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Research Article

Epidemiological profile of accidents involving biological material among primary health care physicians in Minas Gerais, from 2012 to 2021

Perfil epidemiológico dos acidentes por material biológico em médicos da atenção primária em Minas Gerais, de 2012 a 2021

Perfil epidemiológico de accidentes por material biológico en médicos de atención primaria en Minas Gerais, de 2012 a 2021

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Abstract

Introduction: Occupational accidents with biological material represent a public health problem. The occupational exposure of health professionals represents a risk of transmission of various pathogens. In the literature, there is a lack of studies that analyze the profile of accidents with biological material among primary health care physicians. **Objective:** We aimed to understand the epidemiological profile of accidents involving biological material among primary health care physicians in Minas Gerais, Brazil. **Methods:** Descriptive epidemiological study that analyzed the profile of accidents with biological material among primary health care doctors in Minas Gerais, using secondary data. **Results:** In the period analyzed, 111 accidents with biological material were recorded, of which 54% occurred only in 2020 and 2021. Most cases occurred in women (59%) and the most frequent types of exposure were mucosal (38%) and percutaneous (33%). About a quarter (23%) of physicians did not have a complete immunization record for hepatitis B. On average, in 36% of accidents serological tests were negative and in 61% they were not performed or the field was ignored/left blank. In only 7.2% of cases, chemoprophylaxis was indicated, but ignored or blank records stood out. More than half of the victims did not fill out a work accident report. **Conclusions:** Accidents with biological material predominate in female doctors and in forms of mucosal and percutaneous exposure. Investments in biosafety measures and permanent education are necessary to prevent cases and encourage their notification.

Keywords: Family practice; Occupational health; Epidemiology, descriptive.

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Resumo

Introdução: Os acidentes ocupacionais com material biológico representam um problema de saúde pública. A exposição ocupacional dos profissionais da saúde configura-se como um risco de transmissão de diversos patógenos. Na literatura, há carência de estudos que analisem o perfil dos acidentes com material biológico nos médicos da atenção primária. **Objetivo:** Buscou-se compreender o perfil epidemiológico dos acidentes com material biológico em médicos da atenção primária em Minas Gerais. **Métodos:** Estudo epidemiológico descritivo com análise do perfil dos acidentes com material biológico em médicos da atenção primária em Minas Gerais, utilizando dados secundários. **Resultados:** No período analisado, foram registrados 111 acidentes com material biológico, dos quais 54% ocorreram somente em 2020 e 2021. A maioria dos casos deu-se em mulheres (59%), e os tipos mais frequentes de exposição foram mucosa (38%) e percutânea (33%). Dos médicos, 23% não possuíam esquema vacinal contra a hepatite B completo. Em média, em 36% dos acidentes os testes sorológicos foram negativos e em 61% não foram realizados ou o campo foi ignorado/deixado em branco. Em apenas 7,2% dos casos a quimioprofilaxia foi indicada, mas ressaltam-se os registros ignorados ou em branco. Mais da metade dos acidentados não emitiu a Comunicação de Acidente de Trabalho (CAT). **Conclusões:** Os acidentes com material biológico predominam em médicas e nas formas de exposição mucosa e percutânea. Investimentos em medidas de biossegurança e educação permanente são necessários para prevenir casos e estimular sua notificação.

Palavras-chave: Medicina de família e comunidade; Saúde ocupacional; Epidemiologia descritiva.

Resumen

Introducción: Los accidentes de trabajo con material biológico representan un problema de salud pública. La exposición ocupacional de los profesionales de la salud representa un riesgo de transmisión de varios patógenos. En la literatura faltan estudios que analicen el perfil de accidentes con material biológico en médicos de atención primaria. **Objetivo:** Buscamos comprender el perfil epidemiológico de los accidentes con material biológico en médicos de atención primaria en Minas Gerais. **Métodos:** Estudio epidemiológico descriptivo con análisis del perfil de accidentes con material biológico en médicos de atención primaria en Minas Gerais, utilizando datos secundarios. **Resultados:** En el período analizado se registraron 111 accidentes con material biológico, de los cuales el 54% ocurrió solo en 2020 y 2021. La mayoría de los casos ocurrieron en mujeres (59%) y los tipos de exposición más frecuentes fueron mucosa (38%) y percutánea (33%). El 23% de los médicos no disponía de un calendario completo de vacunación frente a la hepatitis B. En promedio, en el 36% de los accidentes, las pruebas serológicas fueron negativas y en el 61% no se realizó o se ignoró/dejó el campo en blanco. Solo en el 7,2% de los casos se indicó quimioprofilaxis, pero destacan los registros ignorados o en blanco. Más de la mitad de las víctimas no emitieron el CAT. **Conclusiones:** Predominan los accidentes con material biológico en médicas y en formas de exposición mucosa y percutánea. Son necesarias inversiones en medidas de bioseguridad y educación permanente para prevenir casos e incentivar su notificación.

