Immunity to Hepatitis B among Workers Victims of Accident with Biological Material at a University Hospital

Imunidade para Hepatite B entre Trabalhadores Vítimas de Acidente com Material Biológico em Hospital Universitário

Inmunidad para la hepatitis B entre trabajadores víctimas de accidentes con material biológico en un hospital universitário

Ana Cleide da Silva Dias[1], Renê Elias Gonçalves[2], Iraneide Nascimento dos Santos[3], Fernanda Gabriel Torres[4], Érica Barbosa Magueta Silva[5], Priscilla Vasconcelos Aguiar[6], Lucimara Araújo Campos[7],Guilherme de Andrade Ruela[8]

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1 Federal University of Vale do São Francisco. Petrolina, Pernambuco, Brazil.
https://orcid.org/0000-0002-4125-2963

2 Federal Institute of Pernambuco. Recife, Pernambuco, Brazil.
https://orcid.org/0000-0001-8449-7840

3 Petrolina City Hall. Petrolina, Pernambuco, Brazil.
https://orcid.org/0000-0002-4930-6380

4 Federal University of Juiz de Fora. Juiz de Fora, Minas Gerais, Brazil.
https://orcid.org/0000-0002-1482-2908

5 University of Pernambuco. Recife, Pernambuco, Brazil.
https://orcid.org/0000-0002-4574-851X

6. Federal University of Vale do São Francisco. Petrolina, Pernambuco, Brazil.
https://orcid.org/0000-0002-9190-8553

7. Federal University of Vale do São Francisco. Petrolina, Pernambuco, Brazil.
https://orcid.org/0000-0001-7054-1599

8. Federal University of Vale do São Francisco. Petrolina, Pernambuco, Brazil.
https://orcid.org/0000-0001-6976-8710

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RESUMO

Objetivo: Descrever o perfil epidemiológico sobre a situação vacinal e a imunidade para hepatite B dos profissionais de saúde que sofreram acidentes com exposição a material biológico no período entre janeiro de 2015 e dezembro de 2021 em um hospital universitário do interior de Pernambuco. **Método:** Estudo epidemiológico, com dados secundários de notificações do SINAN NET - ATEMB (Acidentes de Trabalho com Exposição a Material Biológico). **Resultados:** Dentre os acometidos por ATEMB, a maioria era vacinado (76,6%), entretanto a maior parte não realizou o teste para Anti-HBs (65,6%). Apesar de a maioria dos casos ter a fonte de contaminação conhecida (74,79%), cerca de 10,18% não foram testados para HbsAg. Houve associação entre status sorológico para Anti-HBS e a raça/cor (p = 0,009). **Conclusão:** É essencial que o hospital intensifique estratégias para monitorar a imunidade dos profissionais de saúde, prevenir tais eventos e garantir o registro adequado dos casos.
Descritores: Imunidade; Hepatite B; Acidente ocupacional; Material biológico; Pessoal de Saúde.

ABSTRACT

Objective: To describe the epidemiological profile of the vaccination status and immunity to hepatitis b of health professionals who suffered accidents with exposure to biological material between january 2015 and december 2021 at a university hospital in the interior of Pernambuco. **Methods:** Epidemiological study, with secondary data from sinan net - ATEMB (Work Accidents with Exposure to Biological Material) notifications. **Results:** among those affected by atemb, the majority were vaccinated (76.6%), however, most did not undergo the Anti-hbs test (65.6%). although most cases had a known source of contamination (74.79%), approximately 10.18% were not tested for hbsag. there was an association between serological status for Anti-hbs and race/color (p = 0.009). **Conclusion:** it is essential that the hospital intensifies strategies to monitor the immunity of healthcare professionals, prevent such events and ensure adequate recording of cases.
Descriptors: Immunity; Hepatitis B; Accidents, Occupational; Biocompatible Materials; Health Personnel.

