



## Major article

## Needlestick and sharps injuries among medical undergraduate students

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## Key Words:

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**Background:** Needlestick and sharps injuries (NSIs) can cause a transmission of bloodborne diseases. In this study, injury rate, accident mechanisms, and targets for preventive strategies were investigated at a major university hospital hosting different medical study programs.

**Methods:** In 2009 and 2010, cross-sectional anonymous surveys were carried out among medical undergraduate students. Furthermore, all NSIs reported to the accident insurer from 2007 to 2010 were analyzed. This spans the comprehensive introduction of safety instruments in the university hospital in 2008.

**Results:** The online survey was completed by 1,214 students in 2009 and 917 students in 2010. Results show an injury rate of 21.4% per year (mean value). Accidents are mostly related to vein puncture, surgical procedures, and instrument disposal. Comparing 2 parallel medical programs, the educational curriculum using objective structured clinical examinations, which are associated with significantly lower NSI incidences. The rate of under-reporting is 53% (mean value). Analysis of the injury reports made to the accident insurer showed a 50% decrease in NSIs surrounding the introduction of safe instruments.

**Conclusion:** Undergraduate medical students are at high risk of NSIs. Safe instruments and university instructions can prevent NSIs. Reporting procedures should be part of medical undergraduate training.

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Needlestick and sharps injuries (NSIs) are a hazard in regard to transmission of infectious bloodborne diseases, among them hepatitis B and C viruses and HIV. Health care workers and medical students are at risk of injuries because of daily procedures such as vein puncture or sewing.<sup>1-3</sup> There is a high risk of experiencing a potentially infectious injury or splash of blood or body fluid during work hours.<sup>1,4-6</sup> Because the prevalence of hepatitis B and C viruses and HIV among hospitalized patients is many times higher than in the general population,<sup>7</sup> it is of great importance to take potential exposures seriously. However, as previous studies have

demonstrated, there is a lack of risk awareness and a high under-reporting rate among medical staff and undergraduate medical students.<sup>2,3</sup> A common phenomenon is the high rate of unreported exposures.<sup>4,5,8-10</sup> Among other things, lack of risk awareness, lack of time, and ignorance of the reporting system as well as trivialization by superiors and shame have been evaluated as possible reasons for under-reporting.<sup>4,8</sup>

In this study, undergraduate medical students are the focus group. It is a fact that, among all accidents that are overall reported to the accident insurer, NSIs represent a major part. This observation gave impulse to the present investigation. A lack of clinical experience puts students at risk of experiencing blood and body fluid exposures. Undergraduate education could be vital for taking preventive action and promoting awareness among future physicians. There are suggestions that the quality of training prior to clinical traineeships can have a preventive effect on NSIs.<sup>11</sup> The

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current study's main objectives are, first, to assess the present state at the university including reported and not reported injuries and, second, to identify existing preventive factors and approaches for future preventive strategies. First, all injury reports made to the accident insurer in the years 2007 to 2010 have been analyzed retrospectively. Second, an anonymous online questionnaire was created and sent to all undergraduate medical students of the faculty in 2009 and 2010.

The analysis of the injury reports made to the accident insurer supported the development of the questionnaire. Furthermore, it provides an opportunity to evaluate whether the nationwide comprehensive introduction of safety instruments in 2008—as a major step toward prevention of NSIs—has in fact had an effect on the reported total NSI numbers at the faculty.

The anonymous online survey is a method to reveal cases of unreported injuries and gather detailed information on injury circumstances. Additionally the students' experiences were requested concerning instruction in the use of safety instruments, procedure tutorials, and postexposure measures.

Interestingly, at the time of the surveys, there were 2 different study programs at the university simultaneously: the regular study program and the reformed study program. The reformed study program represents a smaller amount of students (60 students per year vs 300 students per year, respectively) who have been allocated randomly to the study program. The regular study program is based mainly on written examinations, whereas the reformed study program is based on the objective structured clinical examinations, which also include vein puncture using an anatomic model. Thus, different curricula can be compared directly.

