

Risk of professional accidental exposure to biological agents in health care workers: a retrospective analysis carried out in a southern Italian tertiary hospital

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SUMMARY

Worldwide the needlestick injuries of health care workers (HCWs) still represent a major health problem. The authors aimed to evaluate the risk of HCW needlestick injuries in a tertiary university hospital in southern Italy in relation to some HCW characteristics (age, sex, professional profile, work department) and the source of infection. All HCWs of the University Hospital "Federico II" in Naples, Italy, attending the Infectious Diseases Unit after potential accidental contact to blood-borne viruses through needlestick injuries were enrolled during a 22-year period. HCWs underwent clinical analysis and were administered a specific questionnaire to collect (in anonymous fashion) data about age, sex, professional profile and work department. From 1995 to 2016 1,477 needlestick injuries in the same number of people (one accident per person) were recorded by our service. The HCWs were predominately males ($n = 806$, 55%) and the mean age was 39.4 years (± 10.1 SD). The job categories most involved were: physicians (41%), followed by nurses (33%) and healthcare

assistants (HCAs, 10%). The incidence proportion was calculated for these highest-risk categories in three defined time points (at the beginning, in the middle and at the end of the study period): 104/2149 (4.86%) in 1995, 41/2498 (1.64%) in 2005 and 25/2057 (1.22%) in 2015. Most injuries occurred in General Surgery (14.21%), Gynecology and Obstetrics (9%) and Pediatrics (6.49%). In about 34% the HCWs had been exposed to HCV infected fluids. Over time, a significant decrease in accidental exposure was recorded for physicians ($p = 0.019$), nurses ($p < 0.0001$) and HCAs ($p < 0.0001$). Our results confirm that some profiles, namely physicians, nurses and healthcare assistants, are still at risk of needlestick injuries, especially in surgical areas, including obstetric wards. Further primary and secondary prevention strategies are needed to decrease the incidence of new cases of needlestick injuries.

Keywords: Health Care Workers (HCWs), needlestick injuries, professional categories, occupational risk

INTRODUCTION

Worldwide needlestick injuries, namely the accidental puncture of the skin by a needle during a medical intervention, still represent a relevant health problem for about 59 million

of Health Care Workers (HCWs), who may be daily exposed to the accidental contact with the patient's blood or body fluids mixed with blood [1-4]. Yearly, about 3 million of HCWs, one third of them in the European countries, are reported to experience percutaneous exposure to blood-borne viruses: about 2 million to Hepatitis B Virus (HBV), 0.9 million to Hepatitis C Virus (HCV), and 170,000 to Human Immunodeficiency Virus (HIV) [1-3]. The professional exposure can be favoured by several at risk procedures such as

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re-capping of the needle, wound closure, biopsy cleaning up, transporting of waste material and high-stress interventions such as diagnostic or therapeutic endoscopy in patients with gastrointestinal bleeding. The implementation of universal precautions, adequate prophylaxis measures and management of exposure can prevent most blood-borne-acquired infections in HCWs [1-4].

The aim of this manuscript was to evaluate the risk of the HCW's needlestick injuries in a tertiary university hospital of Southern Italy in relation to some HCW's characteristics (age, sex, professional profile, and work department) as well as the source of infection.

■ MATERIAL AND METHODS

This retrospective study focuses on all the HCWs who were referred to the Infectious Diseases Unit of University Hospital "Federico II" (Naples, Italy) because of post exposure prophylaxis after accidental contact with biological fluids from January 1995 to December 2016 in order to undergo blood sampling and when indicated prophylaxis for HBV and HIV. They were required to complete anonymously a data collection form. This form contained personal data (age, sex), job category (physician, nurse, healthcare assistants [HCAs], nursing aid, laboratory technician, trainer nurse, voluntary social, students, other), hospital branch/department, site of accident/injured body part, source of infection, either known (namely bloody fluids from patient known to be infected or not by HBV, by HCV, by HIV) or unknown (e.g., exposure to instruments/needle left in the environment).