RESUMEN

Objetivo: Describir el perfil epidemiológico del estado de vacunación e inmunidad a la hepatitis B de profesionales de la salud que sufrieron accidentes con exposición a material biológico en el período comprendido entre enero de 2015 y diciembre de 2021 en un hospital universitario del interior de Pernambuco. **Método:** Estudio epidemiológico, con datos secundarios de notificaciones del SINAN NET - ATEMB (Accidentes Laborales con Exposición a Material Biológico). **Resultados:** Entre los afectados por ATEMB, la mayoría estaba vacunada (76,6%), sin embargo a la mayoría no se le realizó la prueba Anti-HBs (65,6%). Aunque la mayoría de los casos tenían una fuente de contaminación conocida (74,79%), alrededor del 10,18% no fueron sometidos a pruebas de HBsAg. Hubo asociación entre el estado serológico anti-HBS y la raza/color (p = 0,009). **Conclusión:** Es fundamental que el hospital intensifique estrategias para monitorear la inmunidad de los profesionales de la salud, prevenir este tipo de eventos y asegurar un adecuado registro de los casos.
Descriptores: Inmunidad; Hepatitis B; Accidente de Trabajo; Material biológico; Personal de Salud.

ORIGINAL

Introduction

Occupational accidents with exposure to biological material (ATEMB) are characterized as bodily injuries that involve direct contact with blood and organic fluids in the work environment, and may occur by percutaneous inoculation, by means of piercing and cutting instruments, and by direct contact with non-intact skin and/or mucous membranes[1].

ATEMBs leave workers exposed to contamination by more than 60 species of pathogens, including the human immunodeficiency virus (HIV), the hepatitis B virus (HBV) and the hepatitis C virus (HCV), of great epidemiological relevance. Most accidents with health professionals are related to sharp objects, involving the nursing team, but doctors, laboratory and cleaning staff also have accidents2. In addition, workers in other areas are also susceptible to ATEMB, such as those who work in funeral services, the beauty industry, public security and sanitation[2].

According to Ordinance No. 104, of January 25, 2011, accidents with biological material and ten other types of work-related injuries must be reported to the Notifiable Diseases Information System (SINAN). The high incidence of ATEMB in Brazil is of great concern to the Ministry of Health, since from 2010 to 2015, SINAN received 809,520 notifications of occupational diseases and injuries, of which 276,699 (34.2%) of these cases involved biological material[3].

The World Health Organization (WHO) estimated, in a report on the risk of exposure to biological material, that, among the approximately 35 million health workers, between two and three million were susceptible to the risk of percutaneous exposures of blood-spread pathogens annually, involving the human immunodeficiency virus (HIV), hepatitis B (HBV) and hepatitis C (HCV)[4].

Healthcare workers working in care settings, emergency rooms, operating rooms, and laboratories are at increased risk of exposure, as are cleaners, whose duties involve handling devices and tools containing contaminated material[5].

The risk of HIV infection after occupational exposure with contaminated blood is approximately 0.3%. In the case of occupational exposure to the hepatitis B virus (HBV), the risk of infection varies from six to 30%, depending on the condition of the source patient, among other factors. As for the hepatitis C virus (HCV), the risk of occupational transmission after a percutaneous accident with an HCV-positive source patient is approximately 1.8% to 10.[6]

HBV infection is a global health problem and is considered one of the deadliest infections in the world, with nearly 1.2 million deaths annually. According to recent estimates published by the WHO, 257 million people are living with HBV7 infection. In Brazil, the Ministry of Health (MoH) estimates that 15% of the population has already been exposed to HBV and that 1% suffers from chronic hepatitis[8].

HBV infection can occur in any individual, but there are groups that are significantly more exposed, such as newborns of mothers with HBsAg, health professionals and dialysis patients. Considering percutaneous or mucosal exposures to the blood of individuals infected with the virus, the health work environment portrays the main source of transmission.[8]

The first report of occupational transmission through accidents involving biological material with seroconversion to hepatitis B occurred in 1949 with a professional from a blood bank[9]. In contexts like this, it is important to emphasize that the hepatitis B virus (HBV) is 57 times more infectious than HIV[10].

Considering that there are approximately 17,000 confirmed cases each year[11], vaccination against hepatitis B is the most important strategy for controlling HBV infection. The complete vaccination schedule consists of the administration of three doses of the vaccine against hepatitis B, at intervals of zero, one and six months[12]. It is expected that the first dose confers 30% to 50% protection, and that, after the administration of the two doses in healthy adults, protection reaches 75%13. However, approximately 10% to 20% of vaccinated individuals do not achieve protective antibody titers[14].

The levels of antibodies produced after vaccination (anti-HBs) show a significant decline in the first year, which causes difficulty in interpreting the immune response to vaccination. However, the concentration of anti-HBs antibody titers greater than or equal to 10IU/L proves that immunity is maintained, even if antibody levels are decreased or undetectable[15].