## METHODS

The study was approved by the Ethics Committee of the Charité Berlin.

### Online survey

An anonymous online questionnaire with 15 items concerning NSIs among medical students was designed. It was evaluated by a psychologist who is specialized in validating surveys and was piloted in a group of students. The questionnaire was sent to all students of the university via their personnel university e-mail addresses. In this way, it was ensured that participants were exclusively enrolled medical students. Survey requests were sent in the years 2010 and 2011 with 2 e-mail reminders, respectively. The questionnaire content was determined based on the literature and the analysis of the existing injury reports at the faculty as discussed below. The questionnaire concerned 5 basic topics: (1) Rate of NSIs, (2) circumstances and risk factors for NSIs, (3) reporting behavior, (4) present knowledge and student suggestions, and (5) personal data.

Data about the incidents were collected for the years 2009 and 2010. NSIs were defined as injuries with needles or other sharp instruments that were contaminated with potentially infectious patient material. Needlestick and sharps injuries were listed separately. Other exposures, such as mucosal contacts, for example blood splashes into the eyes, as well as wound contacts were not included in this study.

### Injury reports

Medical students reporting an NSI are obliged to complete a standard injury report. These reports are submitted to the accident insurer. In this study, all injury reports made to the accident insurer

**Table 1**

Characteristics of the study populations in 2009 and 2010 and mean values

	2009		2010		Mean value
	n	%	n	%	%
Total	1,214	100.0	917	100.0	100.0
Median age, y	25		24		
Median study semester	8		7		
Sex					
Male	409	33.7	331	36.1	34.9
Female	805	66.3	586	63.9	65.1
Participation by study program					
Regular medical study program	1,023	84.3	617	67.3	75.7
Reformed medical study program	191	15.7	89	9.7	12.7
Model study program	0	0	211	23.0	11.5

NOTE. The characteristics of the study population are shown for both study years (2009 and 2010), including age, sex, study semester, and the attended study program. The study group can be considered to be representative for the students of the faculty in 2009 and 2010. Most participants attended the regular study program.

in 4 years from 2007 to 2010 were analyzed. In accordance with the online survey, mucosal contacts and wound contacts were not included. Fortunately, the analyzed period includes the introduction of safety devices at the faculty in 2008 so that possible effects on NSIs among students could be evaluated.

### Setting

The project was performed at one of Germany's major medical faculties educating more than 7,000 undergraduate medical students in 2010. One of the most interesting circumstances has been the existence of 2 parallel faculty programs: a regular one with more than 600 students a year based on the national standard education and a reformed program, which started as a trial in 1999. The reformed program with new teaching formats such as PBL, skills laboratory, and objective structured clinical examinations was limited to 60 new students a year selected by chance.

Having had very good experience with the reformed program, the faculty decided to merge the regular and the reformed program and create a new model program bringing together the best elements of both. The model program was started in 2010. Because of legal regulations, the faculty needs to pursue the regular and the reformed program for at least another 5 years. Therefore, the faculty has the unique opportunity to compare different educational curricula.

### Statistical analysis

Data collection was performed with Microsoft Office Excel (version 2003, Microsoft Corp, Redmond, WA). Statistical analysis was performed with SPSS Statistics (version 19; SPSS Inc, Chicago, IL). Nonparametric tests were performed. Values of  $P \leq .05$  were considered statistically significant.

## RESULTS

### Online survey

Characteristics of the study populations are shown in Table 1. More than one-fifth of all participating students received at least 1 injury per year. Less than half of the injured students reported their injuries. The injury and reporting rates are shown in Table 2.

The total counts of injuries were 377 in 2009 and 252 in 2010. In fact, out of all injured students, 82% (mean value of 2009 and 2010) were injured once, whereas 18% experienced 2 or more injuries in the respective year. The activities most frequently associated with

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