

## OUTCOMES OF ACCIDENTS AT WORK WITH EXPOSURE TO BIOLOGICAL AGENTS

Amaury Machi Junior<sup>1</sup>, André Quiaios<sup>2</sup>, José Nuno Domingues<sup>2</sup>, Ana Ferreira<sup>2</sup>, Susana Paixão<sup>2</sup>, Nelson Leite Sá<sup>2</sup>, Lígia Ajaimé Azzalis<sup>3</sup>, Virginia Berlanga Campos Junqueira<sup>3</sup>, Odair Ramos da Silva<sup>1</sup>, Fernando Luiz Affonso Fonseca<sup>1,3</sup>

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### ABSTRACT

**Introduction:** In the labour process there are several occupational hazard risks that present themselves invisibly to workers. Occupational exposure to biological material via sharps is high among health workers. Biosafety is an integral part of safety and occupational hygiene. The risk of contamination by biological material is inherent in anything exposed to it, but it varies according to the activities undertaken by workers. **Objective:** To characterise the outcomes of accidents at work involving the exposure of workers to biological agents, in the ABC Paulista region. **Methods:** This was a descriptive study using a convenience sample from three municipalities in the Grande ABC region: Santo André, São Bernardo do Campo and São Caetano do Sul. The data was sourced from 47 records of reported accidents with biological material in the Greater ABC region in the year 2012. The data was processed and tabulated in the statistical program SPSS 19. We used notification records and obtained the profiles of the injured workers and characteristics of the accident, according to gender, age, county of residence, profession, occupation, type of exposure, material involved, the situation of the agent causing the accident, use of personal protective equipment (PPE) equipment, and communication about the work accident (CAT). **Results:** The incidence of accidents with sharps was related to the frequent handling of these objects and the behaviour of professionals who use practices that pose the risk of needlestick injuries, such as the improper disposal of sharps. **Conclusion:** The main cause of biological accidents was sharps. Females (70.2 %) and nursing staff (63.8 %) were more likely to be involved in accidents.

**Key words:** occupational exposure to biological agents, accidents at Work, occupational health, sharps accidents.

### INTRODUCTION

Workers are subjected to several risks in the labour process, and some of these occupational hazards present invisibly. According to Ordinance 3.214/78 of the Ministry of Labour and Employment, occupational hazards can be classified as chemical, biological, ergonomic, mechanical and physical<sup>1</sup>. In 2007, the Centre for Disease Control (CDC) showed that 385,000 occupational exposures to biological material involving needlestick objects occur annually among health workers<sup>2</sup>.

Biosafety is considered an inclusive part of safety and hygiene at work, involving healthcare workers in workplaces where there are not only biological risk factors present, but also other dangers that may directly aggravate health or can be "triggers" for biological accidents<sup>3</sup>. The risk of contamination by biological material is inherent in any category exposed to it, however it varies according to the activities of workers.<sup>4</sup>

The issue of accidents involving biological material to which health professionals are exposed has been discussed in a meaningful and conscious manner in recent years, especially after the appearance of AIDS<sup>5</sup>. In the second half of the twentieth century, the field of occupational health operated with multi- and interdisciplinary approaches to problem solving, advocating substitution, process modification or intervention at source (collective protection equipment - EPCs) as more effective than personal protection equipment that establishes barriers to exposure without reducing of risk<sup>6</sup>.

Under-reporting of occupational accidents is significant, however, mainly as a result of the low importance given to small injuries, such as pinpricks, and the lack of structured care for this particular accidents. The absence of a programme to sensitize health professionals regarding the risks they are exposed to as a result of accidents, and the importance of reporting and monitoring cases, are

1 Curso de Gestão em Saúde Ambiental – Faculdade de Medicina do ABC, Santo André, SP, Brasil.

2 Curso de Saúde Ambiental – Escola Superior de Tecnologias da Saúde de Coimbra – Instituto Politécnico de Coimbra, Coimbra, Portugal.

3 Departamento de Ciências Biológicas – Instituto de Ciências Ambientais, Químicas e Farmacêuticas – Universidade Federal de São Paulo, Diadema, SP, Brasil.

**Corresponding author:** profferfonseca@gmail.com

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issues that must be taken into account by organization<sup>7,8</sup>.

