

DID LEGAL REGULATIONS CHANGE THE REPORTING FREQUENCY OF SHARP INJURIES OF MEDICAL PERSONNEL? STUDY FROM 36 HOSPITALS IN ŁÓDŹ PROVINCE, POLAND

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Abstract

Objectives: The aim of the study has been to analyze the epidemiological data on sharp injuries among health care workers before and after the implementation of regulations related to the conduct of the register of sharp injuries. **Material and Methods:** We hypothesized that the introduction of legislation would change the existing low reportability of sharp injuries and reporting incidents would increase. In Poland the binding regulations, dating back to 2013, require the employer to keep a record of sharp injuries. Therefore, we compared the data from before and after the entry regulations. Data was collected from the records of occupational exposure/accidents at work in hospitals in the Łódź Province during 2010–2014. The feedback came from 36 hospitals (return index = 51.5%), representing a total annual average of 13 211 medical workers. **Results:** The incidence of injuries did not change significantly over the period 2010–2014, and the number of reported injuries in 2014 (the year when the Regulation had already been effective) was even lower than in the previous years. The average annual injury index was 12.31 injuries per 1000 employees (95% confidence interval: 11.48–13.16/1000). The incidence of injuries among nurses was significantly higher than in other groups of medical professionals ($p < 0.05$). These injuries most often occur while using needles ($p < 0.05$). **Conclusions:** The obligation to record occupational exposures set forth in current regulations is not likely to improve the reliability of reporting the incidents actually taking place. Further research should focus on identifying barriers to reporting cases of exposure to potentially infectious material. Action should be taken to raise awareness of medical personnel about the possible effects of exposure to infectious material, in particular, the benefits of the implementation of early post-exposure procedures. Perhaps it will increase the reporting frequency of sharp injuries of medical personnel. *Int J Occup Med Environ Health* 2018;31(1):37–46

Key words:

Blood, Occupational exposure, Infectious diseases, Medical personnel, Registration, Potentially infectious material

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INTRODUCTION

Patient care is associated with continuous exposure to harmful biological agents found in the work environment, such as pathogenic bacteria, viruses, fungi and protozoa [1]. Since occupational exposure to blood affects the majority of medical workers, on 10 May, 2010, the Council of the European Union adopted Directive 2010/32/EU [2], which is an implementation of the Framework Agreement on preventing sharp injuries in hospital and healthcare sector signed on 17 July, 2009 by the European social partners: the European Hospital and Healthcare Employers' Association (HOSPEEM) and the European Federation of Public Service Unions (EPSU).

The ordinance of the Minister of Health on occupational health and safety when performing work associated with the risk of injury by sharp tools used when supplying health services is the Polish adaptation of the provisions of Directive 2010/32/EU [3]. The Regulation, which came into force in 2013, imposes an obligation on the employer to keep a register of sharp injuries. This register serves as the starting point for the employer who is expected to analyze the circumstances and causes of injuries and propose measures intended to reduce the number of those injuries. At the moment, reliable information on how many such injuries occur in the workplaces in Poland is not available. No precise data is available on the number of events associated with accidental tissue disruption in Poland.

According to data from the Central Statistical Office in Poland in 2013, in the sector of health care and social welfare, a total of 8982 accidents were reported, out of which 1480 events had been caused by sharp objects [4]. According to the Center for Disease Control and Prevention of Infectious Diseases (CDC), in the United States the annual number of injuries among the hospital staff is 385 000 [5]. Throughout Europe, needle stick injuries are also one of the greatest problems in health and safety. A study by Prüss-Üstün et al. found that workers in European healthcare services could expect around 0.64 needle

stick injuries on average each year. Affecting around 6 million employees in the healthcare sector, this corresponds to nearly 4 million injuries of this type each year [6]. Note, however, that these figures are merely estimates, and the problem is that the workers themselves fail to report the injuries, which is confirmed by both the Polish and the study of other countries [7–10]. A huge proportion of the events is not reported, and if the employer is not aware of those events, he/she sees no need to invest in safe equipment.