Palabras clave: Medicina familiar y comunitaria; Salud laboral; Epidemiología descriptiva.

INTRODUCTION

In Brazil, an accident at work is considered to be one that occurs during the performance of work in the service of the company, causing bodily injury or functional disturbance that causes death, or loss, or permanent or temporary decrease in the ability to work[1] It is equivalent to occupational accident the disease resulting from accidental contamination of medical personnel, in the exercise of their activity.[1] This injury represents a public health problem,[2] with several negative repercussions for workers and companies.[3]

According to data from the Digital Occupational Health and Safety Observatory, between 2012 and 2021, approximately 6.2 million Work Accident Reports (CAT in Brazil) were registered in Brazil, and 12% of them had a biological material as the causative agent. In accidents involving biological material alone, 27% of notifications corresponded to hospital care activities and 23% to outpatient care provided by doctors or dentists in the same period.[4]

Occupational exposure of health care professionals to blood and body fluids poses a risk of transmitting pathogens, such as human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C

virus (HCV), cytomegalovirus, herpes simplex and parvovirus B19. Most of the time, this exposure occurs through splashes of blood or other body fluids on mucous membranes or non-intact skin, or through percutaneous injuries.[5] According to the Competency Matrix for Family and Community Medicine, these specialists particularly perform small and intermediate outpatient surgical procedures, less complex emergencies and advanced life support. Examples of procedures are: suturing, lumbar puncture, abscess drainage, bladder catheterization, and intramuscular, subcutaneous and intravenous injection.[6]

In an analysis of the perception of risk at work by professionals involved in the implementation of the Family Health Strategy in the municipality of Rio Grande, located in the state of Rio Grande do Sul, it was observed that, of the group of interviewees, only 16.6% referred the handling of sharp materials and biological fluids as determining factors for the occurrence of work accidents.[7] Another study, when analyzing the distribution of accidents with biological material registered at the Occupational Health Reference Center in Londrina (Paraná), highlighted that most cases occurred in the basic health unit.[8]

Most studies explore accidents involving all categories of health professionals, such as that by Julio et al.,[9] which analyzed work accidents with biological material that occurred in municipalities in the state of Minas Gerais. Furthermore, many authors assess the risks of nursing professionals, responsible for carrying out around 60% of health procedures, such as capillary blood glucose testing and medication administration.[10] Thus, although the percentage rate of notification at the primary and tertiary care levels is remarkably close,[4] there is a lack of studies that seek to understand the current situation of work accidents with biological material occurring with primary health care (PHC) doctors in Minas Gerais.

Thus, the aim of the present study was to describe the epidemiological profile of accidents with biological material among PHC doctors in Minas Gerais.

METHODS

A descriptive, quantitative epidemiological study was conducted on the profile of confirmed cases of accidents with biological material among PHC doctors in Minas Gerais, from 2012 to 2021. The data analyzed are secondary, non-nominal, in the public domain and from the Notifiable Diseases Information System (SINAN) of the Ministry of Health, made available by the State Department of Health of Minas Gerais (SESMG) via TabNet on November 5, 2022.[11]

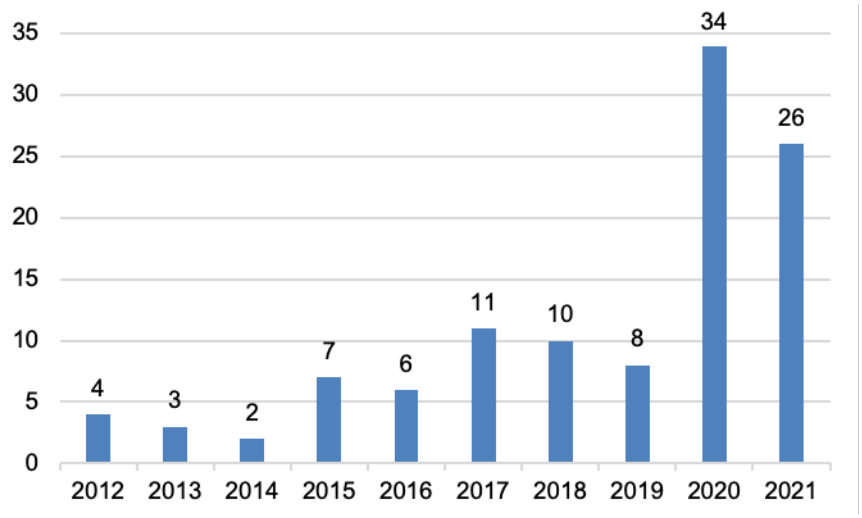
The following codes were considered PHC doctors, according to the Brazilian Classification of Occupations (CBO): family and community doctor (2231-16), Family Health Strategy doctor (2251-42) and family and community medicine doctor (2231F7).