Epidemiological surveillance and the capture of information concerning an accident would allow data analysis to prioritise goals and efforts in high-risk units, identifying the real causes and implications of accidents. The epidemiological profile of institution accidents contributes to more effective actions in restructuring protocols, the process of continuing education, and the technical and structural adequacy of preventive measures<sup>9</sup>.

Awareness, information, training, supervision and material resources must be provided for this preventive practice to be carried out and successful, so as to safeguard the health of professionals<sup>10</sup>.

The objective of this project is to characterise the outcomes of workplace accidents involving exposure to biological agents between workers in the ABC Paulista region.

## METHODS

The research uses a descriptive study and convenience sampling in three municipalities of the Greater ABC: Santo André, São Bernardo do Campo

and São Caetano do Sul. This is a retrospective descriptive study using a quantitative approach, with the aim of connecting accidents at work with exposure to biological material and the profile of workers. The data sources were all 47 records of notification of accidents with biological materials occurring in the ABC region in the year 2012. The data was processed and tabulated in the SPSS 19 statistical programme.

A survey and investigation of accidents from report forms was first performed, and these were analysed according to the profile of injured workers and characteristics of the accident, using the following variables: gender, age, county of residence, profession, occupation, type of exposure, material involved, and situation of the agent causing the accident, use of personal protective equipment (PPE) equipment, and communication reporting the work accident (CAT).

## RESULTS

In this study, 47 reports of accidents involving biological material since January to December 2012 in three municipalities of the Greater ABC region in a total sample of 5803 employees were analyzed.

**Table 1:** Socio-demographic and occupational variables of health professionals

Characteristics	Injuries	%
<b>Gender</b>		
Male	14	29,8
Female	33	70,2
<b>Profession</b>		
Oral Health Technician	1	2,1
Cleaning staff	1	2,2
Logistics Technician	1	2,1
Nursing Assistant	19	40,4
Nurse	5	10,6
Social Services auxiliary	2	4,3
Dentist	6	12,8
Nursing Technician	6	12,8
Community Health Agent	1	2,1
Dentist Assistant	2	4,3
Driver	1	2,1
Pharmaceutical Assistant	1	2,1
Physiotherapist	1	2,1
<b>Age group</b>		
18 a 29 years	8	17
30 a 42 years	23	48,9
43 a 54 years	15	31,9
55 a 66 years	1	2,1

**Table 2:** Correlation among professions and age group with type of accident

	Type of Accident		Total
	Needle Stick	Splash	
<b>Age Group</b>			
18 - 29	5	3	8
30 - 42	22	1	23
43 - 54	15	0	15
55 - 66	1	0	1
<b>Total</b>	<b>43</b>	<b>4</b>	<b>47</b>
<b>Profession</b>			
Oral Health Technician	1	0	1
Cleaning staff	1	0	1
Logistics Technician	1	0	1
Nursing Assistant	17	2	19
NurseSocial Services Auxiliary	4	1	5
Dentist	6	0	6
Nursing Technician	6	0	6
Community Health A.	0	1	1
Dentist Assistant	2	0	2
Driver	1	0	1
Pharmacy Assistant	1	0	1
Physiotherapist	1	0	1
<b>Total</b>	<b>43</b>	<b>4</b>	<b>47</b>

**Table 3:** Relation of accidents registered in different countries with type of accident

	Types of Accident		Total	%
	Needle Stick	Splash		
<b>Counties</b>				
<b>Santo André</b>	19	1	20	43
<b>São Caetano do Sul</b>	1	0	1	2
<b>São Bernardo do Campo</b>	23	3	26	55
<b>Total</b>	<b>43</b>	<b>4</b>	<b>47</b>	<b>100</b>

**Table 4:** Relation between Safety Device and Type of Accident

		Type of Accident		Total	%
		Needle Stick	Splash		
<b>Safety device</b>	Yes	2	0	2	4
	No	35	0	35	74
	Unknown	6	0	6	13
	No answer/Not applicable	0	4	4	9
<b>Total</b>		<b>43</b>	<b>4</b>	<b>47</b>	<b>100</b>

**Table 5:** Chi-square test among the variable "type of accident" with the others variable

Variables	Asymp. Sig. P value
Profession	<b>0,317</b>
Safety Device	<b>0,000</b>
Class Ages	<b>0,014</b>
Gender	<b>0,827</b>
Council	<b>0,699</b>

## DISCUSSION

In order to characterize the outcomes of workplace accidents involving exposure to biological agents in workers in the ABC Paulista region, a study was conducted among a total sample of 5803 employees, which analysed 47 reports of accidents involving biological material since January to December 2012.

