

Field Study

Prevalence and risk factors of needle stick and sharp injury among tertiary hospital workers, Vientiane, Lao PDR

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Abstract: Objectives: Health care workers (HCWs) face risks of needle stick and sharp injuries (NSIs). Most NSIs occur in developing countries, however, no epidemiological study on NSIs is publicly available in Lao PDR. The objective of this study is to identify the prevalence and risk factors of NSIs among HCWs in Lao PDR. **Methods:** This cross-sectional study was designed to determine the prevalence and risk factors of NSIs among four tertiary hospitals in Vientiane, Lao People's Democratic Republic. **Results:** Six months before the survey, 11.4% (106/932) of hospital staff had experienced NSIs, while 42.1% did in their entire career. Key protective factors of NSIs among nurses included adequate availability of needles, syringes, and sharp equipment ($p = 0.042$; odds ratio [OR], 0.47) and attendance to educational or refresher courses on safety regarding NSIs ($p = 0.038$; OR, 0.50). As an on-site practice, single-handed recapping was prevalent (46.7%, 257/550) among participants. **Conclusions:** The result showed that high rates of NSIs persist among HCWs. The findings of this research call for comprehensive health and injection safety programs for HCWs involved in clinical practice.

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Key words: Health Care Workers, Lao PDR, Needle stick and sharp injury, NSI, Occupational health, Tertiary hospital

Introduction

Transmission of blood borne pathogens by means of unsafe injection practices is drawing attention, especially in developing countries¹⁾. Injections are one of the most common health care procedures, with some 16 billion injections administered worldwide each year. Most injections (90%) are given for therapeutic purposes, and only 5% are given for immunization¹⁾. Health care workers (HCWs) face occupational risks of needle stick and sharp injuries (NSIs), which are potentially occupationally acquired viral infections such as hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV)²⁻⁷⁾. The World Health Organization (WHO) estimated that approximately 40% of HBV and HCV infections and 2.5% of HIV infections among healthcare workers around the world are due to NSIs⁸⁾.

Safety-engineered equipment and better management of working conditions have reduced NSIs⁹⁻¹²⁾. However, low budget allocations to health sectors, especially in developing countries, predispose HCWs to inadequate manpower and safety and protective equipment shortages that comprise poor and hazardous working environments^{11,13,14)}. The WHO estimated that >90% of NSI-related infections occur in developing countries⁸⁾.

The Lao People's Democratic Republic (Lao PDR) is a landlocked country in Southeast Asia bordered by Vietnam, China, Myanmar, Cambodia, and Thailand. The Lao PDR government developed the National Poverty Eradication Program in 2003. As in many other developing countries, Lao PDR spent only 1.5% of its gross domestic product on health in 2006. A previous study warned that newly introduced safety syringes posed infectious hazards to healthcare workers and community residents since appropriate waste disposal systems were not sufficiently

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laid out¹⁵). Anecdotal evidence suggested that poor injection practices were rampant; however, no epidemiological study on NSIs is publicly available in Lao PDR. The objective of this study is to identify the prevalence and risk factors of NSIs among hospital staff in Lao PDR.

Methods

Study site

A cross-sectional study was conducted at four of six tertiary hospitals in Vientiane Capital, Lao PDR: Mahosot Hospital, Sethathirath Hospital, Friendship Hospital, and Mother & Children Hospital. Two facilities, a military and police hospitals, were not able to participate in this study. Mahosot Hospital, Sethathirath Hospital, and Friendship Hospital provides emergency medicine and general practice with 450, 220 and 250 of hospital beds, respectively¹⁶. The annual number of out-patients, emergency patients, and in-patients of these hospitals was respectively (414,486: 55,264: 18,982), (66,404: 13,146: 16,258) and (129,331; 13,114; 42,471) in this order in 2013¹⁶. Maternal and child health service is provided by all of the four hospitals, however, mainly provided by Mother & Children Hospital¹⁶.

In HCWs working for public sectors in entire Lao PDR were 1,211 medical doctors, 1,449 auxiliary doctors, 125 advanced level nurses, 1,008 mid-level nurses, and 3,835 primary level nurses in 2010¹⁷. There were 90 medical doctors and 118 nurses in Sethathirath Hospital in 2002¹⁸.

