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# Knowledge, attitudes and practices of medical students regarding needle stick injuries

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## Abstract

**Objective:** To ascertain knowledge, attitude and practices of medical students regarding needle stick injuries.

**Methods:** A cross sectional survey was conducted among the consenting medical students of 3rd, 4th and 5th years at a teaching hospital of Karachi, Pakistan. Convenience sampling was used. Pre-tested questionnaires were administered to approximately 70% of each class. Data was analyzed using SPSS version 16.0. Associations were assessed using chi-square test and Fisher's exact test. A p-value of <0.05 was considered as significant.

**Results:** The response rate of the survey was 85.7%. Sixty one students (33.9%) were from 3rd and 4th year each while 58 students (32.2%) were from 5th year. More than 85% students from each class were aware of the possibility of acquisition of Hepatitis B, Hepatitis C and HIV from needle stick injuries. Only 16.4% 3rd year students, 29.5% 4th year students and 36.2% final year students knew the full details of needle stick injury prevention protocols. Curriculum was cited as an important source of information regarding needle stick injuries. Forty seven (26.1%) students had received a needle stick injury in the past; however, only 14 students (29.7%) had reported the incident either to their consultant or the Infection Control Office.

**Conclusion:** Overall knowledge of medical students regarding various aspects of needle stick injuries improved with seniority in medical college. However, the domains of attitude and practices need to be improved as the frequency of needle stick injuries was also observed to increase with the increasing year of medical education (JPMA 60:151; 2010).

## Introduction

Health care workers (HCWs) can be exposed to blood and other body fluids through needle stick and other sharp injuries as well as through mucocutaneous exposures.<sup>1</sup> Needle stick injuries (NSIs) are, therefore, among one of the potential occupational hazards for HCWs. NSIs are associated with a number of different health hazards for HCWs; the most important of which is the risk of acquisition of potentially fatal diseases such as Hepatitis B and C (HBV, HCV) and Human Immunodeficiency Virus (HIV). Transmission of at least 20 different pathogens by injuries due to sharp instruments and needle sticks has been reported in literature.<sup>2</sup> The risk associated with transmission after percutaneous exposure to infected blood varies according to the specific blood borne pathogen. For HBV, this risk can be up to 30% depending on the presence of various serological markers in the blood of the patient. For HCV, the transmission rate is around 3-4%. At 0.3%, this risk of transmission is lowest for HIV.<sup>3</sup> HBV and HCV infections are among the biggest health challenges facing the developing world today. An estimated one-third of the global population has been infected with HBV; approximately 350 million people are lifelong carriers. For HCV, the World Health Organization estimates that 170 million individuals worldwide are infected.<sup>4</sup> According to UNAIDS, around 39 million people worldwide are living with HIV as of December, 2006.<sup>5</sup> According to data

from EPINet system, hospital workers incur approximately 30 needle stick injuries per 100 beds per year on average - an alarming figure by no exaggeration.<sup>6</sup>

Estimated prevalence of Hepatitis B in the Pakistani population is 4% and Hepatitis C is 6%.<sup>7,8</sup> The general population prevalence of HIV/AIDS in Pakistan was estimated as 0.1% while the high-risk population prevalence as 1-2%.<sup>9</sup> However, it is alarming to note that according to the latest figures, HIV/AIDS prevalence among Intravenous Drug Users (IDUs) has been reported to be from 7.6%- 27%.<sup>10</sup> According to the statistics from Center for Injection Safety, the prevalence of HBV infection in commercial blood donors in Pakistan is 10%. For HCV infection, this prevalence is 20% for commercial blood donors.<sup>11</sup> Many of these patients come for admissions, consultations, procedures and biochemical investigations to hospitals daily where they are encountered by unsuspecting HCWs. Medical students, being a part of the healthcare delivery system, are exposed to the same, if not greater, magnitude of risk as other HCWs when they come into contact with patients and contaminated instruments.

