

Injuries caused by sharp instruments among healthcare workers – international and Polish perspectives

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Abstract

Health care workers (HCW) worldwide are especially exposed to injury by sharp instruments in the course of their duty. The most often executed procedures with injury risk are: intramuscular or subcutaneous injection (22%), taking blood samples, or during intravenous cannulation (20%), and repeatedly replacing the cap on an already used needle (30%). Even a minor sharp injury with only a small loss of blood carries the risk of transfer of over 20 pathogens: Hepatitis B Virus (HBV), Hepatitis C Virus (HCV), HIV/AIDS virus, malaria, syphilis, tuberculosis, brucellosis, herpes virus and diphtheria. The World Health Organization (WHO) estimates that more than two million health care workers experience the stressful event of a percutaneous injury with a contaminated sharp object each year (25-90% of them, however, remain unreported). These exposures result in about 16,000 infections with HCV, 66,000 with HBV and about 1,000 (200-5000) with HIV, which lead to about 1,100 deaths or significant disability. Exposures to sharp injuries and their consequences are highly preventable through simple interventions, such as HBV vaccination, education and providing containers for sharp instruments. Specific guidelines, similar to the American Occupational Safety and Health Administration (OSHA) regulations that have lowered by up to 88% of needle stabbing incidents, should be introduced by the European Union (EU) and other countries. The results of a review of reports leads to the following conclusions: 1) elaboration and implementation of new State regulations, especially in EU countries and in countries where such regulations do not exist; 2) the training of health care personnel should always be undertaken for new employees, and periodically for those already employed; 3) periodical control by appointed inspectors of knowledge of procedures for the prevention of injuries by sharp instruments among health care workers; 4) introducing and training in the use of equipment, which can prevent the sharp injuries; 5) an advanced monitoring system of sharp injuries sustained by worker should also be introduced. Successful implementation of these prevention measures will result in progress for public health and HCW's health and safety.

Key words

needlestick and sharps injuries, occupational disease, health care workers, blood-borne pathogens, HIV, HBV, HCV, infection control

INTRODUCTION

It is estimated that the health care workforce (HCW) of 35 million people worldwide represents 12% of the working population. Health care workers: nurses, physicians, paramedics and laboratory technicians, are especially exposed to injury by sharp instruments in the course of their duty. The most often performed procedures with risk of injury are: intramuscular or subcutaneous injection, taking blood samples, or during the intravenous cannulation, repeated replacing the cap on an already used needle. The first reported case of needlestick-transmitted HIV infection led to increasing awareness and concern about the risks to

health-care workers posed by sharps injuries [1]. Even a minor injury caused by a sharp instrument but with little loss of blood carries the risk of transfer of over 20 pathogens. The most common and serious of the blood-borne pathogens are Hepatitis B Virus (HBV), Hepatitis C Virus (HCV), HIV/AIDS virus, as well as others, such as malaria, syphilis, tuberculosis, brucellosis, herpes virus and diphtheria. The risk of infection following a needlestick injury from a contaminated needle is: HIV – 0.3% (or a 1 in 300 chance of infection); HBV – 2-40% risk; and HCV – 2.7-10% [2].

It is estimated that two million injuries cause about 66,000 HBV, 16,000 HCV and about 1,000 (200-5,000) HIV infections among 35 million health-care workers each year. For health-care workers worldwide, the attributable fractions for percutaneous occupational exposure to HBV, HCV and HIV are 37%, 39% and 4.4%, respectively. These blood-borne infections have serious consequences, including long-term illness, disability and death [3, 4, 5].

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The article presents a review of current literature concerning the exposures to sharp instruments and their consequences for health and social care employees.