The aim of the study has been a retrospective comparative analysis of epidemiological data on sharp injuries among medical staff in the Łódź Province before and after the implementation of regulations related to the conduct of the register of sharp injuries.

The study was dealing with the following questions:

- Has the current regulation [3] improved the frequency of reporting sharp injuries?
- What was the professional category of employees who were most exposed to the sharp injuries?
- Which of the tools used by health care professionals were usually responsible for the injury?
- During which actions do injuries occur most often?

MATERIAL AND METHODS

The research focused on the hypothesis that recently introduced legislation would improve the current low reportability of sharp injuries. To verify the hypothesis, we compared the data before adopting and after revoking the regulation of the Minister of Health [3]. Compared periods are not symmetrical, however, we wanted to explore the initial impact of the implementation of the new regulation.

The study employs a questionnaire sheet in the form of a table on sharp injuries among medical staff, developed specifically for the purpose of this study. The questionnaire sheets were sent through the Internet to all 62 hospitals located in the Province of Łódź, Poland. These were

the hospitals of varying sizes and varying degrees of reference: municipal, provincial, clinical, private. In addition, directors of all hospitals included in the database were contacted on the phone to convince them about the advisability of collecting data on the exposure of the employees to infectious material. The survey was anonymous.

Pursuant to the relevant Polish Ordinance [3], the first report on injuries in the hospitals should be prepared no later than 28 February 2014, and then updated once every 6 months. Data for 2014 originates from those registers. Data from previous years was obtained from reports on accidents at work, or other registers kept by the teams dealing with the nosocomial infections and/or other occupational safety and health (OSH) facilities in hospitals. The feedback came from 36 hospitals (return index = 58.1%), representing a total annual average of 13 211 medical workers. Hospitals that responded to the invitation to participate in the study were of varied sizes: employed from 7 to 2308 health care workers (567 on average).

To assess the prevalence of injuries, rates of injuries were calculated per 1000 workers/year (with 95% confidence intervals (CI)). In order to verify the study hypotheses and to answer research questions, Fisher-Snedecor tests were performed (to verify the differences between the fre-

quencies of injuries in each year), Pearson's Chi² tests of independence (for profession + tool and tool + year variables) were performed. The level of statistical significance was set at $p \leq 0.05$. The analysis and interpretation of the data were done with IBM SPSS Statistics 22 and Microsoft Excel 2010.

The study protocol was approved by the Bioethics Committee of the Medical University of Lodz (Document No. RNN/163/14/KB of 11.02.2014) in full accordance with the Declaration of Helsinki of the World Medical Association.

RESULTS

In the 5-year period, 813 injuries by medical sharps were recorded. The average annual number of the injuries per 1000 workers was 12. The average empirical likelihood of injuries in respective years ranged between 1.09% and 1.38%, and showed a weak downward trend. The likelihood of injury in the consecutive years 2010–2014 among medical personnel was the same ($F = 0.017$, critical value $F^* = 2.37$, $p \leq 0.05$) (Table 1).

The most frequent injuries occurred among nurses and midwives, for whom the incidence of injury in 2010–2014 ranged between 70.3–81.8% (average 76%). Each year, on average, physicians were victims of every 5th in-

Table 1. Sharp injuries among medical employees reported in the Łódź Province hospitals, Poland, 2010–2014

Variable	Reported data from consecutive years					total	Total (M)
	2010	2011	2012	2013	2014		
Sharp injuries [n]	166	148	164	180	155	813	162.60
Medical employees [n]	12 011	12 815	12 824	14 152	14 255	–	13 211.00
Sharp injuries/medical employees rate [n/1000 (95% CI)]	13.82 (11.81–15.98)	11.55 (9.77–13.47)	12.79 (10.91–14.80)	12.72 (10.94–14.63)	10.87 (9.23–12.64)	–	12.31 (11.48–13.16)
Fisher-Snedecor test	F = 0.017, F* = 2.37, p ≤ 0.05					–	–

CI – confidence interval; M – mean.

* Critical value.