In many teaching centers, medical students are the first level of contact of patients with medical care. They are expected to undertake activities related to patient care with the beginning of their clinical years. As future doctors, they will have to face the risks associated with NSIs. Being amateurs, they lack

experience and skill and are, therefore, at a higher risk of infection from unsafe practices related to needles and sharps. While studies assessing the KAP of NSIs have been conducted among nurses, doctors and operation room staff in Pakistan, there has been no study assessing KAP of NSIs among medical students in Pakistan. Only one study has been conducted to determine the knowledge regarding diseases like HIV, HBV and HCV among medical students in Karachi, Pakistan.<sup>12</sup> Therefore, this study was conducted to assess knowledge, attitudes and practices (KAP) of medical students regarding NSIs as risk is high for this group.

## Methods

The medical curriculum in universities across Pakistan spans across a period of five years. From 3rd year onwards, students begin their clinical rotations at the majority of institutions. Therefore, a cross sectional survey was conducted among the consenting medical students of 3rd, 4th and 5th years at a private teaching tertiary care university hospital of Karachi, Pakistan. Students of pre-clinical years (1st and 2nd year) were excluded from the survey. Convenience sampling was used. Structured, pre-tested questionnaires were administered to approximately 70% of each class; the average strength of each class being 90. The total sample size, after adjustment for 10% non-response rate, was estimated to be 210. The questionnaire comprised both open and close ended questions.

The data was entered and analyzed using SPSS version 16.0. In descriptive analysis, the mean and standard deviation of continuous variables and percentages of categorical variables were computed. Associations were assessed using chi-square test and Fisher's exact test; the p-values for the different cross-tabulations have been mentioned in the tables alongside each variable. Multiple logistic regression analysis was also done to ascertain the association between the year of study and receipt of NSI. A p-value of <0.05 has been considered as statistically significant, unless otherwise specified.

The study was approved by the Ethics Review Committee at AKUH. All ethical considerations including informed consent and confidentiality of respondents was ensured throughout the project.

## Results

A total of 210 medical students belonging to 3rd, 4th and 5th years were approached for the survey. One hundred and eighty students consented to participate in the survey; therefore the response rate in our study was 85.7%. Sixty one students (33.9%) were from 3rd and 4th year each while 58 students (32.2%) were from 5th year. Ninety three (51.7%) students were male. The mean age of respondents was  $21.04 \pm 1.59$  years.

Most of the respondents from each class were aware that NSIs and blood and body fluid exposure include injuries from used needles of syringes, sharps and exposure of fluids to mucous

membranes (29.5% of 3rd years, 42.6% of 4th years and 67.2% of final years). More than 85% students from each class were aware of the possibility of acquisition of Hepatitis B, Hepatitis C and HIV from these exposures. Eighteen percent of 3rd year students, 25% of 4th year students and 45% of final year students also mentioned NSIs as a possible source of transmission for Viral Haemorrhagic Fevers. The percentage of final year students able to correctly identify the sero-conversion rates for each of Hepatitis B, Hepatitis C and HIV was higher than 3rd and 4th year students. 16.4% 3rd year students, 29.5% 4th year students and 36.2% final year students had not only heard about universal guidelines about prevention of needle stick and sharp injuries but they also knew the full details of these NSI prevention protocols. The association between the year of study and knowledge of the term NSI ( $p=0.002$ ), knowledge about the sero-conversion rates of each of HBV, HCV and HIV ( $p < 0.001$  for each association) was found to be significant. Table-1 provides details of answers to knowledge questions by participants.

With regards to the source of information about NSIs, most of the students responded that it was taught as a part of the curriculum (22.8%). Other important sources of information mentioned by the students included consultants (20.6%), colleagues (17.8%) and nurses (14.4%). Attendance at an organized training programme as a source of information for NSI was mentioned by 13.3% of the students. The majority of respondents (80%) were aware that effective vaccination is available for Hepatitis B as a post-exposure prophylactic measure. Thirteen percent students, the majority of these (75%) belonging to 3rd year, also mentioned that effective vaccination was available for Hepatitis C as a post-exposure prophylactic measure while 7% held this opinion for HIV.

In response to a hypothetical scenario where students were given the choice to not report any of the three infections (Hepatitis B, Hepatitis C and HIV) after getting an NSI, most of the students (55%) chose not to report NSI associated with HIV. The reason commonly cited by medical students for their choice of not reporting the HIV associated NSI was ostracization by peers (60%) as well as the possibility of significantly harsh rebuke from consultants (28%).

