

Risk of needlestick injuries during medical school¹⁾

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Abstract

Introduction: Healthcare workers (HCWs) are exposed to bloodborne pathogens (e.g., contaminated devices). In the healthcare environment, needlestick injuries (NSI) represent a major risk factor in the transmission of hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV). Medical students are at risk of occupational exposure to bloodborne viruses following needlestick injuries during medical education. Reporting of needlestick injuries is an important step for initiating early prophylaxis or treatment. In the case of a bloodborne infection, pursuant to insure law could result in a claim. The objective of the present study was to describe occupational blood exposure of medical students through needlestick injuries.

Methods: Sixth-year medical students were invited to complete an anonymous questionnaire.

Results: In our study, 58.8% (n=183/311) of medical students recalled at least one needlestick injury during their studies. Overall, 284 needlestick injuries were reported. Only 38.3% of medical students reported all NSI to the appropriate hospital personnel. The main reason (54.0%) for not reporting NSI was being ashamed of having an NSI.

Conclusions: Occupational exposure to blood is a common problem among medical students. Efforts are required to ensure greater awareness among medical students about the risk of bloodborne pathogens. Proper training in procedures and how to act in case of injury

should be offered to reduce the number of needlestick injuries.

Keywords: bloodborne viruses; medical students; needlestick injury; occupational infections.

Introduction

In Germany, an estimated 500,000 needlestick injuries (NSI) occur every year [1]. Various studies conducted in different countries showed an alarmingly high rate of NSI in medical students [2–10].

For healthcare workers (HCWs), NSI represent a major risk factor in the transmission of hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV). Annually, around 66,000 cases of HBV infections, 16,000 HCV infections, and 1000 HIV infections occur worldwide among HCWs due to their occupational exposure to percutaneous injuries [11].

Medical students are often exposed to bloodborne pathogens during their clinical training, because they are still lacking manual skills, which they are eagerly attempting to acquire as fast as possible, while accepting the associated hazard of exposure. Furthermore, many students are initially not even aware of the infection risk [12, 13].

The rate of NSI is widely underestimated, since most students do not report the incidents. Consistent reporting of NSI is, however, an essential prerequisite for providing appropriate treatment and taking post-expositional prophylactic measures (PEP) in a timely fashion.

A complete recording of all NSI is crucial for hospital operators and medical faculties in their efforts of acquiring and evaluating high risk activities [14].

Various factors determine whether or not an NSI will lead to an infection, including the infection state of the index patient (virus load), the immunstatus of the injuring carrier, but also the puncture depth (grade of NSI), the duration of contact, and the interval between injury and cleaning procedure, prophylactic measures taken, and the probability of transmission [15]. The seroconversion rate following NSI is estimated to be about 30% for HBV [1], about 3% for HCV [16, 17], and <0.3% for HIV [18].

The objective of the present study was to describe the frequency and causes of NSI among medical students at the clinical center of the University of Frankfurt/Main.

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We determined the nature and time of the invasive activity leading to an NSI and assessed the reporting behavior of the students. Another objective was the presentation of prophylactic possibilities for NSI.

Methods

Study population

The University Hospital Frankfurt has 1184 beds and a total of 3900 staff members. Three thousand three hundred medical students are enrolled in medical school. When the study was conducted, 339 students were completing the clinical part of medical school.

Study design

Between the months of April and June of 2007, students completing the clinical part of medical school at the university clinical center of Frankfurt were invited to complete an anonymous questionnaire regarding NSI.

This self-developed questionnaire consisted of a brief introduction to the hazards associated with NSI, followed by a four-page questionnaire with a total of ten questions and eight follow-up questions for students who had previously suffered an NSI.

NSI was defined as “any skin injury by a stick, cut, or scratch from needles, scalpels etc., which were contaminated with patient material, no matter if bleeding of the wound occurred or not – including direct contact with the skin or mucous membrane of mouth, nose and eyes”.

