Work accidents with biological material: factors associated with abandoning clinical and laboratory follow-up*

Acidente de trabalho com material biológico: fatores associados ao abandono do acompanhamento clínico-laboratorial

Accidente laboral con material biológico: factores asociados con el abandono del seguimiento clínico y de laboratorio

ABSTRACT

Objective: To analyze the epidemiology of abandoning clinical and laboratory follow-up among health workers who suffered accidents with biological material. Method: Cohort study based on reported work accidents with biological material in Goiânia/Goiás. Data were analyzed in Stata with descriptive and analytical statistics. Results: 2,104 exposures of the 8,596 reported accidents were analyzed, most of them involving females with completed high school education and belonging to the nursing staff. The accidents predominantly occurred by percutaneous injury involving a needle with lumen during medication administration or vascular access. Follow-up abandonment rate was 41.5%. Predictive factors for discontinuing clinical and laboratory follow-up were age, occupation, use of personal protective equipment (gowns), the object involved in the accident, situation in the labor market, circumstance of exposure and recommended prophylactic conduct. Conclusion: Given the high abandonment rate found, it is suggested to implement strategies to ensure follow-up and reduce risks to health workers.

DESCRIPTORS

Accidents, Occupational; Occupational Exposure; Post-Exposure Prophylaxis; Health Personnel; Lost to Follow-Up.

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INTRODUCTION

Accidents with biological material involve a worker coming into contact with blood and/or other organic fluids during the workday. The most frequent exposures occur from percutaneous inoculation, direct contact with skin and/or mucous membranes. The risk of the accident varies according to the exposure type, severity, size of the injury, presence and volume of blood involved, clinical source conditions and applied prophylactic measures.

In accidents where the serological status of the source is unknown or positive for Human Immunodeficiency Virus (HIV), Hepatitis B Virus (HBV) or Hepatitis C Virus (HCV), the worker should conduct a clinical and laboratory follow-up. An indication of chemoprophylaxis, antiretroviral toxicity, laboratory test results and the need for other post-exposure procedures are monitored during follow-up. In addition, the worker is advised about the care that should be implemented until the seroconversion risk is eliminated.

Prophylactic procedures performed during clinical and laboratory follow-up are essential to reduce occupational risk. In the case of HIV, for example, they can reduce the seroconversion risk by 81% if applied in a timely manner. Despite the protection level from prophylactic behavior and the seroconversion risk following an accident with biological material, many health workers abandon the follow-up; this means they do not attend outpatient consultations and do not perform the recommended laboratory tests.

Abandoning clinical and laboratory follow-up after exposure to biological material is a frequent reality, especially in developing countries. The adherence rate to follow-up in Brazil ranges from 2.2% to 54.0%, which highlights the seroconversion risk. Factors related to exposure characteristics, worker profile, network organization responsible for injured care and employer support may be associated with follow-up interruption.

By abandoning clinical and laboratory follow-up, the worker loses access to important conducts such as: chemoprophylaxis continuity, prescription of other prophylactic measures, adequacy of the therapeutic regimen according to their clinical situation, repeating serology for HIV, HBV and HCV, guidance on care actions which should be implemented while there is seroconversion risk, as well as psychological and labor support in coping with the accident. Still, such abandonment increases the infection risk, intensifies the emotional suffering of the injured person, endangers the health of others in their social life and also makes it difficult to grant social security benefits in case of seroconversion. Considering all the consequences of interrupting the follow-up, it is expected that characterizing the abandonment of the clinical-laboratory follow-up of the injured person(s) will promote interventions to increase health workers’ protection, especially nursing team workers who have a high risk of occupational exposure, and the highest number of recorded accidents. It may also subsidize public policies in the area of worker’s health.

Based on the foregoing, the objective of this study was to analyze the epidemiology of abandoning clinical and laboratory follow-up among health workers who suffered accidents with biological material and to identify the factors which are associated with interrupting the follow-up.

METHOD

STUDY TYPE

This is a cohort study developed from secondary data on the follow-up of health workers after exposure to biological material to completing the clinical and laboratory follow-up.