Our study relies on the careful review of these collected data. Statistical analysis was carried out through SPSS 18.0 for Mac, using mean, standard deviation (SD), chi square test. Furthermore, the number of needlestick injuries over the years and comparison of different ages was calculated by "Pearson linear correlation coefficient" and "Unpaired Student test", respectively.

The prevalence rates have been calculated for overall the reported needlestick injuries, while only for three at higher risk professional categories, namely physicians, nurses and HCAs, has been possible to calculate the incidence proportion in three defined time points: 1995, 2005 and

2015, considering as denominator all people belonging to these categories working at the hospital throughout the specific year.

■ RESULTS

From 1995 to 2016, 1,477 needlestick injuries in as many people have been recorded a tour service. The mean number per year was equal to 67.1 injuries. The analysis of the data collection forms showed that the HCWs exposed to needlestick injuries were males in 806 cases (55%) and female in 667 cases (45%); in 4 cases (0,27%) this information was missing.

Overall the mean age of HCWs was 39.4 years (± 10.1 SD), without significant difference between males (40.4 ± 9.8 SD) and females (38.2 ± 10.4 SD) ($p = 0.13$).

Table 1 shows the distribution of needlestick inju-

Table 1 - Distribution of needlestick injuries by sex, age, professional profile, work department and the source of infections among HCWs.

	No (%)
Gender	
Male	806 (54.57%)
Female	667 (45.19%)
Missing data	4 (0,24%)
Mean age (years)	39.4
Professional profile	
Physician	599 (41%)
Nurse	490 (33%)
Healthcare assistant	145 (10%)
Student	77 (5%)
Laboratory technician	39 (2%)
Midwives	10 (1%)
Other	62 (4%)
Unknown	55 (4)
Wards	
General surgery	210 (14)
Gynecology and obstetrics	133 (9%)
Pediatrics	96 (7%)
Orthopedics	75 (5%)
Anesthesiology	61 (4%)
Infectious diseases	23 (1%)

ries by sex, age, professional profile, work department and the source of infection. According to the job category of the HCWs, the largest percentage of cases has been reported between the physician (599 cases, 41%), followed by nurses (490 cases, 33%) and HCAs (145 cases, 10%); although the number of cases between the students of the medical and nursing school was low (77 cases, 5%), it seemed to be higher compared with laboratory technicians (39 case, 2%) and midwives (10 cases, 1%). In 62 cases (4%) this information was missing.

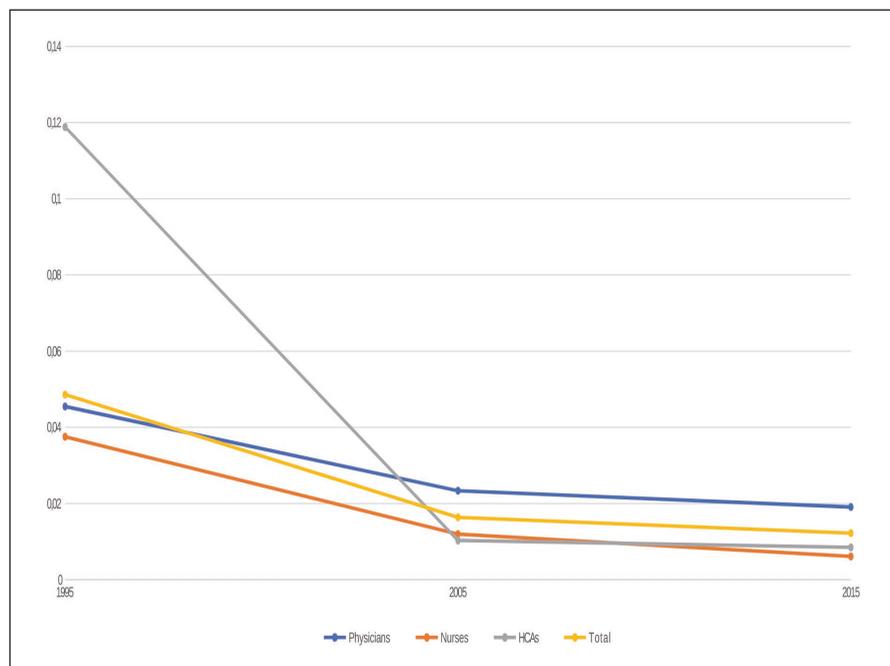
Concerning the hospital branch/department where the injuries occurred, the largest percentage of cases has been reported in the General Surgery (210 cases, 14%), followed by Gynecology and Obstetrics (133 cases, 9%), Pediatrics (96 cases, 7%), Orthopedics (75 cases, 5%) and Anesthesiology (60 cases, 4%); interestingly only 22 cases (1%) had been reported among subjects who worked in the Clinic of Infectious Diseases. However, in 224 (15%) cases there were no related data. The patient source was unknown in 811 cases (55%); in the remaining cases the source was most frequently represented by HCV infected patients in 487 cases (33%) and less frequently by patients with HBV infection (54 cases, 3%) or with HBV/HCV co-infection (7 cases, <1%), or by patients