The number of NSI during medical school prior to its clinical part, the nature of the invasive activity leading to an NSI, the device, which injured the student, the report-

ing behavior, as well as the hepatitis B vaccination status were surveyed by this questionnaire.

Questionnaires were handed out prior to an NSI class by the Occupational Health Service. The Occupational Health Services Director was available to students as a contact person in case of any further questions (e.g., vaccination status, reporting procedure).

Results

Overall, 312 out of 339 medical students participated in the survey (rate of return 92%), 59.8% (n=186) were female, and 40.2% (n=125) were male. This distribution reflects the gender distribution among students at the University of Frankfurt. One questionnaire was excluded from evaluation due to inconsistent and illogical information.

The average age was 27.1 years (range: 23–43 years); all students had recently enrolled in the clinical part of medical school, after completing an average of 11.6 semesters (range: 10–25 semesters).

A total of 58.8% (n=183/311) of all students surveyed reported at least one NSI, more than one-third (n=68/183) of these students had two or more NSI (maximum number: 5 NSI) (Figure 1). The frequency and nature of the invasive activity resulting in an NSI varied among the academic stages and specialty areas. Figure 2 shows the educational stage where each NSI occurred.

The risk of NSI was a function of the activity. A higher NSI rate during a certain invasive activity did, however, also reflect the number of procedures performed. Most NSI occur during venous blood collection, placement of indwelling venous catheter, and during surgical suturing (Figure 3).

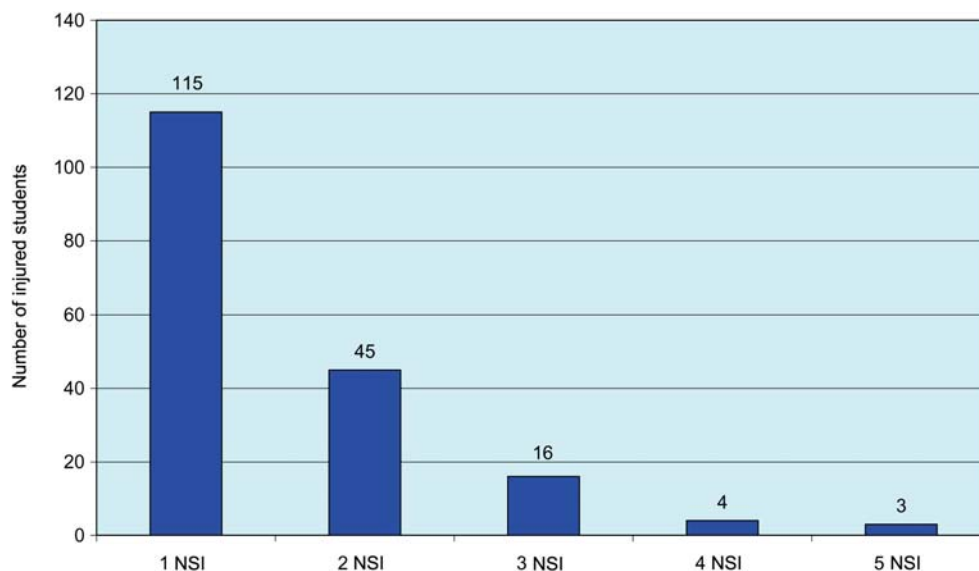


Figure 1 Number of students by frequency of needlestick injuries in the course of medical education up to the clinical part of medical school (6th year).