Knowledge about the risk and awareness of the importance of vaccination and personal behavior become important topics among health professionals, since incomplete vaccination leads to an increased risk of infections, especially in a context of constant exposure to HBV in the workplace. Thus, understanding the epidemiological profile associated with the vaccination status and immunity of workers who have undergone ATEMB is essential for the proper implementation of measures aimed at correcting and mitigating the risks to which these professionals are exposed.

In view of the above, the objective of this study is to describe the epidemiological profile of the vaccination status and immunity to hepatitis B of health professionals who suffered accidents with exposure to biological material in the period between January 2015 and December 2021 in a university hospital in the interior of Pernambuco.

Methodology

This is a retrospective, descriptive epidemiological research with a quantitative approach based on secondary data that included all cases reported for Occupational Accidents with Exposure to Biological Material (SINAN-ATEMB) in a university hospital in the state of Pernambuco, in the period between January 2015 and December 2021. This hospital is a medium and high complexity institution and serves patients from the Unified Health System, being a reference unit for the 53 municipalities of the Interstate Health Care Network of the Middle São Francisco Valley - PEBA, which is formed by six health micro-regions and covers a population of approximately 2,077,000 inhabitants in the states of Pernambuco and Bahia.

The inclusion criteria consisted of occurrences of notifications for accidents with biological material involving students and health workers. Records in which the "occupation" field was left blank or duplicate cases were excluded from the study.

Data collection was carried out through access to the SINAN NET - ATEMB (Occupational Accidents with Exposure to Biological Material -

ANNEX B) notification database of the university hospital that participated in this study, and the information was later included in a single Microsoft Excel spreadsheet version 2010.

For the distribution of cases of occupational accidents with exposure to biological material, the year of occurrence will be evaluated. The characterization of health professionals who are victims of accidents with biological material will be made according to sex (male, female), age group (< 20 years, 20 - 29 years, 30 - 39 years, 40 - 49 years, 50 - 59 years, > 60 years) and professional category.

In addition to this information, accidents with biological material will be identified and distributed according to the type of exposure (not informed, percutaneous, mucosal, intact skin, unintact hair, others), causative agent (not informed, needle with lumen, needle without lumen, intracath, glasses, slide/lancet, others) and organic material involved (blood, amniotic fluid, cerebrospinal fluid, fluid with blood, pleural fluid, serum/plasma, ascetic liquid, others, ignored).

Accidents with biological material will also be separated according to the vaccination status of the injured person in relation to hepatitis B (vaccinated, unvaccinated, unknown), serological status for anti-HBS (>10 IU/L, <10 IU/L, not informed, not performed) and immunization for Hepatitis B. In this study, to define the vaccination status, "vaccinated individual" will be considered one who has received three doses of the hepatitis B vaccine and "immunized individual" is the one whose anti-HBS titration is higher or equal to 10 IU/L, as recommended by the Ministry of Health.

Data were tabulated using the SPSS® statistical software by descriptive statistics (absolute and relative frequency) and inferential statistics (Fisher's exact test). It should be noted that the age variable was dichotomized according to the median.

In the association analysis, the variables were recoded in order to refine significance. The Fisher test was chosen because the number of marriages with a frequency of less than five was greater than 20%. The significance and margin of error adopted were 95% and 5%, respectively.

The ethical aspects of research with human beings of the National Health Council were respected with approval by the Ethics Committee of the University Hospital of the Federal University of Vale do São Francisco (HU - UNIVASF) with opinion number: 6,079,730.

Results

According to Table 1, 374 people suffered occupational accidents with exposure to biological material, of which 25.4% were recorded in 2016, 73.8% were female, 48.1% were brown and 37.2% were nursing technicians. Regarding exposure, 71.9% were percutaneous, 20.6% mucosal, 28.6% intact skin, 9.1% non-intact skin, 69.8% had blood as the material involved, and 42.6% had a needle with a lumen as the causative agent. Regarding vaccination status, 76.5% had a complete three-dose schedule and 65.5% had not undergone anti-HBS serology.