POPULATION

The study population consisted of health workers characterized as professionals directly or indirectly inserted in providing services in health facilities, over 18 years old who suffered accidents with biological material and were attended in Goiânia in a 10-year period from 2006, constituting the implementation year of the Notification Disease Information System (SINAN - Sistema de Informação de Agravos de Notificação) in the state of Goiás (2006-2016).

The occupations analyzed in this study were: nursing staff (nurse, attendant, assistant and nursing technician), laboratory staff (biomedical, laboratory technician and blood bank worker), cleaning staff (general service employees), staff dentist (dental office attendant, oral health assistant, dentist, dental office and oral health technician), medical staff (physicians), students (middle or higher level) and others (health workers who are not part of the other mentioned teams).

SELECTION CRITERIA

The accidents analyzed in this study occurred with health workers over 18 years old, who were treated in Goiânia, Goiás, Brazil after occupational exposure to biological material which occurred between 2006 and 2016 and had an indication for clinical and laboratory follow-up. The total number of notifications was considered regardless of the number of exposures per victim. Accidents in which the evolution field was blank, ignored or closed as death by other causes were excluded from the analysis.

DATA COLLECTION

Data were collected from work accident investigation forms with exposure to biological material, registered in SINAN by the Reference Center for Occupational Health (CEREST – Centro de Referência em Saúde do Trabalhador), Goiânia region. The database for the study period was made available directly from the records center for the purposes of this study. After exporting the cases from the database, individual cases were checked and telephone contact was actively used to fill in the blank fields, or
these cases were excluded according to the criteria if not possible.

**Data analysis and processing**

The outcome variable was abandoning clinical and laboratory follow-up, while the predictor variables were: municipality of residence, age, gender, education, occupational category, employment status, HBV vaccination, type of exposure, biological material involved, circumstances of the accident, object which caused the injury, use of personal protective equipment, identification of source person and conduct at the time of the accident.

Data were analyzed using Stata statistical software, version 14.0. A descriptive analysis of the variables was initially performed in which all were presented as absolute or relative frequency. Bivariate logistic regression analysis was also initially performed to identify the association between outcome and predictor variables. Next, variables with p-value < 0.20 were included in a multiple binary logistic regression model. Wald's chi-squared test was used to verify the statistical significance of the independent variables. The variables which influenced the interruption of clinical and laboratory follow-up in the multiple analysis were those with p < 0.05.

**Ethical aspects**

This study is part of an anchor project entitled “Epidemiology of occupational accidents involving exposure to biological material in the state of Goiás: phase 2”, submitted and approved by the Research Ethics Committee of the Clinical Hospital of the Universidade Federal de Goiás (Opinion no. 414.258/2013). The legal ethical principles contained in Resolution No. 466/2012 of the National Health Council were respected and information confidentiality was ensured.

**Results**

In total, 8,596 work accidents with biological material were registered from 2006 to 2016. Of these, 3,878 were excluded because they did not present information on the evolution of the accident, 1,331 were not involving health workers, 1,266 had no indication of clinical and laboratory follow-up, 18 because they were underage and five died because of causes which were unrelated to the accident, as shown in Figure 1.

![Figure 1 – Accidents with biological material that occurred with health workers between 2006-2016 – Goiânia, Goiás, Brazil, 2018.](image)

After applying the investigation criteria defined in this study, 2,104 work-related accidents with biological material which had an indication of clinical and laboratory follow-up were analyzed. Of these, 1,696 (80.6%) were women, between 18 and 29 years old (803, 38.1%), with completed high school (1,102, 52.3%) and belonging to the nursing staff (1,169, 55.5%).

Percutaneous injury (1,667, 79.2%) occurred in most accidents, with exposure to blood (1,603, 76.1%) during drug administration/vascular access (650, 30.8%), with the involved object being a lumen needle (1,043, 49.5%). Personal Protective Equipment (PPE) with the highest reported use was gloves (1,589, 75.5%), gowns (1,152, 54.7%), and goggles (521, 24.7%). Regarding HBV immunization, 1,874 (89.0%) accident victims confirmed receiving the three vaccine doses before exposure to biological material.

The prophylactic conduct with the highest indication of indication after occupational exposure to biological material was chemoprophylaxis against HIV (468, 22.2%); of these, 16 (1.2%) of the accident victims refused medication. For HBV prevention, vaccine and immunoglobulin were recommended in 99 (4.7%) and 66 (3.1%) accidents, respectively. There is no
recommended prophylactic conduct during clinical and laboratory follow-up regarding HCV; in this case, the diagnosis and treatment of health workers who present seroconversion is performed, which was not identified during this study.