Table 2. Sharp injuries among medical employees reported in the Łódź Province hospitals, Poland, 2010–2014, by occupational group

Variable	Sharp injuries in consecutive years						P
	2010	2011	2012	2013	2014	total	
Physician injuries [n]	35	24	34	33	43	169	< 0.001
within profession [%]	20.7	14.2	20.1	19.5	25.4	100.0	
within year [%]	21.1	16.2	20.7	18.3	27.7	20.8	
Nurse and midwife injuries [n]	128	121	124	136	109	618	< 0.001
within profession [%]	20.7	19.6	20.1	22.0	17.6	100.0	
within year [%]	77.1	81.8	75.6	75.6	70.3	76.0	
Paramedical injuries [n]	3	3	6	11	3	26	< 0.001
within profession [%]	11.5	11.5	23.1	42.3	11.5	100.0	
within year [%]	1.8	2.0	3.7	6.1	1.9	3.2	
Total [n]	166	148	164	180	155	813	
within profession [%]	20.4	18.2	20.2	22.1	19.1	100.0	
within year [%]	100.0	100.0	100.0	100.0	100.0	100.0	

jury (20.8%). Over the 5 years, only 26 cases of injuries (3.2%) were recorded among paramedics. The prevalence of injuries among nurses and midwives was significantly higher ($p < 0.05$) than among physicians and paramedics (Table 2).

In all occupational groups, the most common injury was by needle (76.1% of all injuries). Among the nurses, the proportion of needle stick injuries was 78.2%, while among physicians and paramedics the proportions of those injuries were similar, 69.8% and 69.2%, respectively. The results of the test of independence χ^2 (Pearson's χ^2) confirmed a significant correlation between occupation and the tool involved in the injury ($\chi^2 = 32.618$, $p \leq 0.05$). At the same time, the prevalence of injuries by needle was significantly higher ($p \leq 0.05$) than the prevalence of injuries by other medical instruments (Table 3).

The incidence of injuries by various tools in 2010–2014 is presented in the Table 4. Pearson's test of independence performed by varying the tool and the year in which the injury occurred showed no significant relationship between them; the distribution of tool injuries is constant in time.

The Table 5 shows distribution of tools responsible for the injuries in different occupational groups during consecutive years 2010, 2011, 2012, 2013 and 2014. Only for 2010, the results of Pearson's χ^2 test confirm significant changes in the distribution of tools causing injuries in different occupational groups. During that year, a significant dominance is evident of the frequency of needle stick injuries in the group of nurses, midwives and physicians. The nurses were the group of medical staff most frequently experiencing percutaneous exposure to infectious material. Needle stick injuries were most frequently reported instances of injuries by sharp tools (Table 6). The types of medical procedures and operations during which the injury occurred include:

- blood sampling,
- subcutaneous injection,
- cleaning of tools after surgery,
- disposing of a needle into a container for medical waste,
- intramuscular injection,
- administration of insulin,

Table 3. Sharp injuries among medical employees reported in the Łódź Province hospitals, Poland, 2010–2014, by occupational group and used medical tools

Variable	Sharp injuries by tool					total
	needle	cannula	stylet	lancet/surgical knife	others	
Physician injuries [n]	118	7	10	30	4	169
within profession [%]	69.8	4.1	5.9	17.8	2.4	100.0
within tool [%]	19.1	29.2	20.8	40.0	8.5	20.8
Nurse and midwife injuries [n]	483	16	36	45	38	618
within profession [%]	78.2	2.6	5.8	7.3	6.1	100.0
within tool [%]	78.0	66.7	75.0	60.0	80.9	76.0
Paramedical injuries [n]	18	1	2	0	5	26
within profession [%]	69.2	3.8	7.7	0.0	19.2	100.0
within tool [%]	2.9	4.2	4.2	0.0	10.6	3.2
Total [n]	619	24	48	75	47	813
within profession [%]	76.1	3.0	5.9	9.2	5.8	100.0
within tool [%]	100.0	100.0	100.0	100.0	100.0	100.0
p	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	–
Pearson's Chi ² test	Chi ² = 32.618 for p < 0.0001					

Table 4. Sharp injuries among medical employees reported in the Łódź Province hospitals, Poland, 2010–2014, by years and used medical tools