The variables analyzed were sex, type of exposure (percutaneous, mucosal, intact skin, non-intact skin and others), organic material, circumstances of the accident, use of personal protective equipment — PPE (gloves, apron, glasses, mask, face shield and boots), vaccination status of the injured person in relation to hepatitis B (vaccinated with three doses, not vaccinated), test results of the injured party (anti-HIV, HBsAg, anti-HBs, anti-HCV), how the accident was handled (no indication for chemoprophylaxis, refusal of indicated chemoprophylaxis, AZT+3TC, AZT+3TC+indinavir, AZT+3TC+nelfinavir), case evolution, and issuance of CAT.

Data analysis was carried out using descriptive statistics, with calculation of mean and standard deviation (SD), using Microsoft Office Excel® 2007. This study did not require approval from the Research Ethics Committee as it used public domain data, in accordance with Resolution No. 510/2016 of the Ministry of Health.[12]

RESULTS

In the period from 2012 to 2021, 111 cases of accidents with biological material were confirmed by PHC doctors in Minas Gerais. The mean number of cases per year was 11.1 (SD=10.5). In addition to the increasing trend, the number of confirmed cases showed significant annual variation, especially in 2020 and 2021 (Figure 1).



Source: SINAN/SESMG.[11]

Figure 1. Annual distribution of notifications of accidents involving biological material among primary health care physicians, Minas Gerais, Brazil. 2012 to 2021.

Regarding the codes according to the CBO, 59% (n=65) of accidents occurred with a family health doctor, followed by 34% (n=38) with doctors from the Family Health Strategy and 7% (n=8) doctors in family and community medicine.

Females accounted for 59% (n=66) of cases. The characteristics of the accident are described in Tables 1 and 2. The most frequent types of exposure were mucosal (38%, n=42) and percutaneous (33%, n=37). Doctors were wearing gloves in 72% (n=80) of accidents; in a mask in 54% (n=60) and an apron in 49% (n=54). Accidents involving blood were the most reported (47%, n=52). After other procedures (50%, n=56), a surgical procedure was the main circumstance of accidents, representing 26% (n=29).

Among accidents with mucous exposure, both the circumstance of the accident and the type of material most commonly reported were “others” (67%; n=28) (Table 3). Regarding accidents with percutaneous exposure (n=37), regarding the circumstance of the accident, 43% (n=16) occurred during some surgical procedure, followed by 19% (n=7) in “others”. Regarding the type of material, blood was the most common (84%; n=31) (Table 3). Table 3 presents frequencies of the types of accident exposures by accident circumstance and by type of organic material.

Of the injured doctors, 77% (n=86) had a complete vaccination schedule against hepatitis B, and 3% (n=3) were unvaccinated, but in 20% (n=22) of the notifications this field was ignored or left blank. Regarding the results of the accident’s serological tests (at the time of the accident), one was positive for anti-HIV, one for HBsAg, four for anti-HBs and none for anti-HCV. The tests were negative in 36% (SD=4.5%) of cases; in 24% (SD=2.6%) they were not performed; and in 37% (SD=0.5%), the field

Table 1. Frequency of accidents with biological material by type of exposure and use of personal protective equipment among primary health care physicians, Minas Gerais, Brazil. 2012 to 2021.

	Yes	No	Ignored /Blank
Type of exposure			
Percutaneous	37	59	15
Mucosa	42	62	7
Intact skin	26	67	18
Non-intact skin	5	89	17
Others	23	64	24
Use of PPE			
Gloves	80	18	13
Apron	54	43	14
Glasses	35	62	14
Mask	60	37	14
Face shield	28	68	15
Boots	15	82	14

Source: SINAN/SESMG.[11]

Table 2. Profile of cases of accidents with biological material according to organic material and circumstances of the accident among primary health care physicians, Minas Gerais, Brazil. 2012 to 2021.

Organic material	n	%
Ignored/Blank	8	7
Blood	52	47
Cerebrospinal fluid	2	2
Pleural fluid	1	1
Fluid with blood	3	3
Others	45	41
Accident circumstances		
Ignored/Blank	4	4
Intravenous medication administration	1	1
Intramuscular medication administration	2	2
Subcutaneous medication administration	7	6
Non-specified puncture	1	1
Improper waste disposal	3	3
Improper disposal on ground	3	3
Surgical procedure	29	26
Laboratory procedure	2	2
Dextro	2	2
Recapping	1	1
Others	56	50

Source: SINAN/SESMG[11].

regarding serology was ignored or left blank (Table 4). Regarding the evolution of the case (Table 4), 29% (n=32) were discharged because the source patient was negative. However, in 36% (n=40) of notifications the evolution field was ignored or not filled in.