With regard to clinical and laboratory follow-up, it was found that abandonment occurred in 873 (41.5%) accidents with follow-up indication, and there was no case of seroconversion reported in the analyzed period.

In the bivariate analysis, the predictor variables for abandoning follow-up were: age, race, education, occupational category, employment status, type of exposure (percutaneous and mucous), circumstances of the accident, object involved, source identification, organic material, use of PPE and conduct at the time of the accident (chemoprophylaxis against HIV) and issuance of the Communication of Work Accident (CWA).

The variables which showed significance in the binary logistic regression model (p < 0.20) were submitted to multiple analysis, and the factors associated with interruption of follow-up after an accident with biological material are presented in Table 1.

Nursing (ORadj: 1.55; 95% CI: 1.00-2.40), dentistry (ORadj: 1.99; 95% CI: 1.16-3.42) and cleaning workers (ORadj: 1.71; 95% CI: 1.05-2.80) presented a higher chance of interrupting follow-up when compared to the laboratory workers. The chance of abandonment was also higher among those with formally recorded injuries when compared to those which were not registered (ORadj: 3.55; 95% CI: 2.18-5.77). The chance of abandonment was also 1.61 times higher (ORadj: 1.61; 95% CI: 1.26-2.06) in accidents where no CWA was issued.

Professionals who did not wear gowns at the time of the accident were more likely to abandon the follow-up procedures than those wearing this personal protective equipment (ORadj: 1.39; 95% CI: 1.12-1.73). Regarding the object involved in the exposure, professionals who had accidents with other instruments presented 77.98 (ORadj: 77.98; 95% CI: 46.63-130.41) more chance of abandonment when compared to those who had accidents involving a needle with lumen.

Professionals exposed to biological material aged 40 years and older were found to be 1.26 times (ORadj: 1.26; 95% CI: 1.01-1.59) more likely to abandon than younger professionals (18-29 years). Also, health workers who refused HIV chemoprophylaxis were more likely to abandon the follow-up compared to those who used prophylactic medication (ORadj: 3.35; 95% CI: 1.07-10.49).

Finally, professionals who had accidents during laundry or material washing procedures had a lower chance of abandonment when compared to those exposed during drug administration (ORadj: 0.38; 95% CI: 0.22-0.67).

Table 1 shows the multiple analysis of abandoning clinical and laboratory follow-up after an accident with biological material between 2006 and 2016, according to the sociodemographic characteristics of health workers, exposure profile and conduct at the time of the accident.

### DISCUSSION

The nursing staff had the highest exposure to biological material (1,169, 55.5%) with indication for clinical and laboratory follow-up, which is similar to the findings of

<table>
<thead>
<tr>
<th>Variable</th>
<th>ORadj**</th>
<th>95% CI</th>
<th>p-value*</th>
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<tr>
<td>Age (years)</td>
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<td>18-29</td>
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<td>30-39</td>
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<td>1.01 - 1.59</td>
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<td></td>
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<td></td>
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<td>Nursing team</td>
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<td>1.99</td>
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<td>1.71</td>
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<td>Laundry/Material Washing</td>
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<tr>
<td>Others</td>
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<td>46.63 - 130.41</td>
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<td>1.12 - 1.73</td>
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<tr>
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<td>0.96 - 1.58</td>
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<td>1.07 - 10.49</td>
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<tr>
<td>No</td>
<td>1.61</td>
<td>1.26 - 2.06</td>
<td>&lt; 0.001</td>
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</table>

