practice of universal precautions	34.0	35.0	0.015*

* $p<0.05$

Table 9 Linear regression showing the relationship between episodes of needlestick injury with possible associated factors

Factors	β-value	Standard error	p-value
Mean score of practice of universal precautions	−0.072	0.029	0.012
Mean score of knowledge of universal precautions	0.022	0.034	0.517
Mean score of knowledge of blood-borne diseases	−0.003	0.017	0.847
Duration of exposure (minutes/week)	7.67×10^{-4}	0.0001	0.051

diseases (98.6%) and on universal precautions (93.0%). The median score for knowledge of blood-borne diseases and universal precautions were similar for both cases and non-cases (Table 8). However, the median score for practice of universal precautions were lower in cases of needlestick injuries (34.0) compared to non-cases (35.0) and the difference was statistically significant (p=0.015) (Table 8).

To determine the relationship between episodes of needlestick injuries with the associated factors, linear regression was performed and the result is shown in Table 9. Linear regression test showed that there is a significant linear relationship between episodes of needlestick injures and the score for practice of universal precautions (β=–0.072, p value=0.012). This means the higher the score for practice of universal precautions, the lower the episodes of needlestick injuries. There were no linear relationships between episodes of needlestick injuries and duration of time spent doing procedures on patient in a week (β= 7.67×10^{-4}, p value=0.051), score for knowledge of blood-borne diseases (β=-0.003, p value=0.847) and score for knowledge of universal precautions (β=0.022, p value=0.517) (Table 9).

Discussion

This study showed that needlestick injuries are a potentially serious threat to health care workers. Of concern is the risk of exposure to blood-borne pathogens, including hepatitis B and C viruses (HBV and HCV) and human immunodeficiency virus (HIV). Ninety percent of the health care workers in this study reported HBV immunization. In the study by Norsayani et al. (4), the immunization rate was 93% and only 10.1% did not complete the 3 doses. However, in this study about 40% of the respondents did not complete the immunization schedule. This is of concern because this may result in an inadequate antibody response and as a result the health care workers are not fully protected. The respondents may also have a false sense of security and may not use appropriate prophylaxis after exposure to HBV. The study also showed that health care workers in the hospital, despite the awareness of HBV infection are noncompliant for HBV vaccination. This means that there is a need for a more aggressive approach to the vaccination of health care workers because a significant percentage of them are not fully protected.

Prevalence of exposure to body fluid was high where 39.3% of the respondents reported exposure to either blood or body fluid in the past one-year. Percutaneous injuries were more frequently reported than blood splashes to the eyes, nose or mouth as shown in this study. Prevalence of exposure to hollow-bore needles is the highest involving 23.5% of respondents, followed by mucocutaneous exposure (18.2%), open-skin exposure (7.7%) and exposure to sharp objects (e.g. suture needles, scalpel etc.) (6.7%). Yassi and McGill study also showed 82% of the reported accidental exposures were needlestick injuries, and 18% were cutaneous or mucous membrane splashes (5).

Hollow-bore needles accounted for the highest proportion of sharp object injuries in this study (46.0%), corresponding to findings in another study by Ng et al. (6). The prevalence of exposures of hollow-bore needlestick injuries was highest among house officer (50.0) followed by medical officer (35.7), staff nurse (18.0%) and medical students (22.4%). The prevalence of exposures of hollow-bore needlestick injuries among medical students in this study is equal to that shown in the study by Norsayani et al. where the prevalence rate was 20.9% (4). Hollow-bore needles (the type of needle used for giving injections or drawing blood) is important because they are implicated as the devices most often associated with the transmission of blood-borne pathogen infections (7).