Out of 180 respondents, 47 (26.1%) had received an NSI in the past. Out of these 47 students, 8 (17%) were from 3rd year, 15 (32%) from 4th year and 24 (51%) belonged to final year. The association between receipt of NSI and year of study was found to be significant ( $p=0.002$ ). Thirty three (70.2%) had received a single NSI. Fourteen students (29.8%) had reported the NSI either to their consultant or Infection Control Office. The most common reasons cited by medical students for not reporting the NSI to appropriate authority were the fear of getting into trouble (62%), taking some prophylactic measures on their own (24%), and waiting to feel unwell or symptomatic (11%) before approaching appropriate authorities.

**Table-1: Descriptive characteristics and knowledge variables of NSIs.**

Variables	3rd year % (n=61)	4th year % (n=61)	5th year % (n=58)
<b>NSI/Blood and Body Fluid Exposure includes (p=0.002)</b>			
- Injuries from needles of syringes	19.7	11.5	0
- Injuries from sharps	21.3	16.4	10.3
- Exposure of fluids to mucous membranes	13.1	18	10.3
- All of the above	29.5	42.6	67.2
- Splash on intact skin	16.4	11.5	12.1
<b>Diseases that NSI can transmit (**)</b>			
- Hepatitis B	85	89	94
- Hepatitis C	92	93	95
- HIV	88	94	97
- Hepatitis A and E	22	13	5
- Malaria	38	21	27
-Viral Haemorrhagic Fevers	18	25	45
<b>Sero-conversion Rates for Hepatitis B ( p &lt; 0.001)</b>			
- < 5%	31.1	14.8	6.9
- 5 – 25%	49.2	47.5	37.9
- > 25%	19.6	37.7	55.2
<b>Sero-conversion Rates for Hepatitis C (p &lt; 0.001)</b>			
- < 3%	68.9	21.3	22.4
- 3 – 4%	14.8	34.4	63.8
- > 4%	16.3	44.3	13.8
<b>Sero-conversion Rates for HIV (p &lt; 0.001)</b>			
- < 1%	16.4	39.3	53.4
- 1-3%	27.9	27.9	27.6
- > 3%	55.7	32.8	19
<b>Awareness of Any Preventive Guidelines (p = 0.059)</b>			
- Only heard about them but don't know details	26.2	18	15.5
- Know some details about them	13.1	21.3	24.1
- Know full details about them	16.4	29.5	36.2
- Have not heard about them at all	44.3	31.1	24.1

\* Some percentages do not add up to a 100 because of multiple responses

\*\* P-value was not computed because of a multiple response question format of this variable.

**Table-2: Descriptive characteristics and practice variables of NSI.**

Variables	3rd year % (n=8)	4th year % (n=15)	5th year % (n=24)
<b>Times NSI (p = 0.12)</b>			
- Once	75	73.3	66.6
- Twice	12.5	20	25
- More than twice	0	0	4.2
- Can't recall the exact number of NSIs	12.5	6.7	4.2
<b>Post-exposure Measures Taken (p=0.135)</b>			
- Immediately washed the wound	50	26.7	62.5
- Allowed it to bleed	0	26.7	0
- Notified the infection control office	12.5	13.3	12.5
- Reported the incident to your consultant	25	13.3	16.7
- Applied an adhesive medicated plaster	12.5	19.9	8.3
<b>Enquired About Patient and His Disease History (p&lt;0.001)</b>			
- Yes	25	60	87.5
- No	75	40	12.5

Medical students attributed the event of NSI to personal inexperience (28%), lack of awareness about NSIs (22%), carelessness (18%), stress due to academics and other reasons (13%) and lack of supervision (9%). The majority of injuries had occurred while recapping syringes (32%), injecting or drawing blood samples (27%) and from glass equipment like

broken vials (21%). NSIs during suturing and surgery were an infrequent occurrence overall (8%). The hand and the forearm were the most common sites for receipt of NSI (62% and 36% of instances respectively).

