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RESEARCH ARTICLE

Needlestick Injury among Medical Students in an Australian University

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Abstract

Needlestick Injuries (NSI) commonly occurs in the hospital setting. Medical students are at risk of NSI due to lack of clinical experience. The purpose of this study was to investigate the incidence and knowledge, attitudes, awareness and practices of NSI among medical students at an Australian university. We conducted a cross-sectional study using an online questionnaire on NSI-related knowledge, attitude, awareness, practice, incidents and follow up. The survey was distributed to clinical students (years 3-6) of a 6-year medical program in Australia. Data were analysed with descriptive and bivariate analyses (IBM SPSS v.22; alpha 0.05). Response rate to the study was 13.8% (153/1111). Students' median score for knowledge was 3 out of maximum 6; attitude 3/4; awareness 4/6 and practice 1/2. Twenty-five students sustained a total of 28 NSI events in the past 12 months (proportion 16.6%, 95% confidence interval 10.9%-22.4%; incidence density 1.5/100 person-month); 13/25 did not report their NSI. Students in higher year of study were associated with higher rate of NSI (p = 0.02). Clinical and medical schools must address poor NSI-related knowledge, improve attitudes to reporting and provide instructions on safe handling of sharps. Surveillance of NSI specifically for medical students will provide important information to minimise harm.

Keywords

Needlestick injuries, Medical students, Teaching hospitals, Incidence, Under-reporting, Surveillance, Australia

Introduction

Needlestick Injury (NSI) is a serious occupational health risks for healthcare workers [1] including medical students who still lack clinical experience [2]. Exposure to sharps that have been potentially contaminated with Blood-Borne Viruses (BBV) can lead to Hepatitis B (HBV), Hepatitis C (HCV) or Human Immunodeficiency Virus (HIV) infection [3,4]. Although the risk of BBV infection from a single NSI is low its consequences for an infected medical student can have career-lasting impacts as it may restrict their career pathways and also impact on their long-term health [5].

A literature review in MEDLINE, SCOPUS, EMBASE, Informit e-Library: Health Collection and ScienceDirect found only three studies on NSI among Australian medical students in the past two decades, reporting an incidence of 9.2% [6], 13.8% [7], and 22% [8], although these authors acknowledged that many NSI remain unreported. None examined the knowledge, attitude, awareness and practices of medical students in relation to NSI.

Our study measured the NSI incidence reported by medical students at one Australian university and the students' NSI-related knowledge, attitude, awareness, practices and reporting behaviour across clinical years and teaching hospitals. The NSI management experience of students who reported their NSI was also reported.

Methods

The study population of our cross-sectional survey was all clinical year students from a six-year undergraduate medical program (Years 3 to 6). Pre-clinical year students were excluded because they were not involved with clinical procedures that would place them at risk of a NSI. The University's hospital network included 4 main metropolitan hospitals (350+ to 800+ beds) with 13 other metropolitan hospitals, and 7 rural (base) hospitals with 150-250

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Table 1: Respondents' distribution according to year of study and teaching hospitals.

Year of study	Teaching hospital					Non-hospital research rotation n (%)	Sub-total per year n (%)
	Metropolitan A n (%)	Metropolitan B n (%)	Metropolitan C n (%)	Metropolitan D n (%)	Rural hospitals n (%)		
3	7 (25)	14 (40)	11 (44)	5 (21)	0 (0)	3 (75)	40 (26)
4	8 (29)	4 (11)	9 (36)	8 (33)	9 (24)	1 (25)	39 (26)
5	6 (21)	7 (20)	3 (12)	5 (21)	13 (35)	0 (0)	34 (22)
6	7 (25)	10 (29)	2 (8)	6 (25)	15 (41)	0 (0)	40 (26)
Sub-total per hospital n (%)	28 (18)	35 (23)	25 (16)	24 (16)	37 (24)	4 (3)	153 (100)

beds.

Ethics approval was obtained from the University's Human Ethics Research Committee. The University administrative staff sent out a broadcast email containing the respondent information sheet and a link to an online anonymous questionnaire. Two follow-up reminder emails were sent out at two weeks apart. Respondents submitting the voluntary online questionnaire implied consent.