Variable	Sharp injuries by tool					total
	needle	cannula	stylet	lancet/surgical knife	others	
2010 injuries [n]	136	2	9	12	7	166
within year [%]	81.9	1.2	5.4	7.2	4.2	100.0
within tool [%]	22.0	8.3	18.8	16.0	14.9	20.4
2011 injuries [n]	109	4	12	17	6	148
within year [%]	73.6	2.7	8.1	11.5	4.1	100.0
within tool [%]	17.6	16.7	25.0	22.7	12.8	18.2
2012 injuries [n]	130	4	6	14	10	164
within year [%]	79.3	2.4	3.7	8.5	6.1	100.0
within tool [%]	21.0	16.7	12.5	18.7	21.3	20.2
2013 injuries [n]	131	5	13	18	13	180
within year [%]	72.8	2.8	7.2	10.0	7.2	100.0
within tool [%]	21.2	20.8	27.1	24.0	27.7	22.1

Table 4. Sharp injuries among medical employees reported in the Łódź Province hospitals, Poland, 2010–2014, by years and used medical tools – cont.

Variable	Sharp injuries by tool					total
	needle	cannula	stylet	lancet/surgical knife	others	
2014 injuries [n]	113	9	8	14	11	155
within year [%]	72.9	5.8	5.2	9.0	7.1	100.0
within tool [%]	18.3	37.5	16.7	18.7	23.4	19.1
Total [n]	619	24	48	75	47	813
within year [%]	76.1	3.0	5.9	9.2	5.8	100.0
within tool [%]	100.0	100.0	100.0	100.0	100.0	100.0
Pearson's Chi ² test	Chi ² = 17.975 for p = 0.116					–

Table 5. Sharp injuries among medical employees reported in the Łódź Province hospitals, Poland, 2010–2014, by years, occupational group, and used medical tools

Year and occupation	Sharp injuries by tool [n (%)]						Pearson's Chi ²	P
	needle	cannula	stylet	lancet/ surgical knife	others	total		
2010								
physician	27 (77.1)	0 (0.0)	2 (5.7)	5 (14.3)	1 (2.9)	35 (100.0)	73.145	< 0.001
nurse and midwife	109 (85.2)	2 (1.6)	7 (5.5)	7 (5.5)	3 (2.3)	128 (100.0)		
paramedical	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	3 (100.0)	3 (100.0)		
total	136 (81.9)	2 (1.2)	9 (5.4)	12 (7.2)	7 (4.2)	166 (100.0)		
2011								
physician	17 (70.8)	1 (4.2)	0 (0.0)	6 (25.0)	0 (0.0)	24 (100.0)	10.896	0.208
nurse and midwife	90 (74.4)	3 (2.5)	11 (9.1)	11 (9.1)	6 (5.0)	121 (100.0)		
paramedical	2 (66.7)	0 (0.0)	1 (33.3)	0 (0.0)	0 (0.0)	3 (100.0)		
total	109 (73.6)	4 (2.7)	12 (8.1)	17 (11.5)	6 (4.1)	148 (100.0)		
2012								
physician	26 (76.5)	2 (5.9)	0 (0.0)	5 (14.7)	1 (2.9)	34 (100.0)	13.435	0.098
nurse and midwife	99 (79.8)	1 (0.8)	6 (4.8)	9 (7.3)	9 (7.3)	124 (100.0)		
paramedical	5 (83.3)	1 (16.7)	0 (0.0)	0 (0.0)	0 (0.0)	6 (100.0)		
total	130 (79.3)	4 (2.4)	6 (3.7)	14 (8.5)	10 (6.1)	164 (100.0)		
2013								
physician	21 (63.6)	1 (3.0)	4 (12.1)	7 (21.2)	0 (0.0)	33 (100.0)	12.385	0.135
nurse and midwife	102 (75.0)	4 (2.9)	8 (5.9)	11 (8.1)	11 (8.1)	136 (100.0)		
paramedical	8 (72.7)	0 (0.0)	1 (9.1)	0 (0.0)	2 (18.2)	11 (100.0)		
total	131 (72.8)	5 (2.8)	13 (7.2)	18 (10.0)	13 (7.2)	180 (100.0)		

Table 5. Sharp injuries among medical employees reported in the Łódź Province hospitals, Poland, 2010–2014, by years, occupational group, and used medical tools – cont.