In this study, prevalence of cases of needlestick injuries among the 285 respondents is 24.9%. It involves 71 cases i.e. 24 cases (48.0%) among doctors, 19 cases (22.4%) among medical students, and 28 (18.7%) cases among nurses. In term of episodes, there were a total of 174 episodes of needlestick injuries. Doctors have the highest prevalence of episode (146.0%) of needlestick injuries compared to nurses (50.7%) and medical students (29.4%). The same finding has been shown in a study by Newsom and Kiwanuka in a Ugandan teaching hospital which found that interns suffered more needlestick injuries than any other occupational group (8). However, in one study from Italy by Ippolito et al., where data regarding a total of 1,592 exposures reported in 1,534 workers, showed that nurses were the most commonly exposed hospital personnel (67.2%) followed by physicians and surgeons (17.5%) (1).

The differences in distribution of injuries among health care workers most likely reflect differences in level of exposure to the needlesticks. A study done by Naing et al. revealed that the prevalence of needlestick injury among medical students was 24.7% (9). The result showed a similar picture to the prevalence of injuries among student health care workers in this study. Medical students generally were at somewhat lower risk compared with medical officers and house officers. This result illustrates the importance of targeting prevention efforts to specific groups, such as doctors.

Since the study depends on the respondents to recall cases and episodes of needlestick injuries in the past year, this may result in recall bias as respondents may not be able to remember. They may give socially desirable responses especially when asked about practice of universal precautions. Hence, the results in this study must be interpreted with consideration of recall bias and socially desirable response as reports of occupational exposures and infection control practices may not be accurate.

The median time spent doing procedures on patients in a week for all respondents was 110.0 minutes per week. Median time spent doing procedures for doctors were 147.5 minutes, nurses 100.0 minutes and medical students 100.0 minutes. Doctors (medical officers and house officers) spent significantly more time doing procedures compared to staff nurses and medical students ($p<0.05$) and they also had more episodes of needlestick injuries.

The commonest cause of episode of needlestick injury was during the process of venepuncture (41.1%). Twenty percent of the reported episodes of needlestick injuries when taking blood were due to recapping the needle. This figure is still high considering that recapping of needles should be prohibited. In another study among medical students, 92% of the needlestick injuries occurring during venepuncture were also due to recapping of the needle (9). A study carried out by Jagger et al. showed similar findings where one third of the injuries were related to recapping of used needles (10). Heald and Ransohoff reported that recapping of needles was the cause of needlestick injury in 38% of non-surgical residents (11). Competing hazards were often cited as reasons for recapping (10). They included the risks of disassembling a device with an uncapped, contaminated needle and the difficulty of safely carrying several uncapped items to a disposal box in a single trip. Devices should be designed so that the worker's hand remain behind the needle as it is covered, the needle should be covered before disassembly of the device, and the needle should remain covered after disposal (12). Safety devices have been demonstrated to reduce needlestick injuries by 23–85% (11, 13).

Thirty eight percent of the needlestick injury cases did not wear gloves and gave reasons like in a hurry, uncomfortable wearing gloves, not able to palpate the pulses, lazy, unnecessary because patient not high risk, allergic to rubber gloves, no more gloves and no suitable size. Gloves protect against blood and body fluid skin contamination and reduce the volume of material transferred to the skin in case of needle stick. They should be worn by all health care workers when exposure to blood or body fluid is anticipated.

Only 22.4% of all episodes of needlestick injuries were reported by those reporting. The episodes reporting rate is much lower than the cases reporting rate (22.4% versus 40.8%) because many respondents in this study had been exposed more than once and did not report all their injuries. The results of the episodes reporting rate in this study are higher than previously documented rates by Resnic and Noerdlinger (11.2%) and O'Neill et al. (9%) (13, 14). In Malaysia Ministry of Health hospitals, all cases of needlestick injury must be reported within 24 hours to the Head of Department or the Infection Control Team or to the Safety and Health Committee (15). However, this is just a guideline for health care workers and reporting is purely voluntary. Hence, the prevalence of reported and non-reported sharps injuries remains uncertain. Until health care workers acknowledge the importance of reporting such incidents, the size of the problem cannot be accurately determined.