Data collection

Data were collected from May to June 2006 through interviews. We invited all full-time equivalents and sub-official hospital staff members in the four hospitals, including non-medical staff members such as cleaners, to participate. Interns and volunteers were not included because their total numbers were not available.

The questionnaire addressed the following: 1) socio-demographic characteristics; 2) participants' injection practices; and 3) experience/incidents of NSIs. Participants' injection practices were based on a published questionnaire of WHO, 'Injection Practices: Rapid Assessment and Response Guide,' which was applied in more than 20 countries¹⁹.

Five native Lao interviewers were trained to conduct the interviews, which was supervised by the principal author. Before the interviews, the interviewers individually informed participants of the study objectives and ensured their confidentiality. Subjects who agreed and willingly provided written informed consent participated in this study. The study obtained ethics approval from the Research Ethics Committees at the University of Laos and Graduate School of Medicine, the University of Tokyo.

Data analysis

Data were analyzed with IBM SPSS Statistics 21. NSIs in the past 6 months were the dependent variable in this study. A logistic regression was run with 12 independent variables to predict the risk factors of NSI(s) among nurses who administered injections since they were the largest occupational group. Independent variables included participants' gender, age (<37, ≥37 years, work career (<10, ≥10 years), awareness to universal precaution, attendance to educational class about NSIs, familiar with NSIs reporting system, written protocol at worksite, adequate number of needles, syringes & sharp equipment at worksite, adequate protective equipment at worksite (gloves, masks, and gowns), working hours per week (<64, ≥64 hours), work night shifts, number of injections per week (<30, ≥30 injections), recapping needles after injection. Among the nurses, 86.9% (406/467) were included in the regression analysis. *P* values < 0.05 were considered statistically significant in this study.

Results

The total study population was 932 and the response rate was 71.1%. Among the total study population, 467 participants were nurses. The occurrence of NSIs was 42.1% over the hospital staff members' entire careers.

The occurrence of NSIs in the past 6 months was 11.4% (physicians 7.7% (8/104); surgeons 24.5% (13/53); dentists 15.8% (3/19); nurses 12.8% (60/467); lab workers 12.5% (9/77); acupuncturists 60.0% (3/5); other healthcare specialist 1.8% (1/56); cleaners 15.0% (6/69); administrators 0% (0/82). NSIs occurred most often in surgeons, dentists, and cleaners. The acupuncturists also had high prevalence but the sample size was only 5, but still an aspect that need attention. Even though non-healthcare staff, 15% of cleaners experienced NSIs. The time zone during which NSIs happened in the past 6 months were mostly 8:00 to 12:00 hours (41.9%), then 12:00 to 16:00 hours (31.4%), 16:00 to 20:00 hours (11.4%) and 20:00 to 8:00 hours (15.2%), respectively.

In total, 106 NSIs were found in this study and they were caused by percutaneous injections / procedures (17.9%), suturing needles (17.0%), intravenous line insertion (17.0%), recapping needles (13.2%), disposal (10.4%), and others (24.5%) (data not shown in tables). Among those participants who administered injections, 46.7% (257/550) answered that they recapped needles using one hand, 48.9% (269/550) using both hands.

Univariate analysis showed a significant association between inadequate number of needles, syringes, and sharp equipment at the worksite (*p* = 0.009) and NSIs in the past 6 months as shown in Table 1.

The logistic regression analysis by backward elimination revealed that risk factors of NSI among nurses included the provision of adequate number of needles, syr-

Table 1. Univariate analysis of needle stick and sharps injuries (NSIs) in the past 6 months among hospital staff at four tertiary hospitals in Vientiane, Lao PDR (2006 study) (n=932)