Year and occupation	Sharp injuries by tool [n (%)]						Pearson's Chi ²	p	
	needle	cannula	stylet	lancet/ surgical knife	others	total			
2014									
physician	27 (62.8)	3 (7.0)	4 (9.3)	7 (16.3)	2 (4.7)	43 (100.0)			
nurse and midwife	83 (76.1)	6 (5.5)	4 (3.7)	7 (6.4)	9 (8.3)	109 (100.0)			
paramedical	3 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	3 (100.0)			
total	113 (72.9)	9 (5.8)	8 (5.2)	14 (9.0)	11 (7.1)	155 (100.0)	7.784	0.455	
Pearson's Chi ² test*	Chi ² = 32.618 for p < 0.001						–	–	–

* For testing independence of distribution of tools causing injuries from the occupational group for the whole time period 2010–2014.

Table 6. Frequency of sharp injuries among nurses and midwives reported in the Łódź Province hospitals, Poland, 2010–2014, by used medical tools

Variable	Sharp injuries in consecutive years						
	2010	2011	2012	2013	2014	total	
Needle injuries [n]	109	90	99	102	83	483	
within tool [%]	22.6	18.6	20.5	21.1	17.2	100.0	
within year [%]	85.2	74.4	79.8	75.0	76.1	78.2	
Stylet injuries [n]	7	11	6	8	4	36	
within tool [%]	19.4	30.6	16.7	22.2	11.1	100.0	
within year [%]	5.5	9.1	4.8	5.9	3.7	5.8	
Lancet/surgical knife injuries [n]	7	11	9	11	7	45	
within tool [%]	15.6	24.4	20.0	24.4	15.6	100.0	
within year [%]	5.5	9.1	7.3	8.1	6.4	7.3	
Cannula injuries [n]	2	3	1	4	6	16	
within tool [%]	12.5	18.8	6.3	25.0	37.5	100.0	
within year [%]	1.6	2.5	0.8	2.9	5.5	2.6	
Other injuries [n]	3	6	9	11	9	38	
within tool [%]	7.9	15.8	23.7	28.9	23.7	100.0	
within year [%]	2.3	5.0	7.3	8.1	8.3	6.1	
Total [n]	128	121	124	136	109	618	
within tool [%]	20.7	19.6	20.1	22.0	17.6	100.0	
within year [%]	100.0	100.0	100.0	100.0	100.0	100.0	
Pearson's Chi ² test	Chi ² = 16.825 for p = 0.397						–

- measurement of blood glucose,
- intravenous cannulation,
- auxiliary activities when performing surgery.

The type of needle stick injuries that occurred most often were hypodermic needles, surgical suture needles, pen (insulin) needles, cannula needles, butterfly needles and blood collection needles. Scalpel, stilet, cannula and surgical knife are tools associated with a much lower rate of injury. The mean proportion of needle stick injuries to all other injuries reported by nurses during a year in time period 2010–2012 is equal to 78.2%. The Pearson's χ^2 does not confirm changes in the years 2010–2014 in the distribution of type a sharp tool in a group of nurses.

DISCUSSION

Working with the patient is associated with the continuous risk of exposure to blood-borne infections. Occupational exposure to blood occurs with the majority of medical staff at least once a year, and the hands are the most exposed parts of the body [11]. The Birmingham study has demonstrated that 37% of medical personnel have experienced injury at least once, by used needles (53% of doctors and 29% of nurses) [12]. In our study we have shown that it is the nurses that are more likely to be occupationally exposed to infectious material because this is a kind of profession which have the most frequent contact with the patient and potentially infectious material. Nurses perform many tasks of care and treatment, often using a needle. Ayranci and Kosgeroglu report that among 139 nurses surveyed, up to 52.5% had suffered injury more than once, by a used needle or other sharp medical instruments within 1 year. Nurses frequently experience injuries during injection (34.5%) [13].