Table 1 – Distribution of social and clinical variables of occupational accidents with biological material. Petrolina, PE, Brazil. (N=374)

Variables	Workers	
	n	%
Year of the accident n (=373)		
2015	82	21,9
2016	95	25,4
2017	87	23,3
2018	56	15,0
2019	29	7,8
2020	9	2,4
2021	15	4,0
Age at the date of the accident (n=373)		
Under 33 years old	194	51,9
Over 33 years old	179	47,9
Gender (n=373)		
Male	97	25,9
Female	276	73,8
Race/color (n=374)		
White	118	31,6
Black	23	6,1
Yellow	2	0,5
Brown	180	48,1
Ignored	26	7,0
Not filled	25	6,7
Professional category (n=373)		
Military police soldier	1	0,3
Military firefighter sergeant	1	0,3
Production and Operations Manager	1	0,3
Anesthesiologist	5	1,3
General Surgeon	14	3,7
Clinical Physician	21	5,6
Orthopedist and Traumatologist	6	1,6
Resident Physician	2	0,5
General Practitioner Dental Surgeon	1	0,3
Veterinarian	1	0,3
Nurse	71	19,0
General Physiotherapist	6	1,6
Occupational Physiotherapist	1	0,3
Executive secretary	1	0,3
Industrial Laboratory Technician	1	0,3
Laboratory technician of physicochemical analysis	9	2,4
Nursing Technician	139	37,2
Qualified first responder	1	0,3
Radiology and Imaging Technician	1	0,3
Health Laboratory and Blood Bank Technician	1	0,3
Occupational Safety Technician	1	0,3
Domestic employee in general services	10	2,7
Butler	1	0,3
Building caretaker	1	0,3
Street Sweeper	1	0,3
Clinical Analysis Laboratory Assistant	5	1,3
Barber	1	0,3
Pharmacy clerk	1	0,3

Mason	1	0,3
Construction worker	1	0,3
Driver of a van or similar vehicle	1	0,3
Truck driver (regional and international routes)	1	0,3
Loader (warehouse)	1	0,3
Student	37	9,9
Chronically unemployed or whose usual occupation could not be obtained	26	7,0
Percutaneous exposure (n=374)		
Yes	269	71,9
No	80	21,5
Ignored	11	2,9
Not filled	14	4,7
Mucosal-type exposure (n=374)		
Yes	77	20,6
No	263	70,3
Ignored	10	2,7
Not filled	24	6,4
Exposure of the intact skin type (n=374)		
Yes	107	28,6
No	231	61,8
Ignored	14	3,7
Not filled	22	5,9
Non-intact skin exposure (n=374)		
Yes	34	9,1
No	299	79,9
Ignored	15	4,0
Not filled	26	7,0
Organic material involved (n=374)		
Blood	261	69,8
CSF	10	2,7
Urine	4	1,1
Saliva	3	0,8
Amniotic fluid	2	0,5
Bloody fluid	2	0,5
Serum/Plasma	1	0,3
Unidentified	8	2,1
Ignored	2	0,5
Blank	37	9,9
Tracheal secretion	44	11,8
Causative agent (n=374)		
Needle with lumen (light)	159	42,6
Lumen-free/solid needle	22	5,9
Intracath	2	0,5
Glasses	43	11,5
Blade/lancet (any type)	110	29,4
Other	27	7,2
Ignored	11	2,9
Not filled	0	0,0
Vaccination status (3 doses) (n=374)		
Vaccinated	286	76,5
Unvaccinated	30	8,0
Ignored	38	10,2
Not filled	20	5,3

Anti-HBS serologic status (n=374)		
Positive	1	0,3
Negative	74	19,8
Inconclusive	1	0,3
Not realized	245	65,5
Ignored	16	4,3
Not filled	37	9,9

Regarding Table 2, it was observed that 75.1% of the people who did not undergo or did not fill out the anti-HBS were female, 53.4% were under 33 years of age, 67.1% were black and 60.7% were physicians. Of these variables, there was an association only for race/color (p = 0.009).

Table 2 – Association between anti-HBS serological status, sex, age, and race/color. Petrolina, PE, Brazil. (N=374)

Variables	**Serological status**			**p-value***
	Positive n (%)	**Negative n (%)**	**Unfulfilled/unfilledn (%)**	
Gender (n=356)				
Male	0 (0,0)	20 (27,0)	70 (24,9)	0,824
Female	1 (100,0)	54 (73,0)	211 (75,1)	
Age (n=356)				
Under 33 years old	0	37 (50,0)	150 (53,4)	0,600
Over 33 years old	1 (100,0)	37 (50,0)	131 (46,6)	
Race/color (n=308)				
White	0 (0,0)	33 (54,1)	80 (32,5)	
Negress	1 (100,0)	28 (45,9)	165 (67,1)	0,009
Other	0 (0,0)	0 (0,0)	1 (0,4)	
Professional category(n=107)				
Nurse	0 (0,0)	8 (34,8)	33 (39,3)	0,694**
Doctor	0 (0,0)	15 (65,2)	51 (60,7)	

Note: * Fisher's exact test; ** Pearson's chi-square test.

