ORIGINAL ARTICLE

NEEDLESTICK INJURY CASES AND ADHERENCE TO THE FOLLOW-UP PROTOCOL AMONG HEALTHCARE WORKERS IN SELANGOR

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ABSTRACT

Needlestick injury (NSI) is a serious occupational hazard against healthcare workers (HCWs) in a hospital setting with multiple implications, thus adherence to post-NSI management including follow-up protocol is crucial.This research was conducted to describe the distribution of NSI cases among HCWs working in Ministry of Health Malaysia (MOH)'s hospital in Selangor and adherence to a follow-up protocol, as well as the factors related to it.This was a cross-sectional quantitative study reviewing retrospectively all notified NSI cases in January-September 2016. Data were taken from Sharps Injury Surveillance (SIS) system and analyzed into descriptive and analytical statistics.There were 143 notified NSI cases. The majority of the cases were female (76.2%), Malay(60.1%), medical doctors(56.6%) and in a medical-based department (44.8%). The median age of NSI cases was 27 years old (IQR:5) and median years of employment was 1.5 (IQR:4.5). Most cases happened in a ward setting (58.7%) involving contaminated (95.8%) hypodermic needle (43.4%), occurred mostly during the procedure of drawing blood (23.1%). Only86.7% of NSI cases were source-known and some were tested positive with blood borne pathogens. However, no occurence of seroconversion among the injured HCWs detected. The overall adherence rate to the follow-up protocol was 72.3%. Multiple logistic regression yielded significant association between age, gender, department, device contamination, procedure conducted and source HBV status with adherence to follow-up of post-NSI protocol. Further comprehensive studies involving more determinants such as therapy-related factors and potential interventions are needed to optimize adherence rate to the follow-up protocol post-NSI.

Keywords: guideline adherence, needlestick injuries, health personnel, post-exposure prophylaxis, blood-borne pathogens

INTRODUCTION

Needlestick injury (NSI) is a significant occupational hazard threatening healthcare workers (HCWs) in the hospital setting[1]. Ministry of Health Malaysia(MOH) refers NSI to injury caused by hollow-bore or suture needle[2], whereas sharp injury may also include other types of needle, broken glass, and other sharp devices[3]. NSI has a potential to introduce hazardous materialinto the body of HCWs during workand it is the most frequent route of occupational bloodborne pathogen exposures[4-5].

Globally, the prevalence of NSI ranged from 20.9% to 77.0%, depending on the exposure risk[6-10], with underreporting rate ranged from 9.6% to 60.0%[8-9, 11-14].It is estimated that 385,000 sharp injuries are sustained by HCWs in the hospital settingseach year in the United States[11],however other workplace settings were not included. In Malaysia, NSI contributes to a total of 74.9% of all reported injuries among MOH personnel[3].

There are multiple implicationsof NSI. Physically, HCWscould sustain pain and bleeding. Biologically, numerous dangerous pathogens can be transmitted through NSI[15-16], particularlyHuman Immunodeficieny Virus (HIV), Hepatitis B Virus (HBV) and Hepatitis C Virus (HCV). The estimated risk of seroconversion following percutaneous injuryvaries for HIV (0.3%), HBV (30%) and HCV (1.8%-3.0%)[17]. Other potentially-transmitted pathogensfollowing NSI includes tuberculosis, diphtheria, herpes, and malaria[18-19]. Psychologically, those sustained NSI may exhibit anxiety[20] and depressive[21] symptoms or develop post-traumatic stress disorder and adjustment disorder[22]. The economic implicationsinclude direct cost for post-exposure management, and indirect cost such as lost of productivity[23]. Fortunately, the majority of NSI cases are preventable[24].

Post-NSI management is important, particularly follow-up protocol at 6 weeks, 3 months and 6 months[3] to enable early management of complications because the efficacy of post-exposure treatment correlate positively with the completion of follow-up[25]. During follow-up, blood tests of anti-HIV, HbsAg and anti-HCV are taken to look for any seroconversion.

Worldwide, burden of NSI, risk factors, implications, risk assessment and prophylaxis as well as treatment were extensively studied, but

limited research on the adherence to the follow-up of post-NSI protocol was found. With adherence to follow up, seroconversion status and other complications could be detected earlier for immediate further management. Thus,this study was carried out to describethe distribution of NSI cases among HCWsat public hospitals in Selangor, Malaysia and adherence to the follow-up of post-NSI protocol, as well as the associated factors related to such adherence.