Table 3. Accidents with biological material according to type of exposure by circumstances of the accident and by type of organic material among primary health care physicians, Minas Gerais, Brazil. 2012 to 2021.

Type of exposure	Percutaneous exposure (n=37)		Mucosal exposure (n=42)		Intact skin exposure (n=26)		Non-intact skin exposure (n=5)		Other exposure (n=23)	
	n	%	n	%	n	%	n	%	n	%
Accident circumstances										
Ignored/Blank	0	0	2	5	1	4	0	0	1	4
Intravenous medication administration	1	3	0	0	0	0	0	0	0	0
Intramuscular medication administration	1	3	1	2	0	0	0	0	0	0
Subcutaneous medication administration	4	11	3	7	3	12	0	0	0	0
Non-specified puncture	0	0	1	2	0	0	0	0	0	0
Improper waste disposal	3	8	0	0	0	0	0	0	0	0
Improper disposal on ground	2	5	0	0	1	4	0	0	0	0
Surgical procedure	16	43	7	17	8	31	4	80	0	0
Laboratory procedure	1	3	0	0	1	4	0	0	0	0
Dextro	1	3	0	0	1	4	0	0	0	0
Recapping	1	3	0	0	1	4	0	0	0	0
Others	7	19	28	67	10	38	1	20	22	96
Organic material										
Ignored/Blank	4	11	2	5	1	4	0	0	2	9
Blood	31	84	9	21	17	65	5	100	0	0
Cerebrospinal fluid	1	3	1	2	0	0	0	0	0	0
Pleural fluid	0	0	1	2	1	4	0	0	0	0
Fluid with blood	1	3	1	2	1	4	0	0	0	0
Others	0	0	28	67	6	23	0	0	21	91

Source: SINAN/SESMG.[11]

Table 4. Serological profile of the injured person at the time of the accident of primary health care physicians, Minas Gerais, Brazil. 2012 to 2021.

	Positive		Negative		Inconclusive		Not done		Ignored/Blank	
	n	%	n	%	n	%	n	%	n	%
Anti-HIV	1	1	45	41	1	1	23	21	41	37
HBsAg	1	1	41	37	2	2	26	23	41	37
Anti-HBs	4	4	33	30	2	2	30	27	42	38
Anti-HCV	0	0	40	36	2	2	27	24	42	38

Source: SINAN/SESMG.[11]

Regarding accident management (Table 5), chemoprophylaxis was not indicated in 49.5% (n=55). In one case, chemoprophylaxis was refused, and eight received it (7.2%). The significant incompleteness of the field regarding how accident was handled is highlighted as ignored or left blank records were frequent. Of the doctors injured during the period, 34% (n=38) issued a CAT, while 54% (n=60) did not issue it, and in 11% (n=12) of notifications, the field was ignored or left blank.

Table 5. Management of accidents involving biological material among primary health care physicians, Minas Gerais, Brazil. 2012 to 2021.

	Yes		No		Ignored/Blank	
	n	%	n	%	n	%
Chemoprophylaxis not indicated	55	50	26	23	30	27
Chemoprophylaxis refused	1	1	65	59	45	40
AZT+3TC	5	5	61	55	45	40
AZT+3TC+Indinavir	2	2	64	58	45	40
AZT+3TC+Nelfinavir	1	1	66	59	44	40

Source: SINAN/SESMG.[11]

DISCUSSION

Biological risk in the hospital environment is widely discussed in the literature, whereas, in PHC, this issue is less studied[9] because there is little perception of its severity at this level of care, despite being an environment where there is inherent risk.[13] Furthermore, work accidents in PHC have different characteristics with regard to exposure to biological risk beyond health units, considering the home care program.[14]

During the period studied, an annual average of 11.1 accidents with biological material was observed among PHC doctors (family and community doctors, doctors from the Family Health Strategy and doctors in Family and Community Medicine) in Minas Gerais. This represents 1.5 accidents per year per thousand professionals, considering the 7,455 doctors registered with the Brazilian Classification of Occupations codes considered in this study.[15] Gomes et al.,[16] in a study on accidents with biological material in health care professionals in Brazil., reported an annual rate of 16.9 accidents per thousand health care professionals. Miranda et al.,[17] in turn, observed the incidence of 8.6 accidents with biological fluids per thousand doctors.