The questionnaire included validated questions from previous studies [9-12] relevant to the aim of the survey with some modifications for relevancy to medical students (Appendix). Five clinical-year medical students studying at two different universities undertook pre-testing of all items for face validity and to test the practicability of the online format. Items that were either ambiguous or considered irrelevant were culled or modified. The final survey consisted of 52 items which were closed multiple-choice, mixed-ended and open-ended questions. The first 26 items assessed respondents' NSI-related knowledge, attitude, awareness, practice and experiences with NSI and standard precautions. Twenty-five items examined NSI incidents in the past 12 months and experiences of NSI management. Respondents who reported to have sustained NSI in the past 12 months but did not specify how many times were given a default number of one NSI. The last survey question gave respondents an opportunity to make additional comments at the end of the survey.

Data were analysed using IBM® SPSS® Statistics Version 22. Teaching hospitals were coded for confidentiality. Due to their similarities, all rural hospitals are grouped together in the analyses. Open responses to mixed-ended question was either re-coded into existing categories or assigned a new category. Answers to knowledge, attitude, awareness and practice items were scored as correct/favourable or incorrect/unfavourable based on the literature and State policies, and a summative score was created for each of the four domains: knowledge, attitude, awareness and practice. Descriptive statistics were used to summarise the data and all frequencies were rounded up at 0.5. Independent-Samples Kruskal-Wallis test was used to compare knowledge, attitude, awareness and practice scores across hospitals, years of study and NSI in the last 12 months. Chi-squared and Independent T-tests were used to examine other factors that may have contributed to sustaining NSI. Alpha for statistical significance was set at 0.05.

Results

Response rate was 13.8% (153/1111) and represented all eligible years and both metropolitan and rural settings (Table 1). The four metropolitan hospitals were the main ones in the University's network. Students were rotating through various departments including surgery, medicine, emergency, outpatient and inpatient departments.

Denominators reported in these results vary because not all respondents answered all questions. The median hours per week of direct patient care was 8.0 (range 0-40 hours). Nearly one-third of respondents (31.1%; 47/151) were undertaking hospital-based research projects and reported zero patient care hours; however their data were included because they were still at risk of sustaining NSI. All respondents (152/152) have received Hepatitis B vaccination. Seventy-seven percent respondents (117/152) named HIV as their most feared bloodborne pathogen. Most respondents have administered injections (67.6%; 102/151) and assisted in removal or disposal of needles (80.9%; 123/152). Most respondents reported having access to point-of-use sharps containers and various safety-engineered sharps devices. Out of 67.1% (98/146) respondents who knew about their hospital's NSI prevention program, 84.4% (81/96) believed that the program was effective in informing staff and students about what to do. Identified areas for improvement included more inclusion of staff and students. One respondent stated that the sharps management had been "drilled into our minds"; however a few others expressed a need for more detailed training.

Respondents' NSI-related knowledge, attitude, awareness and practice were generally inadequate with a median score of 3 out of a maximum of 6 for knowledge; 3 out of 4 for attitude; 4 out of 6 for awareness; and 1 out of 2 for practice (Table 2). Ten percent (15/150) of respondents chose the correct post-NSI serum conversion rate for Hepatitis B and 32.0% (48/150) for HIV. When asked how they would separate a needle from a syringe if needed, over half the respondents (56.8%; 84/148) answered "gloved hands" and 7.4% (11/148) would use "bare hands but with great caution". Deficiencies were identified in attitudes to-

Table 2: Median (Md), Lower Quartile (LQ), and Upper Quartile (UQ) of respondents' knowledge, attitude, awareness and practice scores, and percentages of respondents' correct or favourable responses.