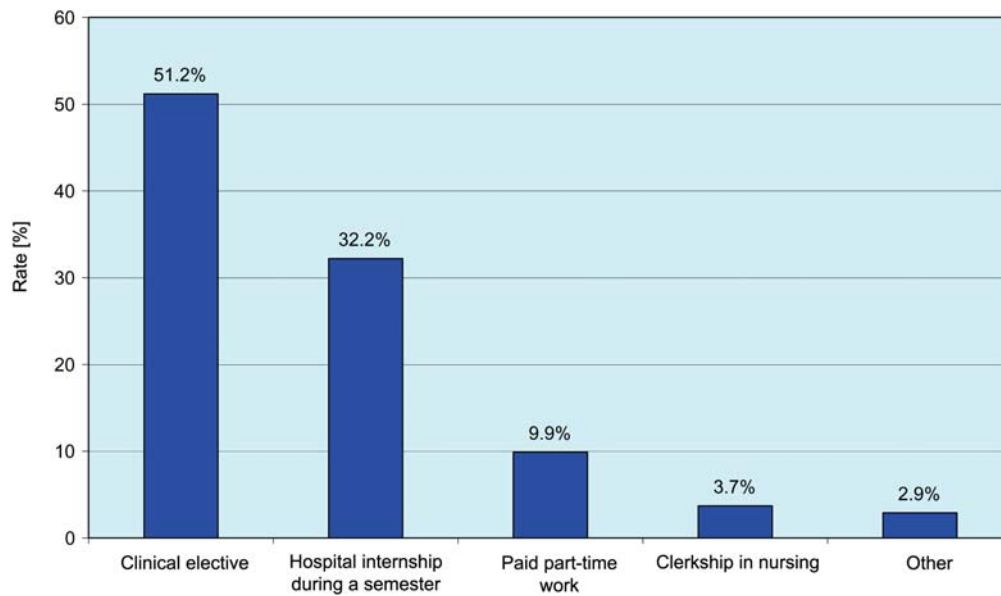


Figure 2 Needlestick injuries occurring at different stages of medical education.

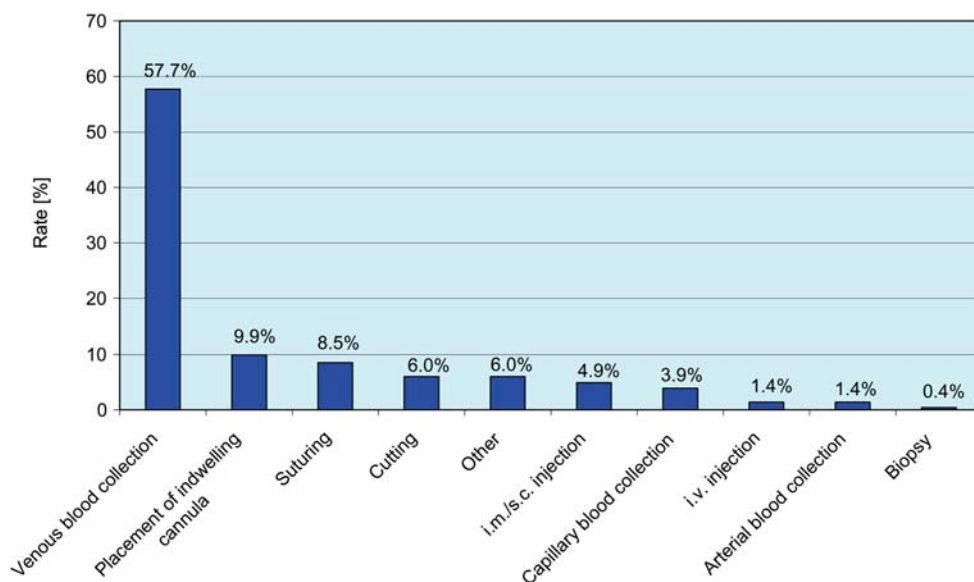


Figure 3 Needlestick injuries occurring with different invasive activities.

A large percentage of NSI occurred during their disposal (58.1%). Other causes were comparatively rare, e.g., recapping (9.5%), unexpected patient movements (7.4%), transfer of a used device to another person (2.1%). Most NSI (79.2%; $n=225/284$) concerned needles, only a relatively small percentage was caused by surgical devices (18.7%; $n=53/284$).