The results obtained by the analysis of the reports were: 14 (29.8%) patients were male and 33 (70.2%) were female. According to the Federal Board of Nursing, the profession in Brazil is currently made up 88.26% of women, indicating a predominance of females. It appears that nursing assistants (19), nursing technicians (6) nurses (5) and dentists (6) were the occupations with the largest number of such accidents. Of those involved,

8 (17%) were between 18 and 29 years; 23 (48.9%) between 30 and 42 years; 15 (31.9%) between 43 and 54 years and only 1 (2.1%) was aged between 55 and 66 years (Table 1).

The study shows that the highest number of accidents with biological material involved sharps, accounting for 43 (91.5%) cases, and there were 4 cases of splashes (8.5%) of the 47 total cases (Table 2). With respect to age, those aged 30-42 years had the highest number of accidents, comprising 23 (49%), of which 22 were caused by sharps or splashes. Thirteen different occupational categories were identified in different health facilities. Nursing professionals, especially assistants and technicians, suffered the most accidents from biological material. It can be seen that nursing assistants represented the highest number of accident cases, 19 (40.4%), of which sharps were involved in 17 cases and the remaining 2 were splashes. Nursing technicians and dentists were involved with 6 (12.8%) cases recorded as sharps accidents, and nurses with 4 (10.6%) cases involving sharps and one involving splashes.

By region (Table 3), the municipality of São Bernardo do Campo had the greatest number of occupational accidents, 23 cases were reported involving sharps and three splashes. In total 26 cases, representing 55% of the sample, were identified. In the municipality of Santo André, there were 19 cases (sharps) and one was recorded as involving splashes. In São Caetano do Sul, as can be seen in Table 3, only one occupational accident involved percutaneous biological material, representative exposure of 2% of the sample. It is noteworthy that the municipality of São Bernardo do Campo had 3665 employees, there were 1948 in Santo André and only 190 in São Caetano do Sul, and that the ratio accidents to workers is highest in Santo André followed by San Bernardo do Campo and São Caetano do Sul.

Table 4 provides descriptions of the notifications of accidents involving two situations where a safety device was in place at the time of the accident, representing 4% of the total sample.

Table 5 highlights the variables "Age Classes" and "Security Device" as significant from a statistical point of view. As the  $p$  value  $< 0.05$ , this means that the correlation between variables is significant. In practice, a 5% probability of error is considered satisfactory, no significant differences above this threshold. The lower the  $p$  value, the higher the significance of the study. Regarding age classes, and given the value of  $p$ , we conclude that there is indeed an age class most prone to accidents, with a statistically significant relationship between these two variables. We obtained a value close to 100% for the relationship between the use of a safety device and the type of accident, according to the  $p$  value, which is significant and which translates as a value of  $p < 0.01$ .

The remaining variables were not significant in this study. Analysis shows their  $p$  values exceed 5%, which is beyond the "acceptable range" of error, in other words the values of these variables are not representative.

In 1988, the Centre for Disease Control published "Universal Precautions" emphasising care with blood and body fluids. Universal precautions are intended to prevent the exposure of health workers to pathogenic blood parenterally, via the skin or mucous membranes that are not intact<sup>11</sup>. The biggest risk to healthcare workers are needlestick accidents that expose them to pathogens; with the highest incidence of hepatitis B disease is among these workers<sup>12</sup>. Huber and Summer say, in a study published in 1987, that accidents with sharp objects constitute the greatest occupational risk<sup>13</sup>. Sharp items should be discarded immediately after use, via collection boxes<sup>14</sup>. The handling of sharps after use has been responsible for most percutaneous accidents<sup>15</sup>.

Although it is recognised that accidents with biological material happen not only to nurses and nursing technicians, there are studies that reinforce the hegemony of this category or worker in accidents, especially with sharps material, as reflected in this study<sup>16</sup>.