In the present study, we observed that 54% of recorded accidents occurred in the years 2020 and 2021, a period coinciding with the COVID-19 pandemic[18] in which high demand led the health system to the risk of collapse. As the majority of confirmed cases were considered mild and could be managed in PHC, this level of care was essential in confronting the pandemic.[19] In the pandemic context, doctors and other health professionals were subjected to physical and psychological pressure due to the increased work burden, the fear of contagion by the SARS-CoV-2 virus and the constant changes in protocols and PPE.[20] Among the many causes of accidents among health care professionals are work overload, physical fatigue and stress.[21]

In this study of PHC physicians, the majority of accidents occurred among females, also observed by Miranda et al.,[17] in which the incidence of accidents was higher among female doctors. This difference in the frequency of the condition can be explained by the predominance of women working as doctors in the context of primary health care.[22] According to the Medical Demography in Brazil 2023 study, 59% of doctors specializing in Family and Community Medicine are women.[23]

Although Regulatory Standard 32 (NR-32) recommends that employers provide PPE to health care professionals,[24] among the accident notifications analyzed in this study, 72% of those injured wore gloves, 49% wore an apron and 54% wore a mask. Mizoguti et al.,[25] when analyzing cases of accidents caused by biological material reported by the Occupational Health Unit of the Hospital do Trabalhador in Curitiba (Paraná), observed that 69% of those injured wore gloves, 31.2% wore an apron and only 9% wore a

mask. In a study on the nursing team's perception of biosafety in an intensive care unit (ICU), Correa and Donato[26] found that the use of PPE did not prevent the occurrence of an accident, but it is a protective factor for post-exposure risk, as the use of this equipment reduces the amount of biological material inoculated by up to 75%, which reinforces its importance.

There was a predominance of mucosal (38%) and percutaneous (33%) forms of exposure, in disagreement with other authors, [27–29] who observed that percutaneous exposure stood out over other types. This fact can be associated with PHC competencies, which include managing the agenda, carrying out individual and group consultations, home visits and educational activities.[6] Furthermore, small-size ambulatory surgical procedures are part of the scope of action of PHC professionals, but these workers are less exposed to biological materials when compared to professionals in medium- to high-complexity services.[30]

Blood was the organic material that caused the majority of notifications, a finding also observed by Hernández Navarrete et al.[31] when analyzing accidents with biological material among health professionals in two PHC areas in Spain. It is worth mentioning that many workers tend to neglect accidents that do not involve blood, which can lead to underreporting of cases.[32]

The high proportion of "others" such as accident circumstances and type of biological material, especially in accidents with mucous exposure, points to a limited characterization of these incidents. PHC professionals can be exposed to airway secretions,[7] for example, when caring for patients with leprosy, tuberculosis, chickenpox and rubella,[14,33] at home or in a doctor's office. Exposure can also occur through other body fluids during the Pap smear.[14] Furthermore, contact with secretions from clean and contaminated wounds is a biological risk.[34]

Regarding accident management afterwards, with involvement of biological material, post-exposure prophylaxis for sexually transmitted infections such as HIV, syphilis and viral hepatitis consists of the use of medications with the aim of reducing the risk of infection. Its indication depends on the serological status of the exposed person and the source person.[35] To do this, it is necessary to run serology tests on the injured person for HIV, HBV and HCV, verify vaccination for hepatitis B and investigate proof of immunity through anti-HBs testing.[36] Despite this, about 24% of reported cases showed that serology tests were not performed at the time of the accident, and in 37.5%, the field for serological tests was ignored or not filled in.

Chemoprophylaxis was indicated in 23% of the accidents analyzed and seroconversion occurred in 14%. Sardeiro et al.,[37] on the other hand, did not observe seroconversion in health workers exposed to biological material in Goiânia, but noted that clinical follow-up was missing in 41.5% of cases, which highlights the risk of seroconversion.

Regarding hepatitis B, the recommendations depend on the serological status of the source patient and the anti-HBs levels of the victim. In cases where the source presents a positive or unknown HBsAg and the professional is unvaccinated or has an incomplete schedule, it is recommended to start or complete the vaccination and administer hyperimmune immunoglobulin against hepatitis B. In cases of vaccinated people, with an adequate protective response, there is no specific measure. On the other hand, when it is not possible to determine a vaccine protection factor in vaccinated professionals, the administration of hyperimmune immunoglobulin against hepatitis B is recommended.[36]

It was observed that only 77% of victims were previously vaccinated against hepatitis B with three doses, coverage similar to that reported by Assunção et al.,[38] who found a prevalence of complete vaccination in 74.9% of health workers in the public sector of Belo Horizonte, Minas Gerais. Therefore, considering that the prevention of this disease occurs through three doses of the vaccine, hepatitis B vaccination coverage is still a problem.[39]