tested negative for markers of HBV, HCV, HIV infection (118 cases, 8%).

The incidence proportion of needlestick injuries in three defined time points (at the beginning, in the middle and at end of the period) has been calculated only for three professional categories (namely physicians, nurses and HCAs) which had shown the higher risk of injuries (Figure 1). The related incidence proportion was: 104/2149 (4.86%) in 1995, 41/2498 (1.64%) in 2005 and 25/2057 (1.22%) in 2015. The results pointed out that a statistically significant needlestick injuries' remarkable decrease occurred in all three professional categories. Among physicians the incidence of needlestick injuries declined from 4.5% (41 cases out of 893 people) in 1995 to 2.3% (24 out of 1006) in 2005 ($p = 0.019$). Among nurses, the incidence of needlestick injuries declined from 3.8% (39 out of 1051) in 1995 to 1.2% (15 out of 1218 in 2005 ($p < 0.0001$)). Lastly, among HCAs, the incidence of needlestick injuries declined from 11.9% (24 out of 205) in 1995 to only 1% (3 out of 274) in 2005 ($p < 0.0001$). Thereafter, until 2016 no statistically significant difference in needlestick injuries incidence between these three professional categories have been recorded.

In the span of time, a 2.1 year decrease of HCWs

Figure 1 - Trend of needlestick injuries reported among physicians, nurses and healthcare assistants of the University Hospital "Federico II" in Naples, Italy



average (38.1 vs. 36.6 years) and increase in female sex cases (34.2% vs. 70%) have been recorded. These results can be mostly attributed to the gradual turnover of the university hospital staff and medical/nursing school population with a numerical increase in younger and predominantly female subjects.

■ DISCUSSION

Worldwide occupational exposure to patient's blood-borne infectious agents still represents a major problem in healthcare setting [1-13]. In the United States alone the National Surveillance System for Healthcare Workers estimated about 236,000 injuries yearly, that means more than 800 every day, but according to other reports this number might be higher than 380,000 [3, 5]. In Germany the number of annually notified injuries has ranged from 37,000 to 51,000 in the last years [8]. In Italy, a national system of collecting data (SIROH) have reported about 50,000 accidental percutaneous or muco-cutaneous exposures, but other studies reported about 96,000-100,000 exposure yearly, most of them not notified [5, 7, 14, 15]. Generally, most cases (more than 80%) are due to sharp instruments and mainly to needle (responsible alone of 70% of injuries) [2]. The reported incidence of sharps injuries ranges widely from 1.4 to 9.5 per 100 HCWs per year [5].

The results of our retrospective study seem to indicate a trend towards declining number of needlestick injuries in one of the largest tertiary university hospitals in Southern Italy. Interestingly, the most relevant reduction has been observed from 1995 to 2005 ($p < 0.00003$), among the three most involved categories (physicians, nurse and HCAs), whereas over the following years the fluctuation has not been significant ($p = 0.11$): indeed, after 2005 the number of cases has slightly oscillated without falling below 28 cases yearly.