METHODOLOGY

Study design and population

This is retrospective review of all 143 notified NSI casesamong HCWs via Sharps Injury Surveillance (SIS) System[3]in January-September2016 involving all 12 public hospitals under MOH in Selangor, Malaysia.

SIS forms consist of 4 different sections.SIS-1 contains socio-demographic, job-related and incident-related data while SIS-2a contains risk-related data such as source's bloodborne disease serology. Both sections were used as independant variables. SIS-2b, which is only applicable to HCWs who sustained sharps injury with contaminated devices, contains data on follow-up at 6 weeks, 3 months and 6 months post-NSI. This section was used as dependant variable. SIS-3 contains data on occupational intervention ifseroconversion occured. This section was not applicable due to no seroconversion has been detected.

Operational definition

In this study, HCWs were defined as workers who are employed by MOH[2] under the permanent scheme, and were exposed to risks of NSI in the occupational settings at all 12 public hospitals in Selangor. HCWs included medical doctors, nurses, assistant medical officers, pharmacists, dentists, health attendants, medical lab technologists, dental surgery assistants and drivers. Outsourced staff, students, patients, relatives and visitors were excluded due to inconsistent exposure to needle-related procedure at particular workplace which may cause heterogeneity to the study population characteristics.

NSI was defined as percutaneous injury caused by all types of needles[3]. Non-needle sharps injury was excluded.

Adherence to follow-up was defined as attending all three follow-ups at 6 weeks, 3 months and 6 months post-NSI.

Data collection

The originally-filled SIS notification form were validatedmanually to minimize error by ensuringcorrect format and data completeness. Incomplete responses were minimized by contacting officer-in-charge at respective hospitals and injured HCWs by phone or electronic mail.Responses from SIS notification form were categorized and coded. Before analysing, data cleaning was done. Data verification was performed by checking back the form for any query.

Data analysis

Data were analyzed by using SPSS version 21. Univariable data were analyzed and presented descriptively as median and interquartiles range (IQR) or frequencies and percentages.

Bivariable data were analyzed to test the association of socio-demographic, job-related and incident-related factors with adherence to follow-up by using simple logistic regression. Data were presented as crude odds ratio (OR) and p-value.

Multiple logistic regression analysis were conductedto identify predictors of adherence to follow-up. All independant variables were initially included and elimination was done by backward stepwise likelihood ratio (LR) test. There were no interaction and multicollinearity detected. Next, Hosmer-Lemeshow goodness-of-fit test was conducted to assess the model fitting. Data were presented as adjusted OR and p-value. Significant level was set at $p<0.05$.

RESULT

There were 143 notified NSI cases among HCWs from January 2016 till September 2016 (Table 1) out of 17,589 HCWs. Prevalence rate of reported NSI cases was 8.13 in 1,000 HCWs during that period. Unreported NSI cases were not included in the numerator.

Out of 143 cases, there were 141 cases involving contaminated and presumed contaminated device which required follow-up at 6 weeks, 3 months and 6 months post-NSI with overall adherence rate of 72.3% and no seroconversion was detected (Table 2). Another 2 cases were discharged after risk assessment in view of negligible risk of seroconversion as it involves uncontaminated needles.

There were varying degrees of adherence for each variable (Table 3).

When other variables were controlled, there were significant association between age, gender, department, device contamination, procedure conducted and source HBV status with adherence to follow-up post-NSI protocol (Table 4).Those aged 30-34 years old significantly has lesser odds to adhere than those aged ≥35 years old. Female significantly has 3.43 times higher odds to adhere than male. Those in medical-based departments significantly have9.13 times higher odds to adhere than other departments. Those cases involving confirmed contaminated device significantly has 53.01 times higher odds to adhere than presumed contaminated devices. Those cases related to injection, drawing blood sample, suturing and setting-up IV access significantly have lesser odds to adhere than other procedures. Cases related to source with HBV non-positive significantly has 4.70 times higher odds to adhere than positive HBV status.