STATE OF KNOWLEDGE TO DATE

Health care workers: nurses, physicians and laboratory technicians are those at the highest risk of needle stabbing and becoming contaminated by a patient's blood. Furthermore, the significant differences between clinical and non-clinical units (26:18 stabbing on 100 occupied beds) are also observed [6]. The explanation for this situation should be pointed out: that the probability of needlesticks and other injuries by sharp instruments among new personnel or health care students is much higher in comparison to experienced personnel [6]. Other hospital personnel who are at risk are: maintenance personnel, hospital laundry employees and other supporting staff. Moreover, it is possible in only in 90-96% of cases of injury can it be identified with a specific patient as the source of blood present on a needle. In the remaining 3-9% of cases, the patient remains unknown. Furthermore, in almost 10% of cases, the status of seroconversion is also unknown. Also, up to 81% of all injuries caused by sharp instruments involve the primary users of such instruments; however, up to 39% concern others who are not directly engaged in executing of given health care procedures.

In Poland, 37,000 cases of needles stabbing occur annually. Most frequently, they happen to nurses, doctors, laboratory technicians and cleaning personnel [7]. Health care workers know that the increased risk of injury incidents are directly connected with being in a hurry, nervousness, absent-mindedness, and multiple attempts at executing the same procedure. The tendency was also noted of increased risk occurs when health care personnel are tired, do not have a patient's co-operation, or when the medical team was not fully present.

The procedure most often executed during injury can be inflicted is intramuscular or subcutaneous injection (22%). Almost 20% of incidents occur during taking blood or during intravenous cannulation. Both procedures are defined as being high risk. Up to 30% of incidents among nurses and laboratory technicians occurred during repeated replacing the cap on an already used needle.

Also in Poland, infections of health care personnel occur mainly during diagnostic, therapeutic and nursing procedures. The results of an analysis carried out in Wrocław

indicate that the most often executed procedures with injury risk are: intramuscular or subcutaneous injection (21%), taking blood samples, or during intravenous cannulation (23%), repeated replacing the cap on an already used needle, and wounds caused by staples [8].

In 2007 in Poland, 161 cases of incidental occupational infection with hepatitis viruses (116- HCV, 45- HBV) were reported in which the highest occupational incidence of hepatitis involved mainly to nurses (145 cases in 2007). Incidental needle stabbing mostly occurred during the repeated replacing of the cap on an already used needle, or during the disposal of used needles [9]. According to the Institute of Occupational Medicine in Lodz, hepatitis B and C accounted for almost 50% of occupational diseases among health care workers in Poland in 2008.

Almost 10% of all European Union employees work in health and social care systems, and a considerable number of them work in hospitals [5, 6]. The number of incidents among them caused by sharp instruments is about 34% higher than the average rate observed among other professional groups in the UE [10]. Health care workers are the highest risk group regarding sharp instrument injuries, most of them being caused by contaminated instruments, which include needles, lancets, scalpels and broken glass. Among all incidents, the greatest danger is from stabbing by needles contaminated by a patient's blood. The European Health Care Workers at Risk (Ecomed) report provides data which states that in European hospitals there occur over 1 million needle stabbings every year [10]. Despite the considerable differences among statistical data of individual European Union countries, it has been estimated that every year, in 100 occupied hospital beds, 12-30 beds were occupied due to needle stabbing [10]. Table 1 provides the estimated data concerning the frequency of injury by sharp instruments incidents which occurred among health care workers in certain EU countries and USA [10, 11, 12]. It is evident that there are significant differences in the incidence of injury by sharp instruments between the compared countries. However, the available data are incomplete and from different periods of time, and there is a lack of comparable data on the number of health care workers in different countries. Moreover, in the presented estimation, the number of inhabitants was adopted in 2005, and available data on the number of injuries caused by sharp instruments from the period 2000-2010. The apparent big differences should be interpreted as the result of differences in the definition of 'injury by sharp instruments', different law regulations and different rules and habits concerning the reporting of 'minor' accidents at work. It should be

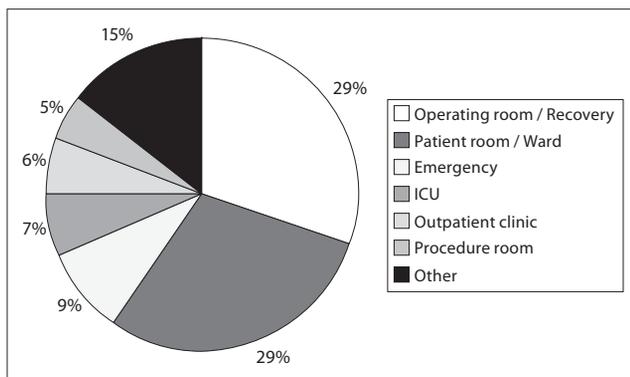


Figure 1. EPINet report concerning places where incidents of needlestick and injuries by sharp instruments most often occurred