ORadj: adjusted odds ratio. 95% CI: 95% confidence interval. Wald chi-squared test. * Considering valid data. **Adjusted for gender and age. Note: (N=2,104).
The high prevalence of accidents among these professionals is due to direct and uninterrupted patient care, frequent handling of sharps, multiple employment relationships and work overload\textsuperscript{[15-16]}. The frequent exposure of nursing professionals can be understood by analyzing the work process developed by the members of this team. In this investigation, 650 (30.9\%) of the injured people who were to perform clinical and laboratory follow-up were injured during medication administration and vascular access puncture. Similar exposure circumstances have been found in other studies which point to the biohazard in handling sharps\textsuperscript{[18-19]}. Materials which cause cuts or punctures in health workers’ skin indicated for clinical and laboratory follow-up are associated with percutaneous lesions. In this study, 1,667 (72.6\%) of the accident victims suffered this type of exposure, with the involved object being a lumen needle in 1,043 cases (56.1\%), while in 1,603 (84.6\%) notifications there was contact of the worker with blood, serum or plasma. This characterization is similar to other publications\textsuperscript{[14,20-21]}. Blood is a potentially infectious biological material and may be contaminated with several pathogens such as HIV, HBV and HCV. Thus, percutaneous accidents are classified as high biological risk due to the possibility of health worker exposure to deep injuries caused by devices used in blood vessels and which may have high biological load\textsuperscript{[19]}. An interesting finding observed in this study was the frequency of accidents among young people from 18 to 29 years old (803, 38.1\%). Similar findings have been found in other studies which associate exposures with poor instrument handling skills\textsuperscript{[4,17]}. These data indicate the need for greater attention from the services that rely on this workforce to develop continuing education processes regarding standard precautions. One of the proposed measures to reduce biological risk is the use of PPE. The results of this research indicate that gloves were the PPE with the highest use record with 1,589 (75.5\%) cases, which is similar to other investigations\textsuperscript{[15,21]}. Although gloves do not prevent percutaneous accidents, they act as a mechanical barrier which is capable of reducing the amount of inoculated material by up to 75\%. In addition to gloves, it is also necessary to use a mask, goggles, face shield, gown, boots and cap in health services according to the occupational risk to which the worker is exposed\textsuperscript{[22]}, and this equipment had low registration usage rates among accident victims.

Another important measure for protecting health workers’ health is vaccination against HBV. In this study, 1,874 (89.0\%) of the injured patients with indication for clinical and laboratory follow-up were vaccinated at the time of exposure to biological material. The prevalence of HBV vaccination in Brazil ranges from 59.2\% to 93.9\%; however, it would be ideal for all health workers to be vaccinated, as vaccination is free and effective\textsuperscript{[23-24]}. In defining prophylactic behavior after an accident with biological material, consideration should be given to the type of exposure, material involved, time elapsed between the accident and care, and the serological status of the source and the worker. Regarding HBV, vaccine and immunoglobulin may be recommended\textsuperscript{[22]}. These prophylactic measures were prescribed in 99 (4.7\%) and 66 (3.1\%) accidents in which the victims were indicated for clinical and laboratory follow-up, respectively. Such conduct may be understood from the perspective of Brazilian public policies which facilitate access for health workers to be vaccinated before accidents with biological material and restrict the use of immunoglobulin after occupational exposure.

In addition, chemoprophylaxis against HIV can be recommended for health workers exposed to biological material, which can reduce the risk of seroconversion by 81\% when initiated in a timely manner\textsuperscript{[19]}. In this study, 468 (22.2\%) health workers had indication for chemoprophylaxis, but 16 (1.2\%) refused the medication. Resistance to initiating or completing the prophylactic regimen is a reality often related to the side effects of the recommended antivirals\textsuperscript{[16,20]}. Another recommended conduct for the accident victims insured by social security is the issuance of the CWA. In this study, a CWA issuance occurred in 1,117 (70.1\%) exposures with indication for clinical and laboratory follow-up, which is higher than that presented in other studies whose emission rates were approximately 50.0\%\textsuperscript{[13,25]}. Unlike CWA, the biological material accident notification form must be completed for all occupational exposures to potentially infectious fluids, regardless of the employee’s employment relationship. However, this legal requirement is not always met.

In this investigation, 873 (41.5\%) injured patients interrupted follow-up, even after contact with potentially infectious fluids from a positive or unknown source. This percentage of abandonment is high, but it is among those described in the literature\textsuperscript{[4-7,8,17,26]}. Multivariate analysis showed that adherence to post-exposure follow-up correlated with worker age, occupation, employment status, PPE use, accident circumstance, object involved in exposure, and refusal to use chemoprophylaxis. It was found that health workers aged 40 years and older were 1.26 times more likely to abandon follow-up than younger health workers, which differs from two other studies which identified greater interruption of follow-up among younger injured people\textsuperscript{[26]} or the absence of statistical association between abandonment and age\textsuperscript{[4,16]}. More experienced health workers are more likely to have previous exposures without seroconversion, which may make them...
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Compliant with biological risk \(^{(6,7)}\). A history of previous accidents also makes the health professional remember dissatisfaction with the service received and the suffering experienced after exposure, motivating abandonment of clinical and laboratory follow-up \(^{(27)}\).