Discussion

It is known that work accidents, in general, are socially determined, predictable and preventable. Thus, it is necessary to analyze the sociodemographic profile, to identify the vulnerabilities arising from the work environments and processes so that effective actions can be carried out, avoiding the trivialization and invisibility of work accidents[16].

According to the frequency of occurrence of accidents with exposure to biological material, the year 2016 stands out with the highest number of notifications in the period, but what draws attention are the years 2020 and 2021, which have the lowest number of notifications in the period studied. This may be related to an underreporting that occurred during the COVID-19 pandemic, since the pandemic changed the profile of illness of workers, causing changes in the routine and in the work environment in a significant way, becoming a problem not only of public health, but also of occupational health[17].

The number of notifications of work accidents involving exposure to biological material could be much higher, given that, although there has been a decrease in notifications of work accidents during the pandemic, some specific groups of workers linked to health care, who were more exposed to COVID-19, such as in hospital and outpatient care, there was an 8% increase in the number of notifications of work accidents[18].

Regarding the profile of workers affected by this problem, most workers are female (73.8%), under the age of 33 (51.9%) and of mixed race (48.1%) and black (6 .1%), which together correspond to more than half of the workers affected by this injury (54.2%) during the accident period. Female workers are generally the most affected, probably since there is a predominance of women among nursing technicians. This data corroborates the information contained in research on the profile of nursing in Brazil, which shows that the nursing workforce is still predominantly female, given that 85% of the nursing team is made up of women. Among these professionals, the majority are young adults, aged between 25 and 40[19].

With regard to color/race analysis according to the IBGE description, the majority of workers declare themselves to be mixed race, which corroborates the race/color profile for the professional category most affected by this type of work accident.[19] This profile is observed in other studies that address the black population as the main victim of fatal work accidents today, resulting from social inequalities, structural racism and poverty.[16]

Another relevant result is the association between anti-HBS serological status and race/color ($p = 0.009$). This suggests that black people have a different serological status compared to white people with a high number of tests not performed or information not having been filled out adequately by the health professional for the first group. Although there are several reasons for not taking the exam or not filling in specific information, such as the limited time available to carry out detailed interviews and fill out forms, the existence of racism cannot be ignored.

Institutional racism within health services is caused by the differentiated treatment of the black population, whether by professionals or by patients themselves, which leads to impediments in treatment and preventive actions made possible by public policies.[20] Not only that, but the implicit bias of health professionals resulting from the structural racism that exists in the Brazilian context influences the decision to request a test or adequately fill out fundamental information, which is the serological status for anti-HBS. There is also a need in health services to fill out basic self-declared information on race/color and other indicators such as morbidity and mortality[20]. This may have implications for epidemiological studies and the implementation of health strategies, such as those related to immunization and prevention of hepatitis B for different ethnic-racial groups.

The effectiveness of the hepatitis B vaccination schedule, when carried out completely, can reach 95%[21]. A complete vaccination schedule associated with confirmation of protective immune status, confirmed by anti-HBS titers > 10 mIU/mL, reduces the risk of infection after exposure to almost zero[13]. Such facts become even more relevant when considered in the context of the prevalence of HBV infection among healthcare professionals, which can be up to four times higher than that found in the general population[22]. In cases where professionals are exposed to HBV without the serological status being verified,

it is necessary to administer immunoglobulin against hepatitis B, aiming to minimize the risks of infection[23].

In the present study, around 76.5% of registered workers had a complete vaccination schedule, with at least three doses of the Hepatitis B vaccine. Similar results were reported by Machado et al.[13] in their research carried out with health professionals working in a reference hospital for infectious diseases in Goiânia-GO, in which around 76.9% of workers had a complete and updated vaccination schedule for hepatitis B. These values, however, are lower than those observed by Frison et al.[24] in his work carried out with professionals from a university hospital in Campinas-SP. In this study, 98% of workers had a complete vaccination schedule and, of these, 94% had anti-HBS titers greater than 10 mIU/mL.