Regarding the post NSI emotional repercussions, students reported feeling anxious (40%), fearful of contracting

**Table-3: Preventive practices of medical students.**

Preventive Practices	3rd year % (n=61)	4th year % (n=61)	5th year % (n=58)
<b>Hepatitis B Vaccination *</b>			
- Received at least 1 dose of Hepatitis B vaccination	95	97	97
- Received All 3 doses of Hepatitis B vaccination	95	90	93
- Got antibody titres checked after vaccination	1.6	4.8	51.7
Regular use of gloves (p=0.247)	65	72	80
Regular use of tray to keep syringes (p=0.596)	40	45	46
Regular use of sharp disposal containers (p = 0.676)	55	62	72
Received sharps related training (p = 0.036)	19.7	32.8	41.4
Avoidance of needle recapping (p <0.001)	44	64	81
Avoid breaking needles by hand (p =0.015)	61	81	92

\* P-value was not computed for this variable because of a multiple response format.

infections (33%) and anger directed at oneself for not being careful enough (21%). The association between the year of study and the enquiry about the patient and his disease history was significant ( $p < 0.001$ ). Table-2 provides details of the practice variables of the respondents.

The majority of the students in our study (96%) had received 3 doses of hepatitis B vaccination. However, only 34 (19%) students had got their antibody titres checked after the vaccination. There was a significant association between the year of study and the receipt of sharps related training ( $p=0.036$ ), avoidance of needle recapping ( $p < 0.001$ ) and avoidance of breaking needles by hand ( $p=0.015$ ). Table-3 details other preventive practices undertaken by medical students with regards to NSIs.

Using multiple logistic regression analysis, the year of study emerged as an independent predictor for receiving an NSI. Students of final year were more likely to get a NSI [Adjusted Odd's Ratio=6.5, 95% Confidence Interval=1.5 - 8.6] as compared to students studying in 3rd and 4th years. Students in 4th year were also more likely to receive a NSI as compared to 3rd year students [Adjusted Odd's Ratio=3, 95% Confidence Interval=0.9 - 5.4]

## Discussion

This study shows an overall good knowledge level of medical students regarding the transmission of important diseases through NSIs; although knowledge about preventive protocols should be improved in the future. On average, around 90% of the medical students were aware that each of HBV, HCV and HIV can be transmitted via NSIs. This is comparable to other studies reported in literature.<sup>13</sup>

The risk associated with transmission after percutaneous exposure to infected blood varies according to the specific blood borne pathogen. The transmission rates for HBV, HCV and HIV are 30%, 3% and 0.3% respectively.<sup>14</sup> In this study, majority of the 3rd and 4th year students underestimated the sero-conversion rates for Hepatitis B but the 5th year students correctly identified it to be above 25-30%. The responses for

sero-conversion rates of Hepatitis C and HIV were variable in this study but the final year medical students showed better awareness of the correct figures.

Although the knowledge regarding NSIs has been generally seen to improve with increasing year of medical education; unfortunately the lifetime prevalence of needle stick and sharp injury is also reported to increase as was seen in this study. This may be attributed to factors such as increasing level of clinical exposure and responsibility in patient care, greater level of stress and longer working hours as medical students progress to more senior years. A cross sectional study done at two medical schools in Munich showed that the prevalence of NSIs among medical students was 23%; ranging from 12% in first year students to 41% in fourth year students. The accidents were reported to have occurred most frequently during blood taking practices.<sup>15</sup> It is comparable to this study where the majority of injuries had occurred while recapping syringes and injecting or drawing blood samples. Another study done in USA reported that 33% of the students of fourth year had sustained one or more injuries. In 34% of cases, the injury was caused by a needle or device being used by another person.<sup>16</sup> Results of a study conducted among medical interns in Iran revealed that needles were the most common object of exposure (41% of exposure episodes) while phlebotomy and suturing were the hospital procedures that accounted for the highest percentage of exposure episodes. It also showed that only a minority of students observed basic safety measures such as wearing gloves, not recapping used needles and proper disposal of sharp objects.<sup>17</sup> Students were questioned regarding their prevention practices as well as measures taken by them for post exposure prophylaxis in the current study conducted at AKUH. Most students reported using gloves and sharp disposal containers to reduce the occurrence of NSI. Avoidance of needle recapping as well as that of breaking needles by hand was also reported.