Category	Question	% (*proportion*) correct or favourable answer
Knowledge Possible range 0-6 Score range 2-4 Median (Md) 3 Lower Quartile (LQ) 2 Upper Quartile (UQ) 4	What is the serum conversion rate secondary to a needlestick injury from a patient who is positive for HIV?	32 (*48/150*)
	What is the serum conversion rate secondary to a needlestick injury from a patient who is positive for Hepatitis C?	52 (*79/150*)
	What is the serum conversion rate secondary to a needlestick injury from a patient who is positive for Hepatitis B?	10 (*15/150*)
	For how long does Hepatitis B immunisation (full course) remain effective?	52 (*79/151*)
	What would you do if you find a used needle on the floor after you have closed the sharps box?	85 (*129/150*)
	If you need to separate a needle from a syringe, how do you do it?	34 (*50/148*)
Attitude Possible range 0-4 Score range 2-3 Md 3 LQ 2 UQ 3	As a medical student, how concerned are you about contracting a blood borne pathogen through your work?	89 (*135/152*)
	How user friendly is your local hospital's sharps policy and procedures?	62 (*94/102*)
	Do you think that an incident report should be completed following a needlestick injury with new/unused sharps?	32 (*49/149*)
	Do you think that an incident report should be completed following a needlestick injury with used sharps?	97 (*147/148*)
Awareness Possible range 0-6 Score range 3-5 Md 4 LQ 2 UQ 5	Are you aware of your current hepatitis B status?	96 (*147/150*)
	Does your hospital have a sharps injury prevention program to prevent needlestick and sharps injuries occurring? (E.g. may include Sharps training, Disposal, Management & Follow-up incidents)	64 (*98/146*)
	Are you aware of your local hospital's sharps policy and procedures?	12 (*19/148*)
	Is there a designated person/department responsible for responding to sharps related incidents?	43 (*66/151*)
	Who would you contact first if you were injured by a sharps injury?	96 (*147/152*)
Practice Possible range 0-2 Score range 1-2 Md 1 LQ 1 UQ 2	How often do you use sharps containers to dispose of needles?	89 (*136/151*)
	How often do you recap needles?	44 (*68/149*)

ward reporting NSI with new or unused sharps (only 32.2% favourable responses; 49/152), awareness of the hospital's sharps policies and procedures (12.5% favourable; 19/152), and practice of recapping needles (44.7% favourable; 68/149).

When compared across years only awareness score differed statistically (Independent-Samples Kruskal-Wallis Test p = 0.004) with students from Year 6 (Median [Md] 4, Lower Quartile [LQ] 4; Upper Quartile [UQ] 5) scoring higher than all other Years. When compared across hospitals, only knowledge score differed statistically (Independent-Samples Kruskal-Wallis Test p = 0.03) with students from Metropolitan Hospital A (Md 2; LQ 1; UQ 3) and Metropolitan Hospital D (Md 2; LQ 2; UQ 3) scoring lower than Metropolitan Hospital B (Md 3; LQ 2; UQ 3), Metropolitan Hospital C (Md 3; LQ 2.5; UQ 4) and Rural Hospitals (Md 3; LQ 2; UQ 4).

Twenty-five respondents out of 151 (16.6%, 95% confidence interval [95%CI] = 10.9%-22.4%) reported to have sustained NSI in the past 12 months. Two students reported 2 and 3 NSI, 21 reported 1 NSI and two students were given the default number of one NSI, giving a total of 28 NSI and incidence density of 1.5 NSI per 100 person-month. Various locations in the hospital were implicated, and all but one respondent noted a sharps box in the vicinity. Nearly all NSI (92%; 23/25) occurred during working days and hours. Hollow-bore needles were involved in 80% cases (20/25). Most NSI occurred before the use of item (64%; 16/25); 28% (7/25) occurred during use, and one (4%) each between steps of a multi-step procedure and while disposing the item. One case involved a patient with known Hepatitis B infection and 3 cases with Hepatitis C; overall, 20% (5/25) respondents with NSI considered the incident putting them at risk of a BBV infection.

All reported NSI (25) were on the hands with similar distribution between the left (47%) and right (53%) hands and the palmar surface being much more commonly involved (79%). Most injuries were of moderate depth (48%) or superficial (40%) with only 3 respondents (12%) sustaining a deep injury. Most respondents had single (48%) or double (16%) gloves on during the incident.

There were significant associations between sustaining NSI in the past 12 months and year of study (more students from higher years having sustained NSI; p = 0.015; p for linear trend = 0.002) and having administered injections (p = 0.002). The distribution of the 25 students with NSI indicated high numbers at Metropolitan Hospital B (10 students) and Rural Hospitals (7); however, the very low number of students with NSI in Metropolitan Hospitals A (4), C (1) and D (3) precluded any assessment of statistical significance. There was no association between sustaining NSI in the past 12 months and assisting in removal or disposal of needles, and attending NSI prevention training in the past 12 months. There was no significant difference (Independent-Samples Kruskal-Wallis Test) in knowledge (p = 0.25), attitude, awareness and practice scores between students who sustained NSI and those who did not.

About half of respondents with NSI (52%) did not report it; 40% always reported and 8% only reported some NSI. Main reasons for not reporting NSI were: uncontaminated device (11 respondents); concern over being judged incompetent (5); considered the risk too low to report (3); fear of being disciplined (2) and fear of dismissal (2). One respondent considered their NSI to be low risk for bloodborne pathogens because the source patient was "82-year-old, no liver function abnormalities and he was a devout Anglican lol [laugh out loud]".