Table 1: Socio-demographic and job-related characteristic of NSI cases

Variables (N = 143)	Frequency(n)	Percentage (%)	Median	IQR[a]
Age, years[b] (range: 21-51)			27.0	5.0
≤24	32	22.4		
25-29	74	51.7		
30-34	26	18.2		
≥35	11	7.7		
Employment duration, years (range: 0.1-26.0)			1.5	4.5
≤3[c]	95	66.4		
4-9	35	24.5		
≥10[d]	13	9.1		
Gender				
Male	34	23.8		
Female	109	76.2		
Ethnic				
Malay	86	60.1		
Non-Malay	57	39.9		
Departments				
Medical-based	64	44.8		
Internal Medicine	51	35.7		
Paediatric	6	4.2		
Intensive Care	7	4.9		
Surgical-based	49	34.3		
Surgery	14	9.8		
Orthopaedic	12	8.4		
Obstetrics and Gynaecology	12	8.4		
Dental	5	3.5		
Ophthalmology	4	2.8		
Operating Theatre	2	1.4		
Others	30	21.0		
Job category				
Medical Doctors	81	56.6		
House Officer	46	32.2		
Medical Officer	31	21.7		
Medical Specialist	4	2.8		
Nurses	39	27.3		
Others	23	16.1		

[a] *Interquartile range*
[b] *Grouping based on significant association findings between age group and prevalence of NSI*[26]
[c] *Maximum probation period for public servants in Malaysia*
[d] *Working in health services more than 10 years is a major risk factor associated with NSI*[27]

Table 2: Distribution of NSI cases and management

Variables (N = 143)	Frequency (n)	Percentage (%)
Duration of reporting[a]		
≤24 hours	137	95.8
>24 hours	6	4.2
Location of injury		
Ward setting	84	58.7
Non-ward setting	59	41.3
Mechanism of injury		
Handling-related	99	69.2
Inserting, manipulating or withdrawing needle	32	22.4
Suturing	15	10.5
Pricked by other people during co-handling	15	10.5
Recapping	10	7.0
Others	27	18.9
Disposal-related	44	30.8
Type of device		
Hypodermic needle	62	43.4
Intravenous catheter stylet	30	21.0
Suture needle	27	18.9
Others	24	16.8
Device contamination		
Contaminated	137	95.8
Unknown (presumed contaminated)	4	2.8
Not contaminated	2	1.4
Procedure conducted		
Drawing blood sample	33	23.1
Setting-up intravenous (IV) access	28	19.6
Injection	26	18.2
Suturing	25	17.5
Others	31	21.7
Source		
Has source[b]	141	98.6
Known	124	86.7
Unknown	17	11.9
No source	2	1.4
Source status[c]		
HIV positive	12	8.5
HBV positive	11	7.8
HCV positive	16	11.3
Adherence to follow-up[c]		
Adhere at 6 weeks post NSI	120	85.1
Adhere at 3 months post NSI	116	82.3
Adhere at 6 months post NSI	116	82.3
Overall adherence to follow-up[c]		
Adherence[d]	102	72.3
Non-adherence	39	27.7
Seroconversion		
Has seroconversion	0	0.0

[a]*Categorization is based on requirement to report within 24hours post-NSI*[3]
[b]*All contaminated and presumed contaminated device were categorized as having source*
[c]*Thedenominator is number of cases with contaminated device (n=141)*
[d]*Attending all three follow-ups at 6 weeks, 3 months and 6 months post-NSI*

Table 3: Distribution of adherence to follow-up post-NSI

Variables(N = 141)		Adherence to follow-up protocol	
		Adherence n (%)	Non-adherence n (%)
Age, years	≤24	25 (78.1)	7 (21.9)
	25-29	52 (72.2)	20 (27.8)
	30-34	15 (57.7)	11 (42.3)
	≥35	10 (90.9)	1 (9.1)
Employment duration, years	≤3	71 (76.3)	22 (23.7)
	4-9	20 (57.1)	15 (42.9)
	≥10	11 (84.6)	2 (15.4)
Gender	Male	20 (60.6)	13 (39.4)
	Female	82 (75.9)	26 (24.1)
Ethnic	Malay	60 (69.8)	26 (30.2)
	Non-Malay	42 (76.4)	13 (23.6)
Departments	Medical-based	52 (81.3)	12 (18.8)
	Surgical-based	31 (63.3)	18 (36.7)
	Others	19 (67.9)	9 (32.1)
Job Category	Medical doctors	56 (69.1)	25 (30.9)
	Nurses	28 (71.8)	11 (28.2)
	Others	18 (85.7)	3 (14.3)
Duration of Reporting	≤24 hours	97 (71.9)	38 (28.1)
	>24 hours	5 (83.3)	1 (16.7)
Location of Injury	Ward	62 (73.8)	22 (26.2)
	Non-ward	40 (70.2)	17 (29.8)
Mechanism of Injury	Handling-related	69 (71.1)	28 (28.9)
	Disposal-related	33 (75.0)	11 (25.0)
Type of Device	Hypodermic needle	47 (77.0)	14 (23.0)
	IV catheter stylet	17 (56.7)	13 (43.3)
	Suture needle	17 (63.0)	10 (37.0)
	Others	21 (91.3)	2 (8.7)
Device Contamination	Contaminated	99 (72.3)	38 (27.7)
	Unknown (presumed contaminated)	3 (75.0)	1 (25.0)
Procedure Conducted	Injection	18 (69.2)	8 (30.8)
	Drawing blood sample	26 (78.8)	7 (21.2)
	Suturing	15 (60.0)	10 (40.0)
	Setting-up IV access	16 (57.1)	12 (42.9)
	Others	27 (93.1)	2 (6.9)
Source	Known	88 (71.0)	36 (29.0)
	Unknown	14 (82.4)	3 (17.6)
Source HIV status	Positive	8 (66.7)	4 (33.3)
	Non-positive	94 (72.9)	35 (27.1)
Source HBV status	Positive	6 (54.5)	5 (45.5)
	Non-positive	96 (73.8)	34 (26.2)
Source HCV status	Positive	10 (62.5)	6 (37.5)
	Non-positive	92 (73.6)	33 (24.6)