It was seen that out of 180 respondents, 26.1% had received an NSI in the past with the majority being final year medical students. However, when compared with other studies on medical students, the exposure rate is low, as Wicker et al and

Okeke et al report NSI incidence rate of 58.8%<sup>18</sup> and 48%<sup>13</sup> respectively. This can be attributed to the fact that the current study conducted was a survey on medical students from all three clinical years at Aga Khan University Hospital, whereas most other studies involved students of senior clinical years only, hence contributing towards a comparatively higher NSI incidence rate. This derivation is further supported by an incidence rate of 67% of NSIs in final year medical students in this study.

The economic cost of managing NSIs is substantial. The associated emotional repercussions must also be considered. Cost analyses indicate that use of needle stick prevention devices will be cost-effective in the long term. To provide more scientific data on the efficacy of needle stick prevention devices, recording of needle stick injuries must first be improved.<sup>19</sup> Administrative response to reports, personal fears, and unit quality management are related to reporting. Patient and staff safety occurrences, including NSIs, are generally underreported as was seen in our study. Strong quality management processes and positive responses to reports of occurrences may increase reporting and enhance safety.<sup>20</sup> A recent study in Pakistan mentioned NSIs' reporting rate of 53% to the infection control office. This figure is superior to other reports published earlier by Alam - 7%, McGeer - 5%, Gurubachaya - 21% and Patterson - 30%.<sup>21</sup> In our study, only 13 students (27.7%) had reported the incident either to their consultant or the Infection Control Office. A number of reasons were cited by the medical students for not reporting an NSI which need to be addressed for better reporting statistics.

Few randomized controlled trials have evaluated the effectiveness of interventions to reduce NSIs in health care occupations. The majority of these studies evaluated interventions during surgical procedures, rather than during patient care on nursing units; probably because the latter is more difficult to observe.<sup>22</sup> Prevention of NSIs can be achieved through elimination of needle recapping and the use of safer needle devices, sharps collection boxes, gloves and personal protective gear. In 1985, the centre of disease control (CDC) and the occupational safety and health administration (OSHA) in the United States introduced the "Universal Precaution Guidelines"; these guidelines are intended to prevent sharp injuries among HCWs and reduce their occupational hazards to a minimum level.<sup>23</sup> Due to the implementation of these practices, NSIs have decreased from an estimated one million exposures per year in 1996 to 385,000 per year in 2000 in the US.<sup>24</sup>

More than 90% of medical students who participated in this survey had received all 3 doses of Hepatitis B vaccination. Comparatively, in other reported studies, the vaccination status of medical students was below par.<sup>13</sup> This is explained by the fact that owing to an increased Hepatitis B prevalence in the region, medical students are routinely vaccinated upon entry into the medical college. Since medical students are at an increased risk of acquiring NSI, it is recommended that a similar policy be implemented in all medical colleges in our region.

However, antibody titres should also be routinely checked among all vaccinated because of the possibility of non-response to the first series of vaccination.

## Conclusion

In summary, this KAP study showed that the overall knowledge of medical students regarding associated risks and preventive measures to avoid needle stick injuries improved with seniority in medical college. However, increasing incidence of needle stick injuries was observed among the medical students with the increasing year of medical education; hence strongly suggesting the need for improvement in the domains of attitudes and practices. Further teaching and training sessions on infection control and sharps injuries need to be incorporated into the medical curriculum to minimize these incidents in the future.

## Conflict of Interest:

None declared.