Only six respondents received post-NSI care. In four cases the student had two repeat blood tests and the source patient also underwent blood test. Most of these six respondents reported to have been seen in a timely manner, supported in their reporting and not being rushed. However, not all received adequate post-NSI information about post-exposure prophylactic treatment (only given in 4 cases); the risk of bloodborne virus infection from their NSI (3); practice modification during window period (3) and counselling service (2). A respondent reported that since their NSI involved a low risk patient, the staff member "didn't bother explaining further". Another student complained about getting inadequate information about how to take post-exposure prophylaxis and its adverse effects.

Discussion

Despite the broad distribution and reminders, this study had a low response rate of 13.8% which limits the generalisation of its findings. We were unable to compare socio-demographic attributes of responders and non-responders; however, the sample of this study was representative for the years of study and teaching hospitals because these hospitals are comparable for size and patient case-mix. Previous similar studies have achieved higher response rates between 42%-100% [7-9,13-20]. These studies used in-class paper questionnaires administration and collection; however this method was hindered in our study by the students' geographical and departmental distribution. Our use of non-face-to-face data collection (online survey) may have contributed to the poor response rate by time-poor medical students.

The proportion of medical students who sustained NSI in our study (16.6%; 95% CI = 10.9%-22.4%) is within the range from similar studies from Australia [6-8] and other countries [18,21-24]. However, different methods in asking about NSI incidents in thosestudies (such as asking about lifetime prevalence or unspecified number of NSI) hinder a comparison of incidence density. It is concerning that NSI incidence among medical students seems to have persisted in the past 2 decades despite the advances in knowledge and preventative measures.

NSI underreporting in this study is around 50%, which is similar to the international range of 33%-70.2% [11,18,21-24]. Our respondents' reasons for not reporting were mainly based on fear and self-assessment of risk, similar to other studies [18,22,25,26]. This consistency of findings despite advances in NSI prevention programs and training, and the development of "no blame" culture in hospitals [27] is concerning. Such high levels of under-reporting prohibit the identification and intervention of underlying NSI risk factors.

Our findings supported other studies' findings that NSI risk is higher among more senior students and those with more sharps-related clinical tasks [7,14]. We found the dominance of hollow-bore needle injuries, which is known to correspond with students' clinical activities [17,19]. Clinical teachers may need to increase medical students' training to assess clinical tasks and identify particular NSI risks that they may pose.

We found gaps in students' NSI-related knowledge and practices, from the risks of BBV transmission to sharps handling and NSI follow up, mirroring findings from other studies of NSI in hospital settings [2,19,23,26]. Although there were no significant differences in knowledge and practice between those who did and did not sustain NSI, under-estimation of risks is important due to our finding of students' tendency to self-assess when they sustained NSI e.g. whether a follow up was needed. It is also concerning that needle recapping was reported by 44% respondents despite being prohibited since 2007 [1]. Training programs could markedly improve medical students' knowledge and awareness [2,6]. However, training impact may be limited by lack of students' involvement [19], and a long-term evaluation in Singapore [20] demonstrated persistent under-reporting despite reduced NSI incidence which indicates the need for a more comprehensive intervention that includes a shift in organisational culture e.g. NSI stigma reduction.

The low number of students who completed their NSI follow-up prohibited any meaningful quantitative analysis; however their survey responses indicated some room for improvement in follow up procedures. Considering the fear factor behind the high levels of under-reporting, it is imperative to cultivate a positive perception of NSI follow up procedure.

Conclusion

Australian medical students in this study reported NSI incidence rate of 16.6% which is comparable to other Australian and international studies in the past 2 decades. Gaps were found in students' NSI-related knowledge, awareness and practice. A high level of underreporting needs to be addressed through improved training and NSI reporting process, as well as building a more conducive hospital culture. Improved surveillance of NSI among medical students, and a qualitative exploration of the incidents, would contribute to identify underlying risk factors and tailor educational programs accordingly.