It is also important to point out the high incidence of ignored and blank data among the variables studied. The incompleteness of data favors the generation of deficient data, which contributes to the lack of knowledge of the real epidemiological profile of cases and impacts the quality of the analysis.[40] In Brazil, recording work accidents through CAT emerged as a control and monitoring of such events, with their issuance and reporting to Social Security by the employer being mandatory.[41] However, even with this objective, there are failures in filling out notifications of accidents involving biological material among health professionals, as demonstrated by Gomes and Caldas.[42]

The use of non-nominal secondary data is one of the limitations of this study, as it is subject to underreporting. This is a reality already known in the literature due to the lack of recording and notification of accidents involving biological material.[36] Among the causes of underreporting are: bureaucracy, lack of knowledge on how to carry it out, HIV-negative source patient and attribution of low risk to the accident.[43] Furthermore, the notification forms used by the Ministry of Health do not allow complete identification of the context of the accident, for example, there is no specification of the fields filled in as “others”.

CONCLUSION

The results collected by the study show that accidents with biological material are predominant in family and community doctors, in the forms of mucosal and percutaneous exposure. Therefore, greater investments in biosafety measures and ongoing education are necessary, with the aim of preventing the occurrence of accidents, reinforcing the importance of following post-exposure protocols and encouraging the notification of cases, advocating data completeness.

Considering the lack of work on the epidemiological profile of these accidents among PHC doctors at the state level and their relevance to public health, it is essential that more research exploring this topic be carried out, especially with primary data.

CONFLICT OF INTERESTS

Nothing to declare.

AUTHORS’ CONTRIBUTIONS

SCO: Conceptualization, Data curation, Formal analysis, Methodology, Project administration, Visualization, Writing — original draft, Writing — review & editing. HSP: Formal analysis, Writing — original draft, Writing — review & editing. GFF: Formal analysis, Writing — original draft, Writing — review & editing. GAA: Formal analysis, Writing — original draft, Writing — review & editing. RCO: Conceptualization, Data curation, Formal analysis, Methodology, Project administration, Visualization, Writing — original draft, Writing — review & editing. SSF: Formal analysis, Supervision, Validation, Writing — original draft, Writing — review & editing.

REFERENCES

1. Brasil. Lei n. 6.367, de 19 de outubro de 1976. Dispõe sobre o seguro de acidentes do trabalho a cargo do INPS e dá outras providências. Diário Official da União. 1976.