However, most workers (65.5%) did not have their serological status checked and, among those whose anti-HBs titers were tested, 98.7% presented negative results. This fact may indicate both the immunization failure of the vaccination schedule, since the routine use of anti-HBS after the end of the vaccine dose schedule, aiming to confirm protective serum levels of antibodies, is not adopted in Brazil, as well as a greater number of professionals whose vaccination status is not favorable. Since anti-HBS titers progressively decline in the first year following the third dose of the hepatitis B vaccine, individuals who do not complete the vaccination schedule are even less likely to reach protective serum antibody levels. This could also be evidenced in the work of Machado et al.[13], in which 100% of workers with an incomplete vaccination schedule were negative for anti-HBs.

Since they do not have a satisfactory serological status, these professionals must receive post-exposure prophylaxis (PEP), using hyperimmune immunoglobulin. In the work of Souza et al.[25], the direct costs resulting from the use of PEP were compared to the resources spent on preventing hepatitis B, based on the administration of the vaccination schedule recommended by the National Immunization Program (PNI) and confirmation of immune protection by measuring anti-HBs titers. It was concluded that PEP was almost thirty times more costly to public services than guaranteeing prevention, with a favorable serological status at the time of ATEMB.[25]

Additionally, according to Regulatory Standard 32 (NR 32), it is the employer's duty not only to provide resources to workers to ensure an adequate vaccination schedule, but also to continuously monitor the vaccination status of employees26. Concomitantly, professionals should be informed of the risks to which they are exposed in the face of refusal of vaccination, as well as of the benefits and importance of maintaining a satisfactory serological status26. Thus, it is up to the service in question to implement measures for the adequate monitoring of the vaccination schedule and the serological status of workers, aiming not only at reducing the probability of infection in the face of an ATEMB, but also at reducing the resources spent due to the need to use PEP for hepatitis B, in the face of events of exposure to the virus.

It is considered that all health professionals are exposed to the risk of infection after accidental occupational exposure27. Due to this, there is an evident need to analyze, together with other variables, the profile of the professional category most affected by these accidents. In the study hospital, it was noted that the nursing team has the highest number of accidents (56.2%),

where nursing technicians comprised a significant number in relation to nurses (66%) and other occupations in the health area (37.2%). This fact must be directly related to the attributions of the profession because, during the working day, they perform functions that have greater chances of exposure to contaminated material, such as the promotion of hygiene and comfort of the patient, organization of the work environment, control of materials, disregard of urine, drainage and secretions of collection bottles. In addition, other circumstances can contribute to the occurrence of accidents with the nursing team: lack of training, inexperience, double workday, lack of organization at work, fatigue and emotional disorders[28].

Immediately after the work accident, a characterization of the event must occur, exposing the type of exposure, type of material involved and the causing instruments, since the more agile the identification of the agents of the situation, the faster care and safety measures can be carried out. management guidelines that, consequently, lead to better resourcefulness of the victim for an adequate solution[29].

Regarding the types of exposure to accidents, it was highlighted in the present study that percutaneous exposure, injuries caused by piercing and/or cutting instruments, represent 71.9% of cases. Next, mucosal exposures, splashes in the eyes, nose, mouth and genitalia, had a lower prevalence (20.6%), as well as exposure to intact and non-intact skin, respectively, represented by 28.6% and 9.1% of accidents. Therefore, this information is also related to the causative agent itself, since accidents caused by needles with a lumen (light) (42.6%) and accidents with blades/lancets (29.4%), two piercing-cutting instruments, represented a relevant percentage in comparison to the other materials involved.

It can also be seen that the main organic material involved was blood (69.8%). This fact may be associated with the variables discussed, since the professional category responsible for administering subcutaneous medications and carrying out venipuncture activities is the nursing team. Furthermore, as needles with lumens are normally the instruments used for such functions, it could be correlated with greater exposure to blood and, consequently, contributing to accidents with this biological material having such a significant number[30].

Conclusion

Among the health professionals who were victims of accidents with biological material, there was a predominance of females, aged between 25 and 40 years and brown or black. The prevalent profile correlates with its higher frequency among nursing technicians and reflects society's patterns of inequality.

The risk of infection cannot be properly verified, since most of them did not have their immune status evaluated. The vast majority of those who had it presented negative results for anti-HBS titers, emphasizing the importance of the administration of PEP for professionals involved in accidents with biological material. The situation evaluated reflects the need for an effective application of NR 32 as a mechanism to prevent accidents with biological material and, consequently, infection by the hepatitis B virus.

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Correspondent Author
Ana Cleide da Silva Dias
Avenida José de Sá Maniçoba s/n. CEP: 56304-917 -Centro. Petrolina, Pernambuco, Brazil.
anacleide.dias@univasf.edu.br