There are professions with higher rates of biological accidents, such as nurses and dentists, but it is important to note that although these professions are the most represented in occupational accidents, the number of workers exposed to biological agents is significantly higher. The proportion is significantly lower among nurses (10.6%) and technicians (12.8%) when compared to the auxiliaries (40.4%). This can be explained by the fact that auxiliaries are exposed to a greater number of risks via a higher workload. These professionals are potentially running multiple invasive procedures, which substantially increases the probability of accidents.

In this sense, it is understood that one of the main instruments of labour are the sharps which constitute 91.5% of accident cases, and are involved in a higher incidence of accidents as observed in the study. A predominance of female professionals is involved in accidents with biological exposure, for the same reason: the greater the number of workers exposed to the risk, the more likely an occurrence of the accident. This also applies to those aged 30 to 42, for whom a greater number of biological accidents were reported. Upon exposure to biological material, only 2 (4%) professionals reported using PPE during the procedure.

The results suggest that most categories of health professionals are subject to accidents with sharps, which requires detailed study that detects the most common causes, and the consequences for practitioners, in order to enable the development of education programmes, worker training, ongoing supervision and systematic changes in work routines, making a habit of practicing precautions safety<sup>5,20</sup>.

The main causes attributed to the occurrence of accidents at work with the materials mentioned above are: lack of the use of personal protective equipment (PPE), the lack of care when disposing of sharps, the transport or handling of unprotected needles, separately from their syringes, which is the main reason for recapping needles, which has been recommended for years as a standard

precautionary measure, and has been shown to be responsible for a significant percentage of accidents with sharp material.

So many of these accidents can be avoided by adopting precautionary measures that are strictly according to standard; repeated training by continuing education staff, addressing, among various other matters, the proper disposal of materials and the importance of reporting; recurring at short time of the Specialized Service staff in Safety Engineering and Occupational Medicine visits. The perception of risk by an employee influences their behaviour and consequently their exposure to risk<sup>17</sup>.

According to Regulatory Norm, NR 32, health professionals should always be trained before the start of activities, and then continuously by trained professionals familiar with the risks inherent in each workplace and with occupational exposures. Potential health hazards, control measures, procedures and standards of hygiene, individual and collective protection equipment, proper work attire, prevention of accidents and incidents and the measures to be adopted in their occurrence are included in this analysis.

NR 32 also states that in any workplace where the possibility of exposure to biological agents exists, written instructions must be provided in an accessible language, for the routines performed in the workplace, measures for preventing accidents and diseases related to work. These instructions must be delivered to the employee, upon receipt, which must be available to inspection by the Labour Ministry.

The NR 32 is the primary Brazilian standard for the prevention of occupational accidents and diseases among health professionals, and has three major axes. The first is the continuous training of workers, the second defines the programmes that address the risks and the third axis determines the measures of protection against occupational risks<sup>18</sup>. Given the above, compliance with NR 32 can bring great financial savings to a municipality and greater security to workers in the performance of their duties<sup>19</sup>.

The lack of systematic data on these accidents in Brazil does not allow us to see the global magnitude of the problem, thereby making it difficult to evaluate the preventive measures currently used<sup>5</sup>. In this study the occurrence of accidents is related to two issues: the frequent handling of sharps which explains the number of accidents related to performing or assisting with procedures, and the behaviour of professionals who continue practices at risk of needlestick injuries, such as the improper disposal of sharps, sometimes even by professional groups that are

not in direct contact with patients, such as housekeeping staff<sup>20</sup>.

In addition to using standard precautions and preventive measures, safe devices such as systems without needles, retractable needles and protective system needles are available on the market<sup>5</sup>. Although we have demonstrated the positive impact these devices could make to reducing the number of needlestick injuries, most health institutions in Brazil have no prospects of deploying them in the short term, due to the high cost.

Although the results are only applicable to the Greater ABC region, they provide important information for the expansion of knowledge about the biological risk assessment, particularly from the data of public institutions. It is important to develop and implement a continuing education programme that addresses the issue of accidents and exposure to biological material, clarifying the importance of notification for health professionals<sup>5</sup>.