	NSIs in the past 6 months		p-value
	Yes (%)	No (%)	
	106 (11.4)	826 (88.6)	
Gender			
Male	20 (9.8)	185 (90.2)	0.409
Female	86 (11.8)	641 (88.2)	
Age (years) (Median, 37; Range, 18-70)			
<37	46 (10.3)	401 (89.7)	0.318
≥37	60 (12.4)	425 (87.6)	
Work career (years) (Median, 10)			
<10	49 (10.7)	407 (89.3)	0.661
≥10	55 (11.7)	417 (88.3)	
Awareness to Universal precaution			
Yes	89 (11.2)	707 (88.8)	0.654
No	17 (12.5)	119 (87.5)	
Attendance to educational class about NSIs			
Yes	26 (9.9)	236 (90.1)	0.383
No	80 (11.9)	590 (88.1)	
Familiar with NSIs reporting system			
Yes	70 (12.1)	508 (87.9)	0.311
No	35 (9.9)	317 (90.1)	
Written protocol at worksite			
Yes	63 (11.4)	489 (88.6)	0.963
No	43 (11.3)	337 (88.7)	
Adequate number of needles, syringes, and sharps equipment at worksite			
Yes	84 (10.3)	729 (89.7)	0.009
No	22 (18.5)	97 (81.5)	
Adequate protective equipment at worksite (gloves, masks and gowns)			
Yes	39 (11.9)	288 (88.1)	0.645
No	66 (10.9)	538 (89.1)	
<u>Questions only for participants who deliver injections</u>			
Working hours per week (Median, 64; Range 30-132)			
<64	40 (13.3)	260 (86.7)	0.355
≥64	34 (16.3)	175 (83.7)	
Work night shifts			
Yes	59 (14.5)	348 (85.5)	0.986
No	15 (14.6)	88 (85.4)	
Number of injections per week (Median, 20; Range 1 to 1,000)			
<30	38 (13.6)	242 (86.4)	0.481
≥30	36 (15.8)	192 (84.2)	
Safety waste box at the site of injection			
Yes	60 (13.0)	402 (87.0)	n.a.
No	0	5 (100.0)	
Recapping needles after injection			
Double-handed	32 (11.9)	237 (87.5)	0.225
Single-handed	44 (17.1)	213 (82.9)	
No	3 (12.5)	21 (87.5)	

PDR, People's Democratic Republic; NSI, needle stick and sharps injuries; n.a., not applicable

inges, and sharp equipment at worksite ($p = 0.042$; odds ratio [OR], 0.47) and the attendance to educational class about NSIs ($p = 0.038$; OR, 0.50), respectively as shown in Table 2.

Discussion

The study showed that the prevalence of NSIs in the past 6 months was 11.4% among tertiary hospital staff in Lao PDR, fewer NSIs than some other low-resource setting studies, 17.5% of needlestick injury and 13.5% of sharp injuries in Ethiopia²⁰, and 45% of NSI in past 12 months in the Democratic Republic of Congo¹³. Regression analysis demonstrated that the provision of adequate sharp equipment and educational or refresher classes on NSIs will reduce NSIs among nurses with limited resources.

Logistic regression showed that a lack of educational classes on NSI was significantly associated with the occurrence of NSIs among nurses (OR, 0.50). Among nurse participants of this study, 41% (152/396) had attended educational class on NSIs. To prevent NSIs, educational classes should focus on a variety of topics related to NSIs (e.g., universal precautions, blood borne pathogen transmission, an incident reporting system, and prophylactic blood borne pathogen testing after NSIs). One previous study from Japan demonstrated that educational classes on NSIs with a participatory approach triggered active participation among nurses by sharing good examples at their own worksites²¹. The educational classes would convince them of the importance of NSI prevention and help them understand the necessity of preventive and protective methods such as post-exposure prophylaxis safety-engineered devices²¹.

Among the non-medical staff, 15.0% of cleaners experienced NSIs in the past 6 months in this study. Previous studies also reported that NSIs among auxiliary staff including nursing assistants and cleaners (55.5%)²², environmental workers (19.0%)²³ and housekeepers (5.6%)²⁴. These results should grow our concerns on NSIs among non-medical staff. There may be two possible explanations: cleaners have less knowledge on NSIs and cleaners pay less attention on Universal Precaution (UP). These explanations may endorse anecdotes that some cleaners collected infusion fluid plastic bags and so on in the hospitals for recycling. The educational classes should preferably be widened to cover not only nurses and other HCWs, but also administrators and cleaners.