For those who did not report, the main reason given was because "the patient's blood and body fluid could not be contaminated". The reason "not infectious" was also quoted by Resnic and Noerdlinger as one of the main reason for not reporting (13). The implication of this result is that a large segment of individuals exposed to sources with unknown HIV status are making the judgment that the patient is in fact HIV negative. This is contradictory to the principles of universal precautions, mandating that all patients be considered infectious. The concept of universal precautions i.e. all patients should be treated as infective using appropriate infection control procedures, because infected patients cannot always be identified is very important to prevent infection (16).

The "prevalence was not important or insignificant", "worried about future consequences if known by administration", "too complicated and too many forms to fill when reporting", "embarrassed", and "it was only a minor injury" were the other reasons given. Reasons stated for not reporting injuries indicate a need for continued education in the risk of acquiring blood-borne pathogens from such injuries. Some of them did not know that needlestick injury needs to be reported and did not know to whom and how to report. In this study, the reports were made to various people including the Sister-in-charge of ward, Head of Department, nurses, specialist and house officer. This shows the lack of clear guidelines on how reporting of cases should be done and to whom they should report to. This findings also agree with previous studies by Norsayani et al., O'Neill et al. and Resnic et al. that students frequently cited "did not know how to report" as a reason for not reporting (4, 13, 14). This result highlights the need for educating the new members of clinical teams and medical students on the procedures for reporting exposures. Efforts may need to be made to simplify the reporting process. Hospital may be able to increase rates of reporting of percutaneous exposure to blood by developing programs that are easy to access and efficient.

In this study, medical officers and house officers form the largest group that underreports episodes of needlestick injuries (at 87.8% and 75.0% respectively). The rate of underreporting for nurses is 80.3% and for medical students is 56.0%. Health care workers, especially doctors, may not report needlestick injuries if they fear that their medical practice would be affected if they contract an infectious illness and that information becomes public.

Less than half (47.7%) of the medical students obtained their knowledge on universal precautions from formal lectures. This is low compared to another study where 77.5% of the students acquired their knowledge through formal lectures (4). Their main source of knowledge (71.0%) appears to be from other health care personnel (informal). More emphasis should be given to the teaching and training of universal precautions through formal lectures to the medical students to ensure students understanding of the universal precautions guidelines. Ideally this should be given in their pre-clinical years before they start performing procedures on patient.

In this study, the median score on practice of universal precautions among the respondents was 35.00. Only 7% of the respondents obtained a full score of 40. Although the scores are average on the whole, however it can be considered low for the respondents as all of them are health care workers working in a high-risk environment. They should all score the perfect score of 40 which means that they should practice universal precautions at all times and not take any risk. Even a small mistake can lead to risk of needlestick injury. This finding is consistent with that of O'Neill et al., who found that less than half of the respondents used universal precautions all the time (14).

There is also still a large percentage of the respondents who still have the wrong practice of universal precautions. Generally, recapping of needles by health care workers is not recommended and prohibited. Education of health care workers about occupational risks and adherence to universal precautions in infection control are important to prevent exposure to blood-borne pathogens.

Knowledge of blood-borne diseases and universal precautions did not seem to influence cases of needlestick injuries. There was no difference in the median score of knowledge on blood-borne diseases and universal precautions between cases and non-cases of needlestick injuries. However, this does not mean that education on blood-borne diseases and universal precautions can be neglected. Knowledge of both these subjects is very important and can lead to increase compliance with practice of universal precautions. The median score for practice of universal precautions is lower for cases of needlestick injuries compared to non-cases. This finding supports the authors hypothesis that the score for practice of universal precautions is lower among cases of needlestick injuries compared to non-cases.

Conclusion

This study showed that health care workers are at high risk of needlestick injuries. This is shown by the high prevalence of cases and episodes of needlestick injuries among the medical officers, house officers, nurses and medical students. The main reason is because they do not fully practice universal precautions although they have adequate knowledge of it. Rate of underreporting is also very high among the health care workers.