Table 4: Factors associated with adherence to the follow-up of post-NSI protocol among cases with contaminated device

Variables (N = 141)	SIMPLE LOGISTIC REGRESSION		MULTIPLE LOGISTIC REGRESSION	
	Crude OR	P-value[a]	Adjusted OR	P-value[a]
Age, years		0.141		0.013*
≤24	0.357	0.363[b]	0.073	0.062[b]
25-29	0.260	0.213[b]	0.076	0.051[b]
30-34	0.136	0.076[b]	0.016	0.004[b]*
≥35	Ref.		Ref.	
Gender				
Male	Ref.		Ref.	
Female	2.615	0.000*	3.431	0.029*
Departments		0.085		0.019*
Medical-based	2.053	0.163[b]	9.130	0.006[b]*
Surgical-based	0.816	0.685[b]	3.949	0.083[b]
Others	Ref.		Ref.	
Device Contamination				
Contaminated	0.868	0.903	53.011	0.042*
Unknown (presumed contaminated)	Ref.		Ref.	
Procedure Conducted		0.009*		0.008*
Injection	0.167	0.034[b]*	0.016	0.003[b]*
Drawing blood sample	0.275	0.128[b]	0.025	0.008[b]*
Suturing	0.111	0.009[b]*	0.007	0.001[b]*
Setting-up IV access	0.099	0.005[b]*	0.008	0.000[b]*
Others	Ref.		Ref.	
Source HBV status				
Positive	Ref.		Ref.	
Non-positive	2.353	0.180	4.701	0.043*

Nagelkerke R Square: 0.372
 # Only significant Crude OR and Adjusted OR were presented in Table 4
[a]Likelihood Ratio (LR) test;[b]Wald test
** Statistical significance at p<0.05*

DISCUSSION

Median age and employment duration in the present study showed that NSI cases occurred mostly among junior personnel, particularly medical doctors and nurses, as discussed in other studies[4, 14, 26, 28].They tend to be involved in routine needle-related procedures such as venepuncture, setting-up IV access and injections in ward setting while relatively having lesser skills and experiences. There is a significant association between age and adherence to follow-up, as demonstrated in other studies[29]. Those aged 30-34 years old has significantly lesser odds to adhere than those aged ≥35 years old, probably due to younger HCWs have other commitments in daily life[30] such as tight work schedule and living with small children that they may not be able to spend time for clinic appointments.

Majority NSI cases in our study occurred among female which consistent with many studies worldwide[4, 6, 28, 29, 31]. It could be explained by higher proportion of female HCWs at risk in hospitals, particularly nurses. Male HCWs has significantly lower odds to adhere, consistent with one study[29] which was possibly due to traditional masculinity trait which has less health-seeking behaviour.

Most of our NSI cases involved Malay ethnic, which were consistent with previous study in Malaysia[26]. It was probably due to higher proportion of Malay-ethnic HCWs, as Malay is the majority ethnic in Selangor and Malaysia[32]. There was no association between ethnic and adherence to follow-up and no other studies to be compared with due to limited similar research in Malaysia.

Medical doctors constituted majority of the NSI cases, as were consistently reported by other studies in Malaysia[6, 13, 33]. However, international studies found that nurses were the most affected by NSI[5,34], probably because their job scope was different as compared to Malaysia healthcare system. Both professions tend to work long hours with rotating shift work which have been implicated in increasing the NSI[35].Our study found no significant association between job category and adherence to follow-up, as was also shown in other study[29].