Safety guidelines in many countries that recommend not recapping needles for NSI prevention assumes compliance by healthcare staff and adequate high-quality facilities and equipment^{1,25}. Several studies demonstrated significant associations between recapping needles and the occurrence of NSIs, for example, 3.7 times in Rumania²⁶ and 1.8 times in Uganda¹¹. The Lao PDR govern-

Table 2. Risk factors of predicting needlestick and sharps injuries in the past 6 months among nurses at the four tertiary hospitals in Vientiane, Lao PDR (2006 study) (n=467)

	B	S.E.	Adjusted odds ratio [95% CI]
Adequate number of needles, syringes and sharps equipment	-0.76	0.37	0.47* [0.23-0.97]
Attendance to educational class about NSIs	-0.70	0.34	0.50* [0.26-0.96]

PDR, People's Democratic Republic; NSI, needle stick and sharps injuries

Independent variables entered: gender, age, work career, awareness to universal precaution, attendance to educational class about NSIs, familiar with NSIs reporting system, written protocol at worksite, adequate number of needles, syringes, and sharps equipment at worksite adequate protective equipment at worksite (gloves, masks, and gowns), working hours per week, work night shifts, number of injections per week, recapping needles after injection

Adjusted R²=0.04 for the best model obtained by backward elimination (Wald); **p*-value <0.05

ment has also recommended needle disposal management without recapping in its national policy. However, 95% of the participants reported they still recap needles, mainly due to a shortage of quality medical waste containers and incinerators. Inadequate supply is an issue that still needs to be addressed in many developing countries²⁰.

Recapping needles did not show a significant association with NSIs in this study. It has been suggested that NSIs control management effectiveness at study sites was attributable to hands-on practices at worksites (e.g., single-handed practice) with limited resources. A total of 46.7% of participants answered that they used a single-handed recapping procedure, which might be safer than double-handed procedure. Medical waste boxes at all worksites except for immunization sites were empty plastic water boxes or soft drink bottles to reduce risks of infection in communities and dump sites. HCWs discarded their recapped needles into the plastic bottles, as non-recapped needles penetrate the plastic bottles. These countermeasures widely taken under limited resources should be highly evaluated and may be shared with other resource-limited countries.

Needles, syringes, and other sharp equipment require proper maintenance. For example, sterilized equipment was often old and blunt, making injections and other surgical procedures a bit more difficult and increasing the risk of NSIs. There is a limit to NSI prevention by on-site efforts only, and prompt improvement in quality equipment provision is necessary for taking elaborate precautions and preventing NSIs, which would make participants' experience fewer NSIs.

This study showed that 41.9% of NSIs happened morning time from 8:00 to 12:00 hours. Similar results were reported from Japan that medical doctors and nurses respectively got NSIs 39.7% and 30.3% from 8:00 to 12:00 hours²⁷. This may be explained by the lack of HCWs' concentration because of their excess workload in the morning. Generally, many of the hospital tasks such as diagnosis, laboratory test, operations and treatment occur in the morning. NSIs will be reduced if hospitals could ad-

just the work process so that the amount of HCWs' tasks in the morning will be reduced accordingly.

This study has some limitations. First, since this was a cross-sectional study, causal relationships could not be identified. Second, since the data were self-reported responses, we cannot exclude the possibility of recall bias. Future studies would be preferable as Laos Government accelerates to secure HCWs, such as embarking a national NSI databank to capture the prevalence of NSIs precisely and a fund to compensate HCWs' accidents.

In conclusion, this study served to quantify the burden of NSIs among tertiary hospitals in Lao PDR. Results of this study provide information for policymakers and suggest the need for proper educational or refresher classes on NSIs to reduce the potential burden of hepatitis, HIV or other bloodborne infectious diseases among hospital workers in Lao PDR.

Although on-site practices were widely prevalent for NSI prevention, educational classes on NSIs must be broadened to reach more nurses as well as cleaners showing high NSI prevalence, in an effort to transfer hands-on techniques such as single-handed recapping of needles together with the provision of sharp equipment in quantity and quality to further strengthen NSI precautions and prevention for HCWs in tertiary hospitals in Lao PDR.

Disclaimer: This report contains the collective views of an international group of experts, and does not necessarily represent the decisions or the stated policy of the World Health Organization.

Conflict of Interest: The authors declare that there are no conflicts of interest.

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