Table 1. Frequency of injury by sharp instruments among health care workers in certain EU countries and USA

Country	General population in 2005	No. of reported of stabbing incidents	Rates per 100,000 inhabitants
UK	59,402,000	100,000	168,34
France	61,181,500	15,000	24,52
Spain	43,398,190	4,108	9,47
Germany	82,469,420	500,000	606,29
Italy	58,607,040	68,000	116,03
Poland	38,161,310	37,000	96,96
USA	295,618,500	385,000	130,24

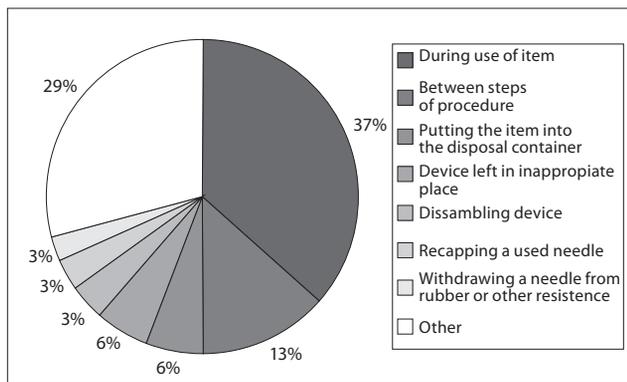


Figure 2. EpiNet report concerning circumstances in which incidents of needlestick and injuries by sharp instruments occurred

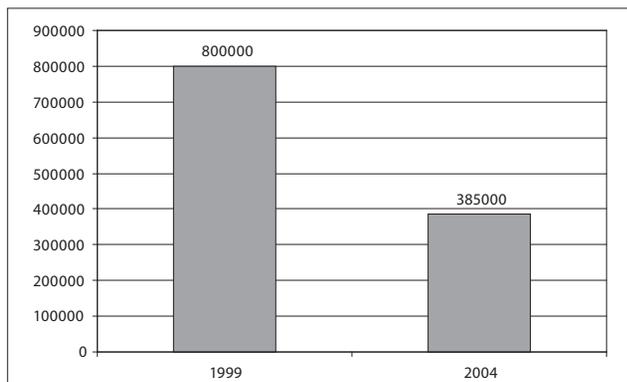


Figure 3. Frequency of needle stabbing incidents among health care workers in the USA before and after OSHA regulation concerning the prevention of such incidents.

pointed out that 25%-90% of needlestabbing incidents remain unreported [6, 12, 13]. Figures 2 and 3 show some data from the EpiNet report concerning places where the incidents most often occurred [6].

In Poland, the incidence of injuries by sharp instruments: needles, cannules, blades, etc., is higher than the European average by 34% (12-20 cases of stabbing per 100 hospital beds) [7]. This is caused by the use of traditional needles and cannules which are almost totally unused in many countries. The average use of cannules by Poland places it behind Ecuador and the Phillipines, and a little better than Vietnam [7]. The results of analysis carried out in Wrocław indicate that stabbing occurs in that city at the rate of 10 health care workers every month. The unreported incidence is potentially higher by as much as 100% [8].

Hepatitis type B (HBV). Hepatitis type B virus is the most frequently occurring serious liver infection worldwide. According to CDC and WHO reports, approximately 30% of the global population, or two billion people, show serological symptoms of hepatitis type B virus infection [14]. In the case of almost 400 million people, chronic HBV infection is observed [15]. These people live in: Asia – 78%, Africa – 16%, North America – 3%, South America – 3%, Europe – 3%. It should be pointed out that the proportion of seroconversion after percutaneous exposure is as much as 30% [10].