These results agree with the literature data for both the declining number and for the at higher job categories. In fact, a significantly decrease ($p < 0.001$) of annual incidence of needlestick injuries has been reported by Sohn et al in United States; also, in this study the decline was greatest in nurses respect to the other categories [16]. Also in Italy a study carried out in five Ligurian public health care institutions reported a decline by approxi-

mately 47% from 2006 to 2010, which corresponds to a mean yearly reduction of about 9% (18). Undoubtedly, this reduction has to be related to the global strategy to prevent occupational exposure to blood-borne pathogens due to needlestick and sharp injuries in healthcare settings; the adoption of devices incorporating safety features played a crucial role in protecting HCWs from needlestick injuries [2-4, 7, 8, 12-17]. Nevertheless, a few disappointing data on the trend of needlestick injuries have been reported. In Germany, after the introduction of safety features the annual number of injuries dropped from 50,000 to 37,000, but after 2007 it increased again up to 51,000 [8]. In the United States, the Exposure Survey of Trends in Occupational Practice (EXPO-S.T.O.P), involving 181 hospitals in 34 states reported that incidence of needlestick injuries has significantly decreased since 2002, but it has plateaued since 2009; even in 2014 incidence was significantly higher than in 2010; the incidence of sharp injuries among nurses was not significantly different in 2015 (3.2/100 nurse) than in 2012 (3.3/100 nurses) [19].

Compared to the literature data, we have found that physicians overcame nurses as at-risk job category. In fact, previous studies reported that nurses accounted for approximately 55-65% of exposed HCWs [8]. Italian data showed that nurses have the highest exposure rates of all occupational groups in almost every working area; indeed, according to their tasks, nurses perform the highest number of diagnostic and invasive procedures on the patient, such as blood drawing, insertion of peripheral vascular catheters and IV therapy (14). In our study, the risk of exposure is related to the tasks carried out by each occupational group; for this reason, HCAs (9.8%), students of the medical and nursing school (5.21%) may also be exposed to needlestick injuries owing to the inappropriate disposal of sharp objects. Another category is represented by housekeepers, whose risk is mainly influenced by the "prevalence" of sharp medical devices in their working area, and by incorrect disposal of sharps by the original users of the items.

Another determinant is the working area, in relationship with the intensity and type of care provided to patients. Several studies reported that general surgery and surgical specialties are the areas with the highest cumulative rates of exposure in Italy (11%) as well as other Countries [5, 14].

Our results confirm the higher risk in subjects attending General Surgery department (14%) and attending the Gynecology and Obstetrics (9%). Interestingly, the number of cases reported in a ward theoretically at risk for the presence of infected patients such as Infectious Diseases has been constantly very low, probably due to the greater awareness of risk by operators and increased adherence to adopt standard precautions [14]. Nevertheless, there is evidence from literature pointing out a risk perception towards biological hazards among employees in surgical areas sometimes higher than the one of colleagues working in non-surgical wards [20].

In our study HCV is confirmed to be the most common blood pathogen present in the patient's source (33%) over the years, whereas the number of HBV or HIV infected source is negligible.

The present study certainly suffers from several limitations, due to the study design itself. The main limitation stems from its retrospective nature carried out only focused on the HCWs who attended the Clinic of Infectious Diseases for the post-exposure prophylaxis from 1995 to 2016 and not on all the number of needlestick injuries that occurred in this time span, since some personnel might have chosen not to be checked. In addition, having reviewed retrospectively self-filled post-exposure questionnaires with limited data, we did not have the possibility to perform more advanced analysis (for instance, multivariable analysis to assess the factors driving the risk of injury). Eventually, we do not have complete follow-up data to determine the sero-conversion rate after the potential exposure.

In conclusion, in recent years we have observed a marked reduction in needlestick injuries among HCWs in our tertiary university hospital; nevertheless, further primary and secondary prevention strategies are needed to lower occupational exposure risk to HCV and HBV and to implement educational and/or technological campaigns to decrease the incidence of new cases of needlestick injuries in all subjects attending health care environment, including students of medical and nursing schools.

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Conflict of interest

None

Ethical approval

This study used a publicly available dataset of de-identified data. Therefore, no institutional review board approval was necessary.

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