The severity of the NSI was classified as “superficial” in 46.5% ($n=132/284$), as “moderate” in 48.9% ($n=139/284$), and as “severe” in 3.2% ($n=9/284$) of all reports.

Only 65.6% ($n=120/183$) of students were wearing gloves at the time of the NSI, and 34.4% ($n=63/183$) of

these students reported they had not been wearing any gloves.

Only 38.3% of medical students injured had reported all NSI to the transition physician, while 54.6% of students had not reported any of the NSI, and 7.1% had reported their NSI occasionally.

The main reason (54.0%) for not reporting NSI was being ashamed, feeling “embarrassed”, and not wanting to “make a big deal” out of the injury. Figure 4 lists reasons for not reporting NSI.

NSI was classified as potentially dangerous by the majority of students (75.6%; $n=235/311$), whereas

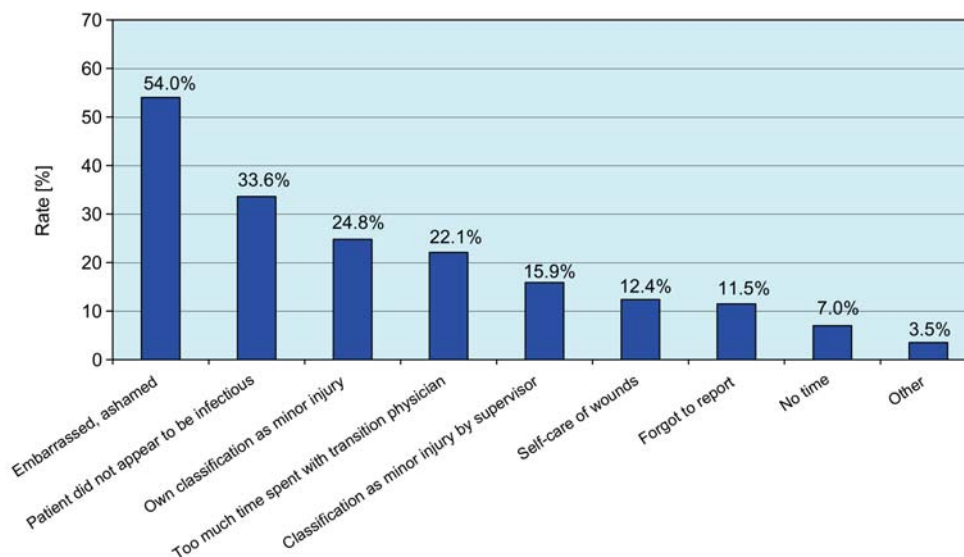


Figure 4 Reasons for not reporting needlestick injuries (more than one answer allowed).

20.6% ($n=64/311$) considered the risks of NSI to be of low significance. Only five students (1.6%) believed NSI were harmless, and seven students did not answer this question.

Only 45.3% ($n=141/311$) of students surveyed had previously heard about safe devices, only 11.3% had already worked with such devices, while 38.3% ($n=119/311$) had never heard about them (5.1%; $n=16/311$ did not answer).

According to German Vaccination Recommendations (STIKO 2007) and a public statement from the medical school, 89% ($n=277/311$) of students had been immunized against HBV. Only 1.9% ($n=6/311$) reported they had not been immunized. However, 7.4% ($n=23/311$) of medical students did not know if they had been immunized against HBV or not. 1.6% ($n=5/311$) gave no response.

Discussion

NSI can result in severe bloodborne infections, e.g., hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV), and pose a serious risk for all medical staff [19, 20]. Compared to a recent study at the University of Frankfurt, in which 31.4% of physicians and HCWs surveyed reported an NSI during the past 12 months [21], this rate was high among medical students entering the clinical part of medical school: 58.8% indicated they had suffered an NSI at some point during medical school. The number of injuries in our student population was higher than at the University of Florida, where 9.3% of students surveyed during the fourth year of medical school had received an NSI [14], or at the University of California in San Francisco, where a seven-

year longitudinal study was conducted, finding 11.7% of students had received an NSI [22].