2. Bertelli C, Martins BR, Krug SBF, Petry AR, De Souza Fagundes P. Occupational accidents involving biological material: Demographic and occupational profile of affected workers. Rev Bras Med Trab. 2021;18(4):415-24. https://doi.org/10.47626/1679-4435-2020-534
3. Oliveira FMRL, Barbosa KTF. Acidentes ocupacionais com exposição a material biológico: Revisão. Rev Enferm UFPE on line. 2016;10(2):830-7. https://doi.org/10.5205/1981-8963-v10i2a11026p830-837-2016
4. Plataforma SmartLab de Trabalho Decente [Internet]. [accessed Nov 18, 2022]. Available at: https://smartlabbr.org/sst
5. Mengistu DA, Dirirsa G, Mati E, Ayele DM, Bayu K, Deriba W, et al. Global Occupational Exposure to Blood and Body Fluids among Healthcare Workers: Systematic Review and Meta-Analysis. Can J Infect Dis Med Microbiol. 2022;2022:5732046. https://doi.org/10.1155/2022/5732046
6. Brasil. Ministério da Educação. Matrizes de Competências Aprovadas pela CNRM [Internet]. 2018 [accessed on Mar 19, 2023]. Available at: http://portal.mec.gov.br/component/content/article?id=71531
7. Regina Cezar-Vaz M, Fernanda de Souza Soares J, Pereira de Figueiredo P, Pinho de Azambuja E, Fontella Sant C, Zavarese da Costa V, et al. Percepção do risco no trabalho em saúde da família: estudo com trabalhadores no sul do Brasil. Rev. Latino-Am Enfermagem. 2009;17(6). https://doi.org/10.1590/S0104-11692009000600006
8. Spagnuolo RS, Cristina R, Baldo S, Guerrini IA, Stella R, Rua S, et al. Análise epidemiológica dos acidentes com material biológico registrados no Centro de Referência em Saúde do Trabalhador-Londrina-PR. Rev Bras Epidemiol. 2008;11(2). https://doi.org/10.1590/S1415-790X2008000200013
9. Julio RS, Filardi MBS, Marziale MHP. Work accidents with biological material occurred in municipalities of Minas Gerais. Rev Bras Enferm. 2014;67(1):119-26. https://doi.org/10.5935/0034-7167.20140016
10. De Araújo TM, Caetano JA, Barros LM, Lima ACF, Da Costa RM, Monteiro VA. Acidentes de trabalho com exposição a material biológico entre os profissionais de Enfermagem. Rev Enferm. 2012;3(7):7-14.
11. Secretaria do Estado de Saúde de Minas Gerais. Informações de Saúde: TABNET-MG [Internet]. Minas Gerais: Secretaria do Estado de Saúde de Minas Gerais [accessed on Nov 5, 2022]. Available at: http://vigilancia.saude.mg.gov.br/index.php/informacoes-de-saude/informacoesde-saude-tabnet-mg/
12. Brasil. Ministério da Saúde. Conselho Nacional de Saúde. Resolução nº 510, de 7 de abril de 2016. Trata sobre as diretrizes e normas regulamentadoras de pesquisa em ciências humanas e sociais. Diário Oficial da União. 2016.
13. Rezende KCAD, Tipple AFV, e Souza ACS, Siqueira KM, Alves SB, Salgado T de A. Risk of exposure to biological material at primary health care facilities. Rev Enferm. 2016;24(2). https://doi.org/10.12957/reuerj.2016.6442
14. Almeida LGN, Torres SC, Santos CMF dos. Riscos ocupacionais na atividade dos profissionais de saúde da atenção básica. Rev Enf Contemp. 2012;1(1). https://doi.org/10.17267/2317-3378rec.v1i1.51
15. Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Cadastro Nacional de Estabelecimentos de Saúde [Internet]. [accessed on Mar 19, 2024]. Available at: http://cnes2.datasus.gov.br/Mod_Ind_Profissional_com_CBO.asp
16. Gomes SCS, Ferreira TF, de Jesus Mendes Caldas A. Temporal trends in occupational accidents involving exposure to biological material in Brazil, 2010 to 2016. Rev Bras Med Trab. 2021;19(1):43-50. https://doi.org/10.47626/1679-4435-2021-565
17. Miranda FMDA, Cruz ED de A, Félix JCV, Kalinke LP, Mantovani M de F, Sarquis LMM. Profile of Brazilian workers victims of occupational accidents with biological fluids. Rev Bras Enferm. 2017;70(5):1061-8. https://doi.org/10.1590/0034-7167-2016-0482
18. World Health Organization. Timeline: WHO's COVID-19 response [Internet]. World Health Organization; 2023 [accessed on Jan 14, 2023]. Available at: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/interactive-timeline#!
19. Silva WR de S, Duarte PO, Felipe DA, Sousa F de OS. A gestão do cuidado em uma unidade básica de saúde no contexto da pandemia de Covid-19. Trab Educ Saúde. 2021;19. https://doi.org/10.1590/1981-7746-sol00330
20. Walton M, Murray E, Christian MD. Mental health care for medical staff and affiliated healthcare workers during the COVID-19 pandemic. Eur Heart J Acute Cardiovasc Care. 2020;9(3):241-7. https://doi.org/10.1177/2048872620922795
21. Damasceno AP, Pereira MS, Silva e Souza AC, Tippçe AFV, Prado MA. Acidentes ocupacionais com material biológico: a percepção do profissional. Rev Bras Enferm. 2006;59(1). https://doi.org/10.1590/S0034-71672006000100014
22. Nogueira LS, Silva Junior MF, Müller EV. Perfil sociodemográfico e fatores de atração e saída dos médicos atuantes na estratégia saúde da família no município de Ponta Grossa, Paraná, Brasil. Rev Bras Med Fam Comunidade. 2021;16(43):2159. https://doi.org/10.5712/rbmfc16(43)2159
23. Scheffer M (Coord.). Demografia Médica no Brasil. São Paulo: FMUSP, AMB; 2023.
24. Brasil. Ministério do Trabalho e Emprego. Portaria n. 485, de 11 de novembro de 2005. Aprova a Norma Regulamentadora nº 32 (Segurança e Saúde no Trabalho em Estabelecimentos de Saúde). Diário Oficial da União. 2005.
25. Mizoguti NN, Hirota MM, Ito FY, Gonçalves MR, Gonçalves MR, Hayashida MR, et al. Occupational accidents involving exposure to biological material reported at a worker's health sentinel unit: 11,645 cases. Rev Bras Med Trab. 2022;20(3):362-8. https://doi.org/10.47626/1679-4435-2022-699
26. Correa CF, Donato M. Biossegurança em uma unidade de terapia intensiva: a percepção da equipe de enfermagem. Esc Anna Nery. 2007;11(2):197-204. https://doi.org/10.1590/S1414-81452007000200003
27. Chiodi MB, Palucci Marziale MH, Lúcia M, Robazzi CC. Acidentes de trabalho com material biológico entre trabalhadores de Unidades de Saúde Pública. Rev Latino-am Enfermagem. 2007;15(4). https://doi.org/10.1590/S0104-11692007000400017
28. Souza RT, Bica CG, Mondadori CS, Ranzi AD. Evaluation of Occupational Accidents with Biological Materials in Medical Residents, Academics and Interns of School Hospital of Porto Alegre. Rev Bras Educ Med. 2012;36. https://doi.org/10.1590/S0100-55022012000100016