The Polish research also shows that among medical personnel, nurses are the group that is most frequently exposed to infectious material and the most frequent causes of injury are needles used earlier for injection [14–16]. For example, Różańska et al. in their study of 5 hospitals in the Małopolska province during 2008–2012 recorded

a total of 775 cases of exposure to infectious material, most of which were experienced by nurses [17]. These reports are in line with our results, which show that the prevalence of needle stick injury was significantly higher ($p \leq 0.05$) than the prevalence of injury by other medical instruments. Needle stick injuries were the most common causes of tissue disruption in all categories of medical staff.

Another question is the rate of occupational exposures reported in different registers. In our study, the annual average exposure rate has been 12.31 injuries per 1000 persons employed (95% CI: 11.48–13.16/1000). In a retrospective study by Waclawski, the rate of injuries among medical personnel was 7.8 per 1000 employees per year (95% CI: 6.8–9.4/1000) [18].

Since 2013 in Poland, the Minister of Health regulation on occupational health and safety when performing work associated with the risk of injury with sharp tools used when providing health care services has been in force, which imposes an obligation on the employer to keep a record of sharp injuries [3]. It would seem reasonable to expect that a law imposing a registration requirement is likely to increase the number of reported incidents of injuries caused by medical sharps. Our study, however, does not confirm that hypothesis. Likelihood of injury throughout 2010–2014 among medical staff was the same, and the number of reported injuries in 2014 (the year when the Regulation [3] had already been effective) was even lower than in the previous years (155 vs. 180 in 2013). The time between the Polish regulation [3] and surveillance data is probably too short to conclude that the law has no impact on registration but this may be the first signal to the fact that in addition to legislative changes other factors, that improve the effectiveness of the registration of adverse events, are still needed – this requires further study.

The research worldwide and the Polish studies confirm that a large number of occupational exposures are not recorded, and official reports may be underestimated (up to 50% of the events of exposure is not reported at all) [7–10,19].

Rybacki et al. found the most frequent reasons for not reporting accidental exposures, that were: lack of time to report, the feeling of a low risk of transmission for human immunodeficiency virus (HIV) and/or hepatitis B virus (HBV) or hepatitis C virus (HCV) and the anxiety of being blamed or getting in trouble for having the exposure [7]. Further research should focus on identifying barriers to reliable reporting of the cases of exposure to potentially infectious material. At the same time, it seems advisable to take steps intended to raise awareness of medical personnel about the possible effects of exposure to infectious material, in particular, the benefits of implementation of early post-exposure procedures. We can speculate that no legislation will significantly improve the reliability of the data in the registers if the employees themselves do not feel the need to report incidents of exposure to potentially infectious material.

Restrictions and limitations

In collecting data, the authors encountered a number of limitations. Due to the different record-keeping practices (non-uniform registers in 2010–2013) in individual hospitals, it was not possible to attempt a more thorough analysis. The advantage is that an attempt was made to systematize data. The problem was also that some of the hospitals changed their administrative structure, and during those 5 years, various people had recorded the events in varied ways. Please keep also in mind that the collected data is merely approximate; it is not known how many people have failed to report the fact of puncture. A major advantage is that the data was collected from a large group of hospitals (51.5%) from one Province (in Poland there is no authority obliged by law to collect such information).

CONCLUSIONS

It should be noted that:

- the incidence of injuries did not change significantly over the period 2010–2014, and the number of reported injuries in 2014 (the year when the Regulation [3]

- was made effective) was even lower than in the previous years. On average, each year there were 12 injuries per 1000 workers;
 - the professional group most frequently exposed to infectious material is represented by nurses;
 - the prevalence of needle stick injury was greater than the prevalence of injury by other medical instruments.
- In our opinion, the procedure of keeping records of occupational exposures in all hospitals should be harmonized. And the most important, legal requirement to record occupational exposures alone will not improve the reliability of reporting actual incidents as long as employees do not feel the need to report exposures to infectious material (as shown by other studies).

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