The success of any educational programme is directly linked to participation and recognition by workers, and support within institutions. There are specific measures to protect the health of workers that are quantitatively and qualitatively satisfactory, although they are still limited in circulation, and should be implemented as mandatory standards of the Labour Minister<sup>21</sup>.

Health care is conventionally regarded as the diagnosis, treatment and prevention of disease, injury and other physical and mental impairments in humans. How the quality of public health is defined at any given time must be compatible with the future generations that will benefit<sup>22</sup>.

There is indication that prevention strategies for the occurrence of occupational accidents with biological material include joint actions established between workers and the management of services, and these should be focused on improving working conditions, particularly involving the organization of labour, the supply of safety devices, the implementation of educational programmes and awareness of a need for behavioural change among both workers and managers, since individual actions are considered less effective for the minimisation of such problems.

It is imperative that the protocols established by the Ministry of Health and its adherence and support, as monitored, as is development, revision, and the execution of a programme and prevention strategies, not only to stimulate knowledge, but also to boost the opinions of professionals regarding practice, behavioural change, biological and social responsibility.

The main cause of biological accidents was sharps, and females (70.2%) and the nursing staff had the highest incidence of accidents (63.8%).

## REFERENCES

- BRASIL. Ministério do Trabalho e Emprego. Lei nº. 6514 de 22 de dezembro de 1997. Dispõe sobre as Normas Regulamentadoras aprovadas pela Portaria 3214, de 08 de junho de 1978. 38. Ed. São Paulo: ATLAS; 1997.
- Sarquis LMM. O monitoramento do trabalhador de saúde após exposição a fluidos biológicos [tese]. São Paulo: Escola de Enfermagem da Universidade de São Paulo. 2007
- Vieira, V.M.; Lapa, R. Riscos em laboratório: prevenção e controle. Cadernos de Estudos Avançados, R. de Janeiro, v. 3, n. 1, p. 25-43, 2006

4. Rapparini C. Occupational HIV infection among health care workers exposed to blood and body fluids in Brazil. *Am J Infect Control*. 2006; 34(4):237-40.
5. Marziale MHP, Rodrigues CM. A produção científica sobre os acidentes profissionais de trabalho com material perfurocortante entre trabalhadores de enfermagem. *Rev Latino Enfermagem*. 2002. 10:571-577.
6. Mina, K; Garcia, E.G; Filho, V. W. Exposição a agentes químicos e a Saúde do Trabalhador - *Rev Bras Saúde Ocupacional*. 2007. <http://dx.doi.org/10.1590/S0034-7167200000400011>
7. Marques B.B, Reis, M.S,Moraes, R.B, Menezes, A.L.T, Sensibilização ao Programa de reorientação da formação do profissional. 2012
8. Doebbeling BN, Vaughn TE, McCoy KD, Beekmann SE, Woolson RF, Ferguson KJ, Torner JC. Percutaneous Injury, blood exposure, and adherence to standard precautions: are hospital-based health care providers still at risk? *Clin Infect Dis*. 2003. <http://dx.doi.org/10.1086/377535>
9. Cardo DM. Patógenos veiculados pelo sangue. In. Rodrigues EAC et.al. *Infecções hospitalares: prevenção e controle*. São Paulo: Sarvier. 1997. Parte IV
10. Souza, AV; Gomes, GP; Vieites, R.L., Evolution of enzymatic browning of blackberries in different stages of maturation 2012. *Communications in Plant Sciences (2237-4027) volume 2, issues 3-4, p.117-119, 2012*
11. Hoefel HHK, Diogo L, Hoppe J. Conhecimento e adesão às precauções universais por profissionais que realizam punção venosa em hospital. *Revista do Controle de Infecção Hospitalar – Ministério da Saúde* 1994.
12. Figueiredo RM. Opinião dos servidores de um hospital escola a respeito de acidentes com material perfurocortante na cidade de Campinas-SP. *Rev Bras Saúde Ocupacional*. 1992.
13. Huber K, Summer W. Recapping the accidental needlestick problem. *Am J Infection Control*. 1987. [http://dx.doi.org/10.1016/0196-6553\(87\)90167-2](http://dx.doi.org/10.1016/0196-6553(87)90167-2)
14. Garner J.S, Hospital Infection Control Practices Advisory Committee. Guideline for hospitals. *Infect Control Hospital Epidemiol* 1996;17: 53-80.
15. Gonçalves J, Oliveira A. Acidente ocupacional por material perfurocortante entre profissionais de saúde de um Centro Cirúrgico, *Rev. esc. enferm. USP* vol.44 no.2 São Paulo June 2010. <http://dx.doi.org/10.1590/S0080-62342010000200034>.
16. Braga, D. Acidente de trabalho com material biológico em trabalhadores da equipe de enfermagem do Centro de Pesquisas Hospital Evandro Chagas [dissertação de mestrado]. Rio de Janeiro: Escola Nacional de Saúde Pública. 2000.
17. Oliveira A.C, Gonçalves J.A. Acidente com material biológico entre os profissionais de saúde; uma análise de cobertura vacinal para a Hepatite B no cenário Brasileiro. 2010. <http://dx.doi.org/10.5205/0101200710>
18. Ministry of Health (BR). Secretary for Health Care. Programmed Strategic Actions Department. Exposure to biological materials. Brasília: Ministry of Health. 2006.
19. Cordeiro R. Suggestion of an inverse relationship between perception of occupational risks and work-related injuries. *Cad Saude Public*. 2002. <http://dx.doi.org/10.1590/S0102-311X2002000100005>
20. Maria Yvone Chaves Mauro, Camila Drumond Muzi, Raphael Mendonça Guimarães Carla Christina Chaves Mauro. *Riscos Ocupacionais em Saúde*. R Enferm UERJ 2004; 12:338-45.
21. Silva, JA; Paula, VS; Almeida, AJ et al. Investigaçao de acidentes biológicos entre profissionais de saúde. *Esc. Anna Nery [online]*. 2009, vol.13, n.3, pp. 508-516. ISSN 1414-8145. <http://dx.doi.org/10.1590/S1414-81452009000300008>
22. Atrash HK, Carpentier R. The evolving role of public health in the delivery of health care. *J. Hum. Growth Dev*. 2012; 22(3): 396-399 ([www.jhgd.org](http://www.jhgd.org))