29. Arantes MC, Haddad M do CFL, Marcon SS, Rossaneis MA, Pissinati PDSC, De Oliveira SA. Acidentes de trabalho com material biológico em trabalhadores de serviços de saúde. Cogitare Enferm. 2017;22(1). https://doi.org/10.5380/ce.v22i1.46508
30. Soares JF de S, Lua I, Santos KOB, Cruz MLS, Araújo TM de. Fatores associados a acidentes com exposição a material biológico de trabalhadores da saúde da atenção básica e da média complexidade em cinco municípios baianos. Cad Saúde Colet. 2023;31(3). https://doi.org/10.1590/1414-462X202331030272
31. Hernández Navarrete MJ, Montes Villameriel FJ, Solano Bernad VM, Sánchez Matienzo D, del Val García JL, Gil Montalbán E, et al. Accidents with biological material in health care workers in 2 primary health care areas (1990-1999). Aten Primaria. 2001;28(4):255-8. https://doi.org/10.1016/s0212-6567(01)78943-3
32. Reis LA, Gómez La-Rotta EI, Diniz PB, Aoki FH, Jorge J. Occupational Exposure to Potentially Infectious Biological Material Among Physicians, Dentists, and Nurses at a University. Saf Health Work. 2019;10(4):445-51. https://doi.org/10.1016/j.shaw.2019.07.005
33. Shires DB. Health hazards in medical institutions. Can Fam Physician. 1993;39:166-70.
34. Nascimento G de M, David HMSL. Avaliação de riscos no trabalho dos agentes comunitários de saúde: um processo participativo. Rev Enferm UERJ. 2008;16(4):550-6.
35. Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. Departamento de DST A e HV. Protocolo Clínico e Diretrizes Terapêuticas para Profilaxia Pós-Exposição (PEP) de Risco à Infecção pelo HIV, IST e Hepatites Virais. Brasília: Ministério da Saúde; 2021.
36. Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Departamento de Ações Programáticas Estratégicas. Exposição a materiais biológicos. Brasília: Editora do Ministério da Saúde; 2006.
37. Sardeiro TL, de Souza CL, de Arvelos Salgado T, Júnior HG, Neves ZCP, Tipple AFV. Work accidents with biological material: Factors associated with abandoning clinical and laboratory follow-up. Rev Esc Enferm. 2019;53:e03516. https://doi.org/10.1590/s1980-220x2018029703516
38. Assunção AI, Brito Nery Ribeiro III Sérgio Vinícios Soares Oliveira RI, Ávila Assunção A. Vacinação contra hepatite B e exposição ocupacional no setor saúde em Belo Horizonte, MG. Rev Saúde Pública. 2012;46(4):665-73. https://doi.org/10.1590/S0034-89102012005000042
39. Souza F de O, Freitas P de SP, Araújo TM de, Gomes MR. Vacinação contra hepatite B e Anti-HBS entre trabalhadores da saúde. Cad Saúde Colet. 2015;23(2):172-9. https://doi.org/10.1590/1414-462X201500020030
40. Marques CA, de Siqueira MM, Portuga FB. Assessment of the lack of completeness of compulsory dengue fever notifications registered by a small municipality in Brazil. Ciênc Saúde Coletiva. 2020;25(3):891-900. https://doi.org/10.1590/1413-81232020253.16162018
41. Brasil. Lei nº 8.213, de 24 de julho de 1991. Dispõe sobre os Planos de Benefício da Previdência Social e dá outras providências. Diário Oficial da União. 1991.
42. Gomes SCS, Caldas ADJM. Qualidade dos dados do sistema de informação sobre acidentes de trabalho com exposição a material biológico no Brasil, 2010 a 2015. Rev Bras Med Trab. 2017;15(3):200-8. https://doi.org/10.5327/Z1679443520170036
43. Barbosa ASAA, Do Amaral Diogo G, Salotti SRA, Silva SMUR. Subnotificação de acidente ocupacional com materiais biológicos entre profissionais de Enfermagem em um hospital público. Rev Bras Med Trab. 2017;15(1):12-7. https://doi.org/10.5327/Z1679443520177034