Several areas of concern related to health workers' occupational health warrants further emphasis. There is a need to ensure all health care workers complete the 3 doses hepatitis B immunization. All health care workers must be properly trained in infection control, for example, on the safe use and disposal of needles and sharps at the earliest opportunity. Universal precautions should be included in the training curriculum of medical students and nurses. Modification of work practices such as appropriate handling of needles, the adoption of the concept of universal precautions, and compliance with use of personal protective barriers should be emphasized. Procedures for reporting of needlestick injuries should strengthened and made very clear to all health care workers. Health care workers should also be encouraged to report any hazards from needles they observe in their work environment.

Acknowledgments

We would like to thank Professor Paul C.Y. Chen, Director and the staff of Seremban Hospital, our research assistants and all the study participants for their help and support and International Medical University for providing the research fund.

References

(1) Ippolito G, Puro V, De Carli G. The risk of job occupational human immunodefiency virus infection in health care workers. Italian Multicenter Study. The Italian Study Group on Job occupational Risk of HIV infection. Arch Intern Med. 1993; 153: 1451–1458.

(2) International Health Care Worker Safety Center. Exposure Prevention Information Network (EPINet) Data Reports. Charlottesville: University of Virginia. (online), 1998. http://www.med.virginia.edu/medcntr/centers/epinet/estimates.html (3 January 2003).

(3) Perry J. CDC Releases National Needlestick Estimates. Advances in Exposure Prevention 2000; 5: 19. (online) http://www.med.virginia.edu/medcntr/centers/epinet/cdcestim.html (6 January 2003).

(4) Norsayani MY, Noor Hassim I. Study on incidence of needle stick injury and factors associated with this problem among medical students. J Occup Health. 2003; 45: 172–178.

(5) Yassi A, McGill M. Determinants of blood and body fluid exposure in a large teaching hospital: hazards of the intermittent intravenous procedure. Am J Infect Control. 1991; 19: 12–135.

(6) Ng LN, Lim HL, Chan YH, Bachok D. Analysis of sharps injury occurrences at a hospital in Singapore. Int J Nurs Pract. 2002; 8: 274–281.

(7) CDC (Centers for Disease Control and Prevention). Preventing Needlestick Injuries in Health Care Settings. DHHS (NIOSH) Publication No. 2000–108. 1999. http://www.cdc.gov/niosh/pdfs/2000-108.pdf

(8) Newsom DH, Kiwanuka JP. Needle-stick injuries in an Ugandan teaching hospital. Ann Trop Med Parasitol. 2002; 96: 517–522.

(9) Naing NN, Ahmad Z, Kamaruzzaman I. Puncture injuries during undergraduate medical training. Journal of Islamic Medical Association 1999; 31: 270–273.

(10) Jagger J, Hunt EH, Brand-Elnaggar J, Pearson RD. Rates of needlestick injury caused by various devices in a university hospital. N Engl J Med. 1988; 319: 284–288.
(11) Heald AE, Ransohoff DF. Needlestick injuries among resident physicians. J Gen Intern Med. 1990; 5: 389–393.
(12) CDC (Centers for Disease Control and Prevention). Immunization of health care workers: recommendations of the Advisory Committee on Immunization Practices (ACIP) and the Hospital Infection Control Practices Advisory Committee (HICPAC). MMWR 1997; 46: 1–42.
(13) Resnic FS, Noerdlinger MA. 1995. Job occupational exposures among medical students and house staff at a New York City Medical Center. Arch Intern Med. 1995; 155: 75–80.
(14) O'Neill TM, Abbott AV, Radecki SE. Risk of needlesticks and job occupational exposures among residents and medical students. Arch Intern Med. 1992; 152: 1451–1456.
(15) Ministry of Health Malaysia. Incidence rate of needlestick injuries among health care workers within the Ministry of Health. Quality Assurance Indicator; Dec 1998.
(16) Department of Health. Standard principles for preventing hospital-acquired infections. J Hosp Infect. 2001; 47 (Supplement): S21–S37.
Available online at http://www. needlestickforum.net/6bestprac/pdfs/EPIC-Standard-Principles-HAI.pdf (5 October 2004)