## RESUMO

**Introdução:** No processo de trabalho existem vários riscos que os trabalhadores estão submetidos sendo que alguns riscos ocupacionais se apresentam de forma invisível. As exposições ocupacionais a material biológico entre os trabalhadores de saúde, envolvendo objetos perfurocortantes são elevadas. A Biossegurança é parte integrante da Segurança e da Higiene do Trabalho. O risco de contaminação por material biológico é inerente a qualquer categoria exposta a ele, porém, varia de acordo com as atividades desenvolvidas pelos trabalhadores. **Objetivo:** caracterizar os desfechos de acidentes de trabalho com exposição a agente biológico entre trabalhadores na Região do ABC Paulista. **Método:** trata-se de estudo descritivo por amostra de conveniência em três municípios do Grande ABC, a saber: Santo André, São Bernardo do Campo e São Caetano do Sul. As fontes de dados foram as 47 fichas de notificação de acidentes com material biológico, ocorridos na região do grande ABC, no ano 2012. Os dados foram processados e tabulados no programa de estatística SPSS 19. Utilizou-se das fichas de notificação e obteve-se o perfil dos trabalhadores acidentados e características do acidente, de acordo com as variáveis sexo, idade, município de residência, profissão, ocupação, tipo de exposição, material envolvido, circunstância do acidente e agente causador, uso de equipamento de proteção individual (EPI), bem como o preenchimento da comunicação de acidente de trabalho (CAT). **Resultados:** A ocorrência de acidentes com materiais perfurocortantes foi relacionada à manipulação frequente desses objetos e ao comportamento dos profissionais que utilizam práticas que oferecem riscos de acidentes com agulhas, tais como o descarte inadequado de objetos perfurocortantes. **Conclusão:** o principal causa de acidentes foi com material perfurocortante, sendo que o sexo feminino foi predominante (70,2%) e a equipe de enfermagem foi a que teve maior incidência (63,8%).

**Palavras-chave:** exposição ocupacional a agentes biológicos, acidentes de trabalho, saúde do trabalhador, acidentes perfuro cortantes.