References

1. NSW Health (2007) Sharps injuries - prevention in the NSW public health system.
2. Elliott SK, Keeton A, Holt A (2005) Medical students' knowledge of sharps injuries. J Hosp Infect 60: 374-377.
3. Whitby RM, McLaws ML (2002) Hollow-bore needlestick injuries in a tertiary teaching hospital: epidemiology, education and engineering. Med J Aust 177: 418-422.
4. Deuffic-Burban S, Delarocque-Astagneau E, Abiteboul D, Bouvet E, Yazdanpanah Y (2011) Blood-borne viruses in health care workers: prevention and management. J Clin Virol 52: 4-10.
5. Trim JC, Elliott TS (2003) A review of sharps injuries and preventative strategies. J Hosp Infect 53: 237-242.
6. Liddell MJ, Davidson SK, Taub H, Whitecross LE (2002) Evaluation of procedural skills training in an undergraduate curriculum. Med Educ 36: 1035-1041.
7. Smith DR, Leggat PA (2005) Needlestick and Sharps Injuries among Australian medical students. J UOEH 27: 237-242.
8. deVries B, Cossart YE (1994) Needlestick injury in medical students. Med J Aust 160: 398-400.
9. Patterson JM, Novak CB, Mackinnon SE, Ellis RA (2003) Needlestick injuries among medical students. Am J Infect Control 31: 226-230.
10. Tabak N, Shiaabana AM, Shasha S (2006) The health beliefs of hospital staff and the reporting of needlestick injury. J Clin Nurs 15: 1228-1239.
11. Sharma GK, Gilson MM, Nathan H, Makary MA (2009) Needlestick injuries among medical students: incidence and implications. Acad Med 84: 1815-1821.
12. Winchester SA, Tomkins S, Cliffe S, Batty L, Ncube F, et al. (2012) Healthcare workers' perceptions of occupational exposure to blood-borne viruses and reporting barriers: a questionnaire-based study. J Hosp Infect 82: 36-39.
13. Sullivan M, Masters O, Venkatesan P (2000) Needlestick injuries amongst medical students in Birmingham, UK. J Hosp Infect 44: 240-241.
14. Norsayani MY, Noor Hassim I (2003) Study on incidence of needle stick injury and factors associated with this problem among medical students. J Occup Health 45: 172-178.
15. Cervini P, Bell C (2005) Brief report: needlestick Injury and Inadequate Post-Exposure Practice in Medical Students. J Gen Intern Med 20: 419-421.
16. Okeke E, Ladep N, Agaba E, Malu A (2008) Hepatitis B vaccination status and needle stick injuries among medical students in a Nigerian university. Niger J Med 17: 330-332.
17. Wicker S, Nürnberger F, Schulze JB, Rabenau HF (2008) Needlestick injuries among German medical students: time to take a different approach? Med Educ 42: 742-745.
18. Salzer HJ, Hoenigl M, Kessler HH, Stigler FL, Raggam RB, et al. (2011) Lack of risk-awareness and reporting behavior towards HIV infection through needlestick injury among European medical students. Int J Hyg Environ Health 214: 407-410.
19. Liyanage IK, Caldera T, Rwma R, Liyange CK, De Silva P, et al. (2012) Sharps injuries among medical students in the Faculty of Medicine, Colombo, Sri Lanka. Int J Occup Med Environ Health 25: 275-280.
20. Seng M, Lim JW, Sng J, Kong WY, Koh D (2013) Incidence of needlestick injuries among medical students after implementation of preventive training. Singapore Med J 54: 496-500.
21. Deisenhammer S, Radon K, Nowak D, Reichert J (2006) Needlestick injuries during medical training. J Hosp Infect 63: 263-267.
22. Varsou O, Lemon JS, Dick FD (2009) Sharps injuries among medical students. Occup Med (Lond) 59: 509-511.
23. Saleem T, Khalid U, Ishaque S, Zafar A (2010) Knowledge, attitudes and practices of medical students regarding needle stick injuries. J Pak Med Assoc 60: 151-156.
24. Kessler CS, McGuinn M, Spec A, Christensen J, Baragi R, et al. (2011) Underreporting of blood and body fluid exposures among health care students and trainees in the acute care setting: a 2007 survey. Am J Infect Control 39: 129-134.
25. Askarian M, Malekmakan L, McLaws ML, Zare N, Patterson JM (2006) Prevalence of Needlestick Injuries Among Medical Students at a University in Iran. Infect Control Hosp Epidemiol 27: 99-101.
26. Bernard JA, Dattilo JR, Laporte DM (2013) The incidence and reporting of sharps exposure among medical students, orthopedic residents, and faculty at one institution. J Surg Educ 70: 660-668.
27. Walton M (2004) Creating a "no blame" culture: have we got the balance right? Qual Saf Health Care 13: 163-164.