Studies at different German Universities showed lower NSI rates than in the Frankfurt collective. A study conducted at the University of Erlangen/Nürnberg documented, e.g., a rate of 29.5% [10], and a study conducted at the University of Munich documented 12% during the first year of clinical practice, and 41% during the fourth year of clinical education [23].

The difference in NSI rates between the US and Germany is surely due to the less frequent use of safe devices in Germany, which explains the high number of NSI in Germany vs. the US (500,000 NSI among 750,000 HCWs in Germany [1] vs. 1 million NSI among 6 million staff members in the US [15, 24]).

A direct comparison of reasons for NSI among medical students and physicians as well as nursing staff at the University of Frankfurt [26] demonstrated that the NSI rate among students was particularly high (more than doubled) during venous blood collection (57.7% vs. 22.4%). This may be partly due to students' lack of experience, but predominantly to the fact that this is what they mostly do, and that they are not performing any sophisticated invasive procedures yet.

The high number of NSI among medical students is alarming, and should be cause for concern and a review of operational procedures and prophylactic measures. Despite applicable hospital infection control recommendations, 34.4% of medical students did not wear protective gloves during invasive procedures. In addition, the rate of students who reported an NSI to the responsible transition physician was only 38.3%. Similar results were obtained in different studies. The reporting deficit was 40% in a study of students from Washington [7], and 43% in a study of students from the University of Virginia [25].

Similar data were obtained among HCWs. In a recent study among physicians and nursing staff at the University of Frankfurt the reporting deficit was 75% [26]. The reporting deficit in a multicenter study (17 medical centers) in the US, conducted with physicians in the surgical residency program, was 51% [19]. Summarizing the results obtained in these studies, it has to be concluded that the true degree of NSI frequency is being substantially underestimated.

Reporting an NSI is crucial for its adequate treatment. Any NSI that is not reported or that is reported too late can result in a significant risk. In this context, the transmission of nosocomial infections from infected HCWs to patients is of concern [19].

In our study, the main reason for not reporting an NSI was being ashamed and embarrassed of having an NSI (54%), followed by the belief that the patient was not infectious (33.6%), low or lacking perception of risk (24.8%), and by discontentment about the transition physician procedure, waiting times, and follow-up measures (22.1%). Supervisors who consider NSI a minor injury also play a significant role in our study collective (15.9%).

Medical students have to be informed of the necessity of reporting each NSI. In a first step, reporting procedures should be standardized, along with the reduction of waiting times during the reporting process. Medical staff has to be urged to report an NSI in a timely fashion, since delays can result in a necessary PEP being applied too late and ultimately fail [27].

Our study, even though providing new data on NSI among medical students, is limited by the fact that our retrospective assessment was based on students' capacity for recalling events. Furthermore, the accuracy and plausibility of data obtained from students could not be verified when using anonymous questionnaires.

Our data do, however, suggest that the implementation of preventive measures, like e.g., educating students in the use of safe operational procedures, as well as practical training of students, should be strongly promoted [21, 28].

Various studies demonstrated the benefits of safe instruments [16, 21]. The needle stick study conducted in Frankfurt during 2006/2007 illustrated clearly that safe devices reduce the risk of infection for HCWs and thereby improve the protection of patients [26].

The NSI rate during medical school is alarming and demonstrates the necessity of optimizing the education and training of medical students. Teaching staff physicians should follow safe operational procedures and hospital infection control recommendations stringently and model appropriate behavior in front of their students.

It is the responsibility of medical schools to create a safe work environment and educational concept for their students, before students are exposed to the risk of bloodborne infections, which might have a long-lasting impact on their personal lives, their private environment, their professional perspective, and on the patients they will treat.

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