Majority NSI cases occurred during procedures of drawing blood sample, setting-up IV access, suturing and injection, which involved handling of hypodermic needles, IV catheter stylets and suture needle. These findings were consistent with other previous studies locally[26, 33]and internationally[14, 31, 36]. In Malaysia's hospital settings, the first three procedures are generally performed by junior medical doctors, while injection is mostly done by nurses except for local anaesthesia[33]. Those involved with these four procedures have significantly lesser odds to adhere to follow-up protocol. This was probably due to desensitization of HCWs to the risk of seroconversion because although these devices had caused a majority of NSI cases previously, there were no seroconversion cases ever detected in Selangor. However other related study did not evaluate this association[5, 29].

Most NSI cases happened among HCWs from medical-based department in the ward setting, consistent with other studies[26, 28, 36]. These were probably due to higher exposure to needle-related procedures[37].HCWs who work in medical-based departments significantly had higher odds to adhere to follow-up, probably due to higher knowledge and perception of transmission risk of blood borne disease. However, there were no published studies that evaluate knowledge and perception of transmission risk of blood borne disease stratified based on departments to support our postulation.

As the majority of the cases occurred during or after the procedures, 95.8% cases in our study involved contaminated needles, as shown in other previous studies[4, 28, 31]. This may be partially contributed by perception of no risk of blood borne disease transmission and self-voluntary reporting system[3].Those NSI cases involving known contaminated needle significantly had higher odds to adhere to follow-up than presumed contaminated needle. This is probably due to relatively higher perception on risk of complications compared to presumed contaminated device.

There was only 86.7%NSI cases were source-known and some were seropositive with HIV, HBV and HCV, almost similar with other studies in Hong Kong[4].There were more than one third of NSI cases with seropositive source that did not adhere to follow-up, consistent as in other study[5]. We found no association between known source and seropositivity with adherence to follow-up except for source HBV seropositive, which conflicting with two studies conducted in a relatively more homogenous setting with larger number of NSI cases[28-29]. NSI cases involving source with HBV positive has lesser odds to adhere to follow-up, probably due to perceived low risk of seroconversion contributing by implementation of Hepatitis B vaccination programme among HCWs in Malaysia and national Hepatitis B vaccination programme.

There was slight reduction of adherence from 6 weeks to 3 months and 6 months. Overall adherence rate was better than other studies[14, 28-29]. We did not explore the reason for non-adherence but other studies found that it was due to busyness and forgetfulness[14, 28].

There was no case of seroconversion detected, similar with other study in Hong Kong[4]. It was probably due to good national Hepatitis B vaccination programme and Hepatitis B vaccination programme among HCWs at risk as well as effective identification of high risk NSI cases for early post-exposure prophylaxis management. However, the data on post-exposure management and prophylaxis were not sufficient to be analysed in present study to support this postulation.

There are some limitations in this study. First, data were collected only from hospitals under MOH, thus the result cannot be generalized to all healthcare institution. Second, hospitals under MOH setting in actual havesome degree of heterogeneity in specialization, workload, resources and management system, thus could affectrisk rating of NSI, its burden and post-injury protocol adherence. Third, this study only considered notified NSI cases but in actual the under-reportingrate should be acknowledged.Fourth, there were limited data due to its retrospective review, for example no data were obtained regarding method of ensuring adherence to follow-up and reasons for non-adherence. Fifth, due to the same reason, most of the discussion showed comparison in term of count, proportion and percentage which does not reflect true magnitude of NSI, thus proper comparison with other study or time period could not be achieved.Sixth,we only studied part of thesocio-demographic, job-related, and incident-related factors, but in theory there are fivemain determinants including therapy-related and health system-related.

CONCLUSION

There werenumbers of NSI cases and non-adherence to follow-up protocol with some significant associated factors although no seroconversion were detected. Further comprehensive study is needed to identify all other relavant factors such as therapy-relatedfactors and determine appropriate intervention to ensure adherence to follow-up. We suggest for multicenter studies in Malaysia with larger sample size and mixed method to get better precision as well as identifying possible reason for non-adherence to enable planning and implementation of better public health preventive measures at all levels.

ACKNOWLEDGEMENTS

The authors wish to thank Occupational Health Unit at respective hospitals and Selangor State Health Office in providing assistance in this study.We would also like to thank the Director General of Health Malaysia for his permission to publish this article (NMRR-17-1341-36816)

COMPETING INTEREST

There is no conflict of interest.

FUNDING SOURCE

None

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