Nursing, dentistry and cleaning professionals presented the highest chance of interruption of follow-up, which is similar to a study conducted in Colombia \(^{(28)}\). Some authors mention that these health workers abandon follow-up due to lack of knowledge about biological risk \(^{(6,9,30)}\). It is noteworthy that there are different degrees of education in these professional categories with a predominance of health workers with lower levels of education, which reinforces the need for greater investments in training which help the workers incorporating biosecurity measures and prophylactic post-exposure conducts into their practice \(^{(27,29)}\).

An important precaution to reduce the occupational biological risk is the use of PPE. In this study, health workers who were not wearing gowns at the time of the accident were more likely to abandon the follow-up than those who reported using this PPE. This result shows a health worker profile that apparently does not adhere to preventive measures such as the use of PPE, nor to the conducts to reduce the risk of seroconversion, such as clinical and laboratory follow-up.

The literature points out that the low adherence of professionals to prevention measures and prophylactic behavior after an accident with biological material is related to the mistaken perception about the risk of exposure. Therefore, health workers who tend to classify the accident as low risk are more likely to abandon follow-up because they devalue the importance of prophylactic behavior \(^{(5,7,9,29)}\).

Corroborating the literature, this study found that professionals exposed to other agents (scissors, tweezers, etc.) were 77.98 more likely to abandon when compared to those who suffered lumen needle injury. Accidents involving devices used in blood vessels are usually recognized by the health workers as a factor that increases the possibility of seroconversion, which contributes to adherence to clinical and laboratory follow-up; not so with exposures involving other devices which have not had contact with blood \(^{(5,9,28)}\).

The perception of the accident risk also interferes with the use of chemoprophylaxis against HIV. In this study, health workers who refused prophylactic medication had a higher chance of abandoning compared to those who used antiretrovirals. This result differs from other investigations which found no association between chemoprophylaxis and abandonment of clinical and laboratory follow-up \(^{(9,26)}\). It is known that the use of antiretrovirals may cause mild, moderate or severe reactions. However, health workers who perform the follow-up have access to care which can reduce side effects. The same does not occur when the injured person refuses chemoprophylaxis and still abandons the follow-up, increasing their vulnerability to the accident \(^{(9,17,30)}\).

Another fundamental aspect for understanding the abandonment of clinical and laboratory follow-up is the employer’s conduct after exposure to biological material. In this investigation, health workers with formal registration had 3.55 more chances of interrupting follow-up when compared to those without formal registration. The chance of abandonment was also 1.61 times higher in accidents where the CWA was not issued.

These results reinforce that work organization can stimulate or limit access to clinical and laboratory follow-up. The factors which encourage the injured person to follow post-exposure care correctly are pre-accident counseling, support from their boss/supervisor and colleagues, incentive to attend follow-up appointments and the supervision of follow-up until discharge. The aspects which hinder adherence are lack of guidance, threat of dismissal, recriminatory attitudes and refusal of release to attend scheduled appointments \(^{(8,27,29)}\).

Interruption of follow-up also varied according to the circumstances of exposure. Workers who were injured in the laundry room or while washing materials were less likely to abandon when compared to those exposed during drug administration. These findings are consistent with the greater presumption of risk for exposures whose source is unknown, but differ from other studies which showed higher abandonment rates among professionals from the Center for Material and Sterilization (CMS) and other sectors where the majority of accidents had an unknown source \(^{(5,9)}\).

The limitations of this research are related to the low completeness of biological material accident reporting forms, as 3,878 (approximately 54.0%) exposures were excluded because the evolution field was blank or ignored. Another relevant aspect regarding the notifications is the outdated formatting and the lack of some variables which are essential for investigating the accident. Thus, there is an evident need for reviewing the notification instrument which has not been updated since its implementation.

CONCLUSION

Among health workers with indication for clinical and laboratory follow-up after an accident with biological material, there was a predominance of young women with completed high school and member of the nursing team. Regarding the accident profile, percutaneous lesions involving needle with lumen which had contact with blood during drug administration or vascular access puncture was highlighted. Forty-one and a half (41.5) of the injured patients interrupted follow-up even after exposure with a positive or unknown source.

The chances of abandoning clinical and laboratory follow-up were higher among health workers aged 40 years or older, belonging to the nursing, dental and cleaning teams, who were not wearing personal protective equipment (gown) at the time of exposure, suffered injury by an object which was not a needle lumen, were working formally registered, did not issue a CWA and refused chemoprophylaxis against HIV. It was also found that the accident victims who were exposed while performing procedures in the laundry or in washing material had lower chance of interrupting follow-up.
The need for qualification of the health workers involved in all follow-up is worth mentioning for reliable recording of the information of each case. The lack of records was a limiting factor of this study due to its direct impact on the assessment and consequently on the proposition of strategies to improve care for health workers who suffer accidents with biological material. In fact, only part of reality could be known.

The abandonment of clinical and laboratory follow-up after an accident with biological material is a multifactorial event influenced by post-exposure behavior, employer attitude and factors related to accident victims. The high rate of abandoning follow-up found in this study reinforces the need for greater investments in continuing education of health workers exposed to biological risk, implementing biosafety measures, timely initiation of prophylactic conduct, structuring of services responsible for the care of the injured, and also employer support from the moment of exposure until discharge.

RESUMO
Objetivo: Analisar a epidemiologia do abandono do acompanhamento clínico-laboratorial entre os trabalhadores da área da saúde que sofreram acidente com material biológico notificados em Goiânia/Goiás. Os dados foram analisados no Stata com estatística descritiva e analítica. Resultados: Dos 8.596 acidentes notificados, foram analisadas 2.104 exposições, a maioria no sexo feminino, com ensino médio completo e pertencente à equipe de enfermagem. Os acidentes ocorreram, predominantemente, por lesão percutânea, envolvendo agulha com lúmen, durante administração de medicamentos ou acesso vascular. A taxa de abandono do acompanhamento foi de 41,5%. Os fatores preditores para a interrupção do seguimento clínico-laboratorial foram idade, ocupação, uso de equipamento de proteção individual (avental), objeto envolvido no acidente, situação no mercado de trabalho, circunstância da exposição e condutas profiláticas recomendadas. Conclusão: Frente à elevada taxa de abandono encontrada, sugere-se a implementação de estratégias para garantir o seguimento e reduzir os riscos para o trabalhador.

DESCRITORES
Acidentes de Trabalho; Exposição Ocupacional; Profilaxia Pós-Exposição; Pessoal de Saúde; Perda de Seguimento.

RESUMEN
Objetivo: Analizar la epidemiología del abandono del seguimiento clínico y de laboratorio entre los trabajadores del área sanitaria que sufrieron accidente con material biológico. Método: Estudio de cohorte realizado a partir de los accidentes laborales con material biológico notificados en Goiânia/Goiás. Los datos fueron analizados en el Stata con estadística descriptiva y analítica. Resultados: De los 8.596 accidentes notificados, fueron analizadas 2.104 exposiciones, la mayoría del sexo femenino, con nivel escolar de educación secundaria y perteneciente al equipo de enfermería. Los accidentes ocurrieron, predominantemente, por lesión percutánea, involucrando aguja con lúmen, durante administración de fármacos o acceso vascular. La tasa de abandono del seguimiento fue del 41,5%. Los factores predictores para la interrupción del seguimiento clínico y de laboratorio fueron edad, ocupación, uso del equipo de protección individual (delantal), objeto involucrado en el accidente, situación en el mercado laboral, circunstancia de la exposición y conductas profiláticas recomendadas. Conclusión: Ante la elevada tasa de abandono encontrada, se sugiere la implementación de estrategias para asegurar el seguimiento y reducir los riesgos para el trabajador.

DESCRITORES
Accidentes de Trabajo; Exposición Profesional; Profilaxis Posexposición; Personal de Salud; Perda de Seguimento.

REFERENCES

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