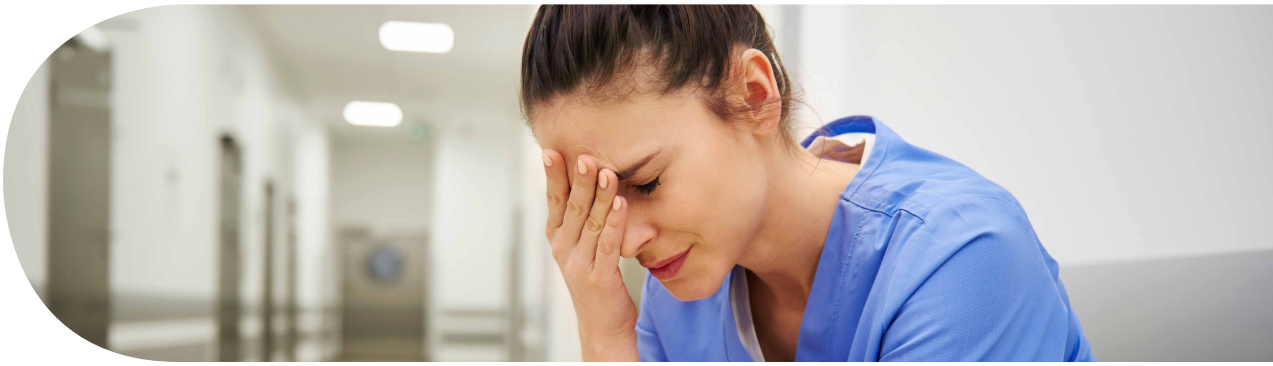
Safety-related aspects of healthcare workers associated with blood sampling

BD

Introduction

Within all the activities of an organization, certain type of hazard is implicit.

Even though zero error does not exist, mainly because every real process has a certain probability of error, it should tend to zero or be reduced to its smallest possible magnitude. The clinical laboratory environment represents a workplace with well-characterized health risks for workers. The hazard level from exposure to one or more of these risks may be different in each clinical laboratory, so the definition of hazard is an essential dimension of the social responsibility of each organization.



A hazard is estimated on the basis of a given risk and is expressed in terms of the probability of its occurrence, the seriousness, and the possibility or not of being detected. Therefore, a hazard that may exist in two different laboratories could result in various levels of risk.

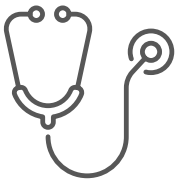
A survey by the International Labor Organization (ILO) of the European Union estimated that approximately 2,34 million people worldwide die each year from work-related accidents or illnesses resulting from work-related accidents[1]. Healthcare workers should be aware that safety is the responsibility of everyone, as well as employers should be commitment to provide a safe work environment for their entire staff.

This point becomes critical in our industry, due to the fact that healthcare workers often show a certain degree of indifference when it comes to safety hazards in their workspaces. Each stakeholder values differently the probability of occurrence of a risk and, therefore, its severity. The acceptability of this risk is influenced by the perceived hazard, by their cultural, socioeconomic, and educational background, and by the patient's actual and perceived health status, among other factors.

Work safety in the clinical laboratory represents a set of preventive and corrective measures regarding the following aspects:

Technical

Educational



Medical

Psychological

Combined with the appropriate behavior of personnel to ensure a safe and healthy work environment with an adequate level of quality.

The safety program aims to protect everyone's health, prevent accidents in the laboratory and reduce harms.

There are local regulations and international reference standards, such as ISO 45001, which is the international standard for work-related safety and health management systems, aimed to protect workers and visitors from work-related accidents and illnesses[2]. This standard aims to provide an organization with information on the issues that may affect it and how to manage its work-related health and safety responsibilities towards its workers[2]. Several clinical laboratories in Latin America have incorporated this standard into their work-related health programs. As for the standard applicable to Clinical Analysis Laboratories, it is the "ISO 15189:2012: Clinical Analysis Laboratories. Requirements for quality and competence" calls for the development of a Risk Management process by which the impact of work processes and potential failures on the results of the analyses that affect patient safety must be evaluated and the process modified to reduce or eliminate the identified risk, documenting the decisions and actions taken[3].