Approximately 33%-50% of patients with acute hepatitis have such symptoms as: jaundice, fever, nausea and abdominal pain. Many of these acute symptoms were eased, but in 2%-6% of patients the chronically hepatitis form of the disease will appear. Up to 15% of these patients will die due to the

liver cirrhosis or cancer [16]. Furthermore, every year, over one million people die due to chronic liver diseases connected with liver cirrhosis and hepatocellular carcinoma (HBV). It should be pointed out that every year another 10-30 million people become infected with HBV.

The total number of infected individuals reaches 400,000-600,000, of which 60% of the infections occurred in hospitals and other health care institutions. Since 1991, the WHO has recommended the inclusion of the vaccine against HBV in the national programme of vaccinations [14]. According to statistical data, 70%-90% of health care system employees in the EU acquire immunity after vaccination against HBV. On the contrary, the medical literature reports show that only in 5% of HBV vaccination, immunity will not be observed [17]. As a result of the global vaccination programme, usually begun in childhood or early youth, the incidence of HBV infection has been significantly reduced.

The post-exposure prophylaxis (PEP) needs to be started within 24 hours after exposure to HBV-positive material [18]. Recommendations for HBV post-exposure management include initiation of the hepatitis B vaccine series to any susceptible, unvaccinated person who sustains an occupational blood or body fluid exposure. Post-exposure prophylaxis (PEP) with hepatitis B immune globulin (HBIG) and/or the hepatitis B vaccine series should be considered for occupational exposures after evaluation of the hepatitis B surface antigen status of the source, and the vaccination and vaccine-response status of the exposed person. Guidance is provided to clinicians and exposed HCW for selecting the appropriate HBV PEP [19, 20].

Hepatitis type C (HCV). Globally, over 120-170 million people (3%) are infected by the hepatitis type C virus [18]. Among the population of the European Union and North America, the percentage of those who are HCV positive amounts to 1%, in some Mediterranean and Asiatic countries 3%-4%, and up to 20% in Central Africa and Egypt. Unfortunately, every year, another 3-4 million people are infected by HCV [21]. In Poland, 730,000 people are infected with HCV, and every year the detection rate reaches 2,500 cases [8]. Worldwide there exist 6 different genotypes of HCV with approximately 30 subtypes [18]. The seroconversion percentage has been estimated at around 3% after percutaneous exposure [17, 22]. Nowadays, in the EU there live 2-5 million people infected by HCV, or people who are carriers of the virus [21].

In the USA, hepatitis type C is the most prevalent chronic disease transferred by blood. It is estimated that 4.1 million of Americans are infected by HCV, while in 3.2 million the chronic form of the disease is observed [23]. According to numerous literature sources, HCV infection usually shows no symptoms (80%) or the symptoms are very mild. Unfortunately, in 55%-85% of patients with HCV, chronic infections are observed [23]. Liver cirrhosis is observed in about 10%-20% of patients with the chronic form of hepatitis [16]. There is no effective vaccine against HCV. Immune globulin and antiviral agents (e.g. interferon with or without ribavirin) are not recommended for PEP of hepatitis C. For HCV post-exposure management, the HCV status of the source and the exposed person should be determined, and for HCV exposed to an HCV positive source, follow-up HCV testing should be performed to determine if infection has developed. [19, 20].

Human Immunodeficiency Virus (HIV), Acquired Immune Deficiency Syndrome (AIDS). The first case of HIV infection due to needle stabbing occurred in 1984. This incident showed the risk of working with sharp instruments [4, 19]. However, despite this incident, public consciousness of the risk of infection, especially among health care workers, still needs to be stressed. The 2001 CDC report announced 57 confirmed and 138 possible cases of transfer of the infection among health care workers during the performance of their duties [24]. Here, it should be mentioned that there are 40 million HIV/AIDS positive people, and every year about 3 million people die due to AIDS infection. Currently, the number of those infected in Poland reaches 9,000 [8]. It should also be pointed out that at this moment in time there is no effective vaccine against the HIV virus; the only post-exposure prophylaxis is to take anti-viruses drugs. PEP is the most effective therapy and should be started as soon as possible, at a maximum of 72 hours after the incident. Recommendations for HIV PEP include a basic 4-week regimen of 2 antiviral agents for most HIV exposures, and an expanded regimen that includes the addition of a third drug for HIV exposures that pose an increased risk for transmission. When the source person's virus is known or suspected to be resistant to one or more of the drugs considered for the PEP regimen, the selection of drugs to which the source person's virus is unlikely to be resistant is recommended [19, 20].

Guidelines for prevention. Exposure to sharp instruments and their consequences are highly preventable through such simple interventions as vaccination, education and providing containers for sharp instruments [5]. The principal existing regulation in the USA concerning the prevention of stabbing is the Department of Labor, Occupational Safety, and Health Administration, in which the final paragraph concerns occupational exposure to blood-borne pathogens, needlestick, and other injuries caused by sharp instruments [13]. Figure 3 shows that the Occupational Safety and Health Administration regulation introduced and implemented in the USA in 2004 lowered by up to 88% the number of needle stabbing incidents. The only guidelines for European Union countries concerning needlestick injuries are the implementation of pilot projects to reduce injuries to health care workers by sharp instruments: the World Health Organization 2005 [25] and the European Health Care Workers at Risk (Eucomed) [10]. However, there is no unified State regulation in the EU which could lower needle stabbing and other incidents involving injuries inflicted by sharp instruments on health care workers. The basic principles for the prevention of incidental needle stabbing are: improvement of organization at work places, employment of safe and adequate procedures and use of instruments, performance of medical interventions according to verified procedures, and constant supervision of procedures.

The list of simple measures available for the effective primary prevention of injuries by sharp instruments is as follows: avoidance of unnecessary injections, collection of contaminated waste sharp instruments immediately after use, and without recapping, placed in puncture- and liquid-proof containers for such instruments; waste sharp instruments should be managed in a safe, efficient and environment-friendly manner, programmes should be considered to

immunize health care workers at risk of injuries against hepatitis B, and consideration should be given to the use of safety and needle-free devices [5].

SUMMARY

Employees of health and social care systems worldwide are especially exposed to injury by sharp instruments during the performance of their duty. The procedures most often performed with risk of injury are: intramuscular or subcutaneous injection (22%), taking blood samples, or during intravenous cannulation (20%), repeated replacing of the cap on an already used needle (30%). Even a minor injury with a sharp instrument with little loss of blood carries the risk of transfer of over 20 pathogens: Hepatitis B Virus, Hepatitis C Virus, HIV/AIDS virus, malaria, syphilis, tuberculosis, brucellosis, herpes virus, diphtheria and others.

Despite substantial progress in industrialized countries, in most developing and transitional countries the protection of health care workers is still far from complete, and it is estimated that more than 2 million health care workers every year experience the stressful event of a percutaneous injury with a contaminated sharp instrument. Such adverse consequences weaken the health-care system by impacting on its workforce at a time when shortages of health care workers are reported in many countries. In addition to the burden caused in this professional group, occupational exposure to sharp instruments may lead to additional problems, including the discrimination of HIV-infected patients through fear of becoming infected by them.

Exposure to sharp instruments and their consequences are highly preventable through such simple interventions as vaccination, post-exposure prophylaxis, education and providing containers for sharp instruments. The results of this review of reports leads to the following recommendations:

Elaboration and implementation of new State regulations, especially in countries of the European Union and in countries where this kind of regulation does not exist.

The importance of training of health care personnel which should always be performed for new employees, and periodically for employed nurses, physicians and laboratory technicians, and other clinical personnel, as well as for supporting staff.

Periodical control by appointed inspectors who impart knowledge and procedures for the prevention of injuries by sharp instruments among health care workers.

Introducing and training in the use of new and safer equipment which can prevent the occurrence of injuries by sharp instruments.

An advanced monitoring and reporting system of injuries caused by sharp instruments incurred by health care workers should also be introduced.

Successful implementation of these prevention measures will result in progress for public health and HCW's health and safety.

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