## References

1. Bloodborne Infectious Diseases HIV/AIDS, Hepatitis B Virus, and Hepatitis C Virus. OSHA Bloodborne Pathogens and Needlestick Prevention Topic Page. (Online) 2009 (Cited 2008 Nov 5). Available from URL: <http://www.cdc.gov/niosh/topics/bbp/#prevent>.
2. Apisarnthanarak A, Babcock HM, Fraser VJ. Compliance with universal precautions among medical students in a tertiary care center in Thailand. *Infect Control Hosp Epidemiol* 2006; 27: 1409-10.
3. Needle stick injuries. Canadian Centre for Occupational Health and Safety. (Online) 2009 (Cited 2008 Nov 5). Available from URL: [http://www.ccohs.ca/oshanswers/diseases/needlestick\\_injuries.html](http://www.ccohs.ca/oshanswers/diseases/needlestick_injuries.html).
4. Hamid S, Ismail FW, Jafri W. Hepatitis and the healthcare worker - a Pakistani perspective. *J Coll Physicians Surg Pak* 2007; 17: 240-5.
5. UNAIDS: The Joint United Nations Program on HIV/AIDS. UNAIDS/WHO Epidemiological Fact Sheet. (Online) 2009 (Cited 2008 Nov 10). Available from URL: <http://www.unaids.org>.
6. EPINet. Exposure Prevention Information Network data reports. University of Virginia: International Health Care Worker Safety Centre 2003.
7. Abbas Z, Jafri W, Shah SHA, Khokhar N, Zuberi SJ. PGS Consensus Statement on management of Hepatitis B Virus Infection 2003. *J Pak Med Assoc* 2004; 54:150-8.
8. Hamid S, Umar M, Alam A, Siddiqui A, Qureshi H, Butt, J. PSG Consensus Statement on management of Hepatitis C Virus Infection 2003. *J Pak Med Assoc* 2004; 54: 146-50.
9. UNAIDS Country Profile. (Online) 2009 (Cited 2008 Nov 5). Available from URL: <http://www.unaids.org/Unaid/EN/Geographical+area/By+Country/pakistan;July2005>.
10. Rai MA, Warraich HJ, Ali SH, Nerurkar VR. HIV/AIDS in Pakistan: the battle begins. *Retrovirology* 2007; 4:22.
11. Center for Injection Safety. (Online) 2006 (Cited 2008 Nov 6). Available from URL: <http://www.safeinjections.org>.
12. Anjum Q, Siddiqui H, Ahmed Y, Rizvi SR, Usman Y. Knowledge of students regarding Hepatitis and HIV/AIDS of a private medical university in Karachi. *J Pak Med Assoc* 2005; 55: 285-8.
13. Okeke EN, Ladep NG, Agaba EI, Malu AO. Hepatitis B vaccination status and needle stick injuries among medical students in a Nigerian University, Niger. *J Med* 2008; 17: 330-2.
14. Needle stick injuries. Canadian Centre for Occupational Health and Safety. (Online) 2009 (Cited 2008 Nov 10). Available from URL: [http://www.ccohs.ca/oshanswers/diseases/needlestick\\_injuries.html](http://www.ccohs.ca/oshanswers/diseases/needlestick_injuries.html).
15. Deisenhammer S, Radon K, Nowak D, Reichert J. Needlestick injuries during medical training. *J Hosp Infect* 2006; 63: 263-7.
16. Shen C, Jagger J, Pearson RD. Risk of needle stick and sharp object injuries among medical students. *Am J Infect Control* 1999; 27: 435-7.

17. Shariati B, Shahidzadeh-Mahani A, Oveysi T, Akhlaghi H. Accidental exposure to blood in medical interns of Tehran University of Medical Sciences. *J Occup Health* 2007; 49: 317-21.
  18. Wicker S, Nürnberger F, Schulze JB, Rabenau HF. Needlestick injuries among German medical students: time to take a different approach? *Med Educ* 2008; 42: 742-5.
  19. Lee JM, Botteman MF, Xanthakos N, Nicklasson L. Needlestick injuries in the United States. Epidemiologic, economic, and quality of life issues. *AAOHN J* 2005; 53: 117-33.
  20. Blegen MA, Vaughn T, Pepper G, Vojir C, Stratton K, Boyd M, et al. Patient and staff safety: voluntary reporting *Am J Med Qual* 2004; 19 :67-74.
  21. Zafar A, Aslam N, Nasir N, Meraj R, Mehraj V. Knowledge, attitudes and practices of health care workers regarding needle stick injuries at a tertiary care hospital in Pakistan. *J Pak Med Assoc* 2008; 58: 57-60.
  22. Rogers B, Goodno L. Evaluation of interventions to prevent needlestick injuries in health care occupations. *Am J Prev Med* 2000; 18: 90-8.
  23. Centers of disease control. Perspective in disease prevention and health promotion update. Universal precautions for prevention of transmission of HIV, HBV and other blood-borne pathogens in the health care settings. *MMWR* 1988; 37: 377-88.
  24. Wilburn SQ Needlestick and sharps injury prevention. *Online J Issues Nurs* 2004; 9: 5.
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