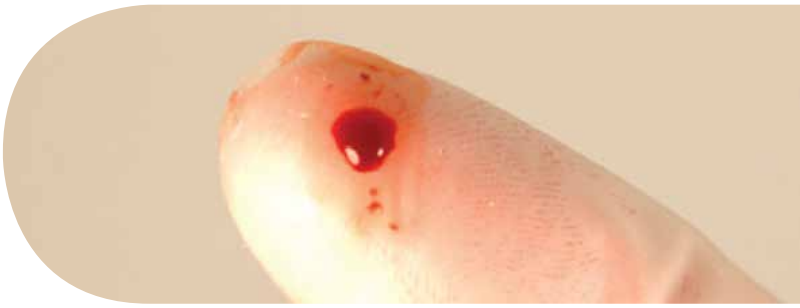
However, it is not dispensable to have a certification or accreditation as the one mentioned above for the top management of a clinical laboratory to establish policies, characterize hazards, implement barriers at the source, the environment, or the worker, measure the accident rate, record work-related diseases, and promote good practices.

Work-related hazards can be classified as:

Mechanical **Biological** **Chemical** **Ergonomic** **Psychosocial**

However, in recent years, transmission of pathogens through blood emerged as an important work-related hazard for healthcare workers. Information on these transmissions has been obtained from a variety of sources, including individual case reports, surveillance programs, and various epidemiologic studies, although these adverse events are not faithfully reported, either because of lack of time, for fear of being judged by superiors, or for presumption of negative source.

Accidental puncture due to biological exposure of healthcare workers represents an incredibly significant impact for the healthcare workers involved and their families, and for the organizations that employ them.



It is a preventable, measurable, and controllable event, based on actions designed and controlled in such a way as to ensure that the process is sustainable over time, such as the implementation of biosafety devices, continuous training and the evaluation and mitigation of hazards associated with the healthcare activity.

Penetrating needlestick injuries to the skin are the most frequent source of biological exposure and the main reason for blood-borne infections in healthcare workers, with the most frequent causes being two-handed recapping and improper collection and disposal of sharps waste[4].

Most infections have resulted from injuries caused by blood-filled hollow needles. Less frequently, workers have been infected with solid sharps, such as suture needles or scalpels, and by exposure to splashes of blood or body fluids[4].

Hazards assessment in the clinical laboratory[5]

It is important to study the work environment by describing the processes and operations to identify activities and places with critical exposure potentials, gathering the necessary information to establish the diagnosis of the safety and health situation in the work laboratory. In this way, the Laboratory Management can draw up the risk map, which is a graphic representation of the set of factors present in the workplace that can harm the health of workers, such as accidents and work-related diseases.

The following list shows hazards in laboratories:

Biological: bacteria, fungi, protozoa, viruses, parasites. These are microorganisms with infectious potential for humans, animals, and plants in the environment, and also include nonreplicating recombinant vectors capable of delivering and expressing recombinant gene products that can cause health hazards, injuries or diseases to humans.

Chemicals: substances, compounds or products that can enter the body through the respiratory tract in the form of dust, fumes, smoke, mist, fog, gas, or steam. Or which, by the nature of the exposure activity, may have contact with or be absorbed into the body through the skin or by ingestion.

Physical: noise, vibrations, abnormal pressures, extreme temperatures, ionizing radiation, non-ionizing radiation, levels of lighting and humidity.

Ergonomic: any factor that may interfere with the psychophysiological characteristics of the worker, causing discomfort or affecting his health, such as heavy lifting, excessive work rhythm, monotony, repetitiveness, heavy physical work; incorrect postures; uncomfortable positions; working in shifts and night shifts, working hours.

Accident: any factor that places the worker in a vulnerable situation and may affect his or her integrity and physical and psychological well-being, such as accidents without the use of protective equipment, probability of fire and explosion, inadequate physical layout, improper storage of products.

In this context, the WHO and various international organizations around the world have promulgated general measures to promote a work environment that minimizes the hazard of this and other risks:[6]

- Define and periodically maintain a plan for monitoring and controlling exposure to the hazard, established according to the role of each worker and his or her degree of exposure.
- Implement universal precautions, therefore all biological samples are presumed to be potentially infectious, to reduce the risk of transmission of blood-borne pathogens and other types of pathogens from both known and/or unknown sources.
- Identify technologies and process engineering that isolate or eradicate the risk of exposure.
- Provide, at no cost to the worker, adequate and sufficient personal protective equipment, and make it available through adequate training in its use and maintenance.
- Implement a program of vaccination and surveillance of immunoprotection status for relevant communicable diseases.
- Offer clinical and laboratory management by qualified health professionals in the case of exposure, at no cost to the worker, ensuring treatment, follow-up, and surveillance.
- For the proper handling of risk source substances, label equipment, conservation elements, storage, transportation, disposal, processing and other processes with warning notices and explanation of the risk.
- Train workers conveniently when starting work and periodically on the type of risk to which they are exposed, maintaining their knowledge on how to minimize it, how to use the technologies implemented in risk control, and how to proceed in case of exposure.

In this area, it is widely recognized that the incidence of injuries associated with clinical laboratory work occurs mainly in the pre-analytical phase, with sharps.

In practical experience, the reader is witness to the persistence of high-risk behaviors in some laboratories and despite the existence of comprehensive guidelines, standards, procedures and programs, nothing is achieved without the participation of the worker as part of the work-related safety culture.

Discipline and training of staff are essential components within this culture to avoid accidents in the laboratory. Improving standardization of phlebotomy techniques and making biosafe devices available to the healthcare worker, along with dissemination of operational guidelines, continuing education, certification or accreditation of standards, and training of healthcare workers decrease the possibility of accidents while increasing the likelihood of consistently obtaining samples of adequate quality for analysis. Besides, it is important to report accidents, even when minor injuries occur, which are ignored by healthcare workers because they are unaware that such recording supports their safety and contributes to the analysis of scientific research[1].

This article presented in a reprint of pre-analytical notes entitled “Safety-related aspects of healthcare workers associated with blood sampling” discusses the risks and infectious agents involved in healthcare worker activities and presents several devices that offer the opportunity to mitigate exposure risks associated with blood sampling. With this knowledge, it is intended to encourage its adoption for use in clinical laboratories and blood sampling areas in hospital settings.

A successful blood sampling procedure can be defined as one in which the sample is taken with:

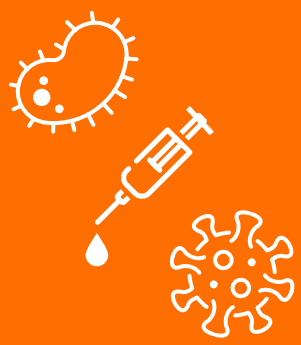
- Minimal risk of exposure to infectious agents to healthcare workers;
- Minimal risk to the patient;
- Absence of pre-analytical errors.

In this article we will examine common sources of risk in percutaneous hollow needle injuries (sharps accidents) associated with blood or other body fluid sampling procedures.

The pandemic that the world is currently experiencing has focused on the arduous task of exposure to pathogens that healthcare workers face in their daily tasks, and the use of personal protective equipment has been a great ally in this situation. However, healthcare workers sometimes show a certain degree of indifference when it comes to handling sharps. This problem is especially true with the collection of blood and other body fluids - particularly when the collection is performed in a busy clinical unit by someone who does not take-out blood as his or her primary task.

Even when healthcare workers are exclusively engaged in biological sampling, blood collection occurs in remarkably diverse situations: in the outpatient setting in a freestanding clinical laboratory, in an emergency medical center situation, in a chronic inpatient setting, in an operating room, or in an intensive care unit.

Each setting has a different mix of exposure factors, but the outcome is always the same: preventable exposure to a blood-borne infectious agent.



Transmission of infectious agents through accidental puncture with sharps represents a fundamental problem, being blood sampling a major cause of these injuries. Currently, there are a wide variety of known pathogens that can be transmitted by sharps. Among these, Hepatitis B Virus (HBV), Hepatitis C Virus (HCV) and Human Immunodeficiency Virus (HIV) represent the greatest risks[7].

Whether or not exposure to infectious agents results in seroconversion, the development of the disease depends on:

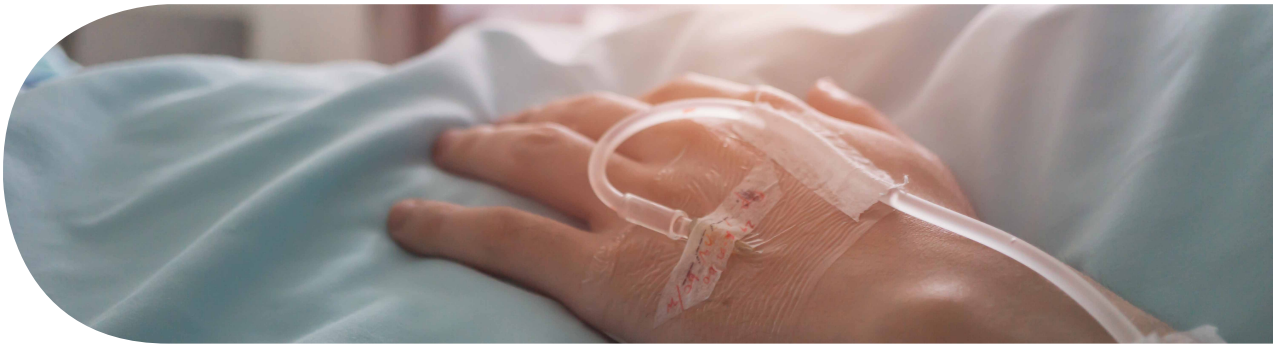
- Type of exposure - by mucosae or skin (percutaneous)
- Volume of blood transferred
- Extent of the wound - superficial or deep (defined as > 2 mm, sufficient to cause bleeding)
- Type of device - hollow needle or sharp solid device
- Type of virus
- Viral load in patient's peripheral blood

To modify attitudes of indifference and implement consistent blood collection practices that reduce risks, it is necessary to understand where and when sharps accidents are most likely to occur.

A study by the Center for Disease Control (CDC) in the United States showed that 61% of percutaneous accidents occur seconds after the removal of the needle from the vein or intravenous line[8].

Although best practices should be applied to the entire sampling collection procedure, it is clear that this is an area of emphasis.

There is compelling evidence that biosecure devices significantly reduce these types of injuries. In addition to this, continuous training of healthcare staff and control of work practices can effectively contribute to reduce adverse sharps events and mitigate the incidence of accidents for the one performing the venipuncture and for the one in charge of final disposal of waste.



When choosing the biosafety device to be implemented in the organization, it is recommended to evaluate:

1. The activation of the device using a single-handed technique.
2. The security feature should not interfere with the normal use of the device.
3. The security feature must be required for the use of this device.
4. The device shall not require more time for use than a non-biosecure device.
5. The safety feature shall function adequately with a wide variety of hand sizes.
6. The use of this device should not increase the number of times the patient must be punctured.
7. Activation of the safety feature shall produce a clear and unmistakable change in the device (audible and/or visible).
8. The safety feature must perform dependably.
9. The exposed cutting edge must be dulled or covered after use and before disposal.
10. The device should not require extensive training to operate properly.

There are different types of situations in which sample quality and work-related safety risks to healthcare workers are promoted that are unnecessary and entirely preventable with the use of commercially available devices worldwide. These situations can be mitigated in a simple and cost-effective manner simply by using a closed vacuum system, reducing the likelihood of exposure of healthcare workers. Additionally, if we consider the risk determinant factors associated with sharps injuries, the probability of seroconversion (new appearance of a positive serological marker for an infectious agent) may be lower with a closed system (multiple needles with adapter) than when using a hypodermic needle and syringe.

On the other hand, multiple needles that provide the additional advantage of visualization and "flashback" of the sampling can be of significant help to improve the sampling technique with the vacuum system (Figure 1). When the decision is made to collect a blood sample using a syringe and needle (open collection), consideration should be given to the use of devices that facilitate the transfer of the sample from the syringe to the vacuum tube (Figure 2).

Figure 1

BD Vacutainer® multiple needle Flashback. Offers better acceptance for closed system implementation

BD transfer device

Figure 2: Other devices "designed for protection" include multiple extraction needles and protective winged collection systems that cover the needle.

BD Vacutainer® Eclipse™ needle

BD Vacutainer® Safety-Lok® Winged System

BD Vacutainer® Push Button Winged System (vein needle retraction)

Additional benefits to biosafety have been proven with the use of the aforementioned biosafety devices, such as improved sample quality due to reduced hemolysis; the correct additive blood ratio - essential in the area of hemostasis - and the reduction of insufficient sample rates.

In relation to the disposal of sharps, the highest rate of events occurs after sample collection and prior to disposal. To minimize exposure to the risk of an adverse event, appropriate containers should be used according to the type of item to be discarded and located close and accessible to the physical space where the puncture is performed. It is recommended that they are fixed to a surface (countertop, wall) and that their level is periodically checked to ensure that they do not exceed three quarters of their capacity.

Adoption of a quality culture

The introduction of "designed for protection" devices should be complemented with appropriate educational programs. These should be designed not only to teach best practices but also to change attitudes by providing healthcare professionals with knowledge of the risks they face. In addition to the obvious lower cost of avoiding preventable claims, the presence of a safety program and culture represents cost reductions for the clinical laboratory, for those that are independent or are associated with a medical center.

It is responsibility of those in charge for the welfare and safety of healthcare workers to take initiative-taking positions aimed at preventing work-related accidents and work-related diseases.

Moreover, in any organization that identifies this type of risk, strategies should be adopted for sensitization of healthcare workers, educate them on an ongoing basis, and promote a culture of safety that protects the common interests of hospitals, clinical laboratories and their human resources exposed to the risk of accidental needlesticks with the risk of acquiring blood-borne agents or other transmissible thought another body fluid.

The measures outlined above are affordable, cost-effective, available worldwide, and consistent with each organization's contemporary notion of social responsibility.

Concept and application of behavioral observations in the clinical laboratory

Behavioral observation is a tool designed to help promote safe work practices and discourage hazardous attitudes. This approach results in:

- Increased leadership's commitment to safety and improving their perception of laboratory risks;;
- Staff's valorization of safety;
- Surveillance of the laboratory staff behavior;
- Adequacy of behavior of the staff to the work instructions;
- Reviewing processes and reducing risks to staff.

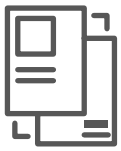
In order to prevent laboratory staff from suffer an injury, it is recommended to act on the triggers, improving the perception of danger and reinforcing values and beliefs, to avoid triggers that can generate undesirable behaviors.

This, should be implemented associated to the observation of staff behaviors, valuing positive attitudes, and helping to develop their perception to eliminate negative behaviors.

Steps of behavioral observation

- **Approach:** It is the first contact of the observer with the observed. It is critical that the member is aware that the observer is making his or her assessment. The observer presents the objectives of this routine and explains the process to the employee, demonstrating credibility, clarity and ensuring a relationship of trust.

- **Observation:** This is the evaluation of the members behavior, with the analysis of his/her behavior during the performance of activities in the clinical laboratory. Observations are focused and accurate, followed by individual or group feedback. The observer records evidence according to the reality of the laboratory (on paper or electronic media). The report lists critical behaviors to be observed.



- **Data collection:** Data are obtained through the various observation processes, and facts are reported. Risk behaviors and barriers are identified, reported, analyzed and, to the extent possible, resolved on the spot, with the presentation of the problem and with the agreement of the employee and his or her supervisor.

- **Feedback:** The observer has the opportunity to connect emotionally with the employee, asking questions and discovering beliefs and values related to the difficulties and resistances observed.

- **Results:** Based on the feedback, the observer obtains the employee's commitment to change the behavior and reports the agreed action on the form. Problems identified in the process that could not be corrected at the time are registered by the observer and reported to the sector leader to be addressed managerially and to the work-related safety professionals for corrective actions to be surveillance. The results of the behavioral observations are transformed into management indicators, with pre-established goals.

Reality cases

Reality case	Corrective action
Case 1: During puncture, patient suffers a lipotimia and his body falls on his arm, causing the needle to come out of the vein. Phlebotomist punctures his hand with the needle exposed, attempting to lift the patient's body.	It was protocolized that for those patients who have previous lipotimia or are observed to be anxious when entering the sampling room, care should be performed lying down on a stretcher and the patient should be observed until he recovers and then discharged.
Case 2: At the end of the care of a pediatric patient, the phlebotomist removes the winged needle, due to a lack of coordination of movements between the performer and the assistant, causing the accidental puncture of the assistant. This situation occurred on several occasions.	These situations motivated us to change the normal winged needles for those with the bio-secure device (push button).
Case 3: In Chile, in the past, cardboard boxes were used to dispose of the short-sharp elements. This meant that needles protruded from the boxes and on several occasions staff were sticked.	With the incorporation of the Waste from Healthcare Facilities (REAS, acronym in Spanish) regulation, the institution was forced to purchase hard plastic boxes, which eradicated this problem.

Written and reviewed by:
Dra. Carolina Trunzo, Argentina, Dr. Carlos Vega Salinas, Chile y Dr. Nairo Massakazu Sumita, Brasil.

References

1. SANTOS LT, ROCHA FLR, MARZIALE MHP. Needlesticks with safety devices and accident prevention: an integrative review. Rev Bras Enferm 2018; 71(6):3084-92. [Accessed: February 20th, 2022]. Available at: http://dx.doi.org/10.1590‰0034-7167-2017-0719

2. INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO). ISO 45001:2018 Occupational health and safety management.

3. INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO). ISO 15189:2012 Medical laboratories — Requirements for quality and competence.

4. GABRIEL J. Reducing needlestick and sharps injuries among healthcare workers. Nurs Stand 2009; 23(22):41-4. [Accessed: February 20th, 2022]. Available at: http://dx.doi.org/10.7748/ns2009.02.23.22.41.c6777

5. MENDES ME, TURIBIO LO, BADARÓ MLS, HOJDA RG, LIMA RC, SUMITA NM. Prácticas seguras en el laboratorio clínico. In: Sumita NM, Andriolo A, Ferreira CES, Campana GA, Oliveira GF, Brazão FV, Vasconcellos LS, Pulchinelli Junior A, Lopes ACW, Shcolnik W, Mendes ME (Organizadores). Recomendaciones de la Sociedade Brasileira de Patologia Clínica/Medicina Laboratorial (SBPC/ML): Buenas Prácticas en Laboratorio Clínico. São Paulo: Manole; 2021. p. 47-59. [Accessed: February 20th, 2022]. Available at: http://www.bibliotecasbpc.org.br

6. OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA). OSHA's Bloodborne Pathogens Standard. 2011. [Consultado: 20 de febrero de 2022]. Disponible en: https://www.osha.gov/sites/default/files/publications/bbfact01.pdf

7. JAGGER J, DE CARLI G, PERRY J, PURO V, IPPOLITO G. Chapter 31. Occupational exposure to bloodborne pathogens: epidemiology and prevention. In: WENZEL RP. Prevention and Control of Nosocomial Infections. 4th ed. Baltimore, Md: Lippincott, Williams & Wilkins; 2003.

8. CENTERS FOR DISEASE CONTRO L AND PREVENTION . Updated U.S. Public Health Service. Guidelines for the management of occupational exposures to HBV, HCV, and HIV and recommendations for post exposure prophylaxis. MMWR, Atlanta, v. 50, n. RR 11, 2001. [Accessed: February 20th, 2022]. Available at: http://www.cdc.gov/mmwr/PDF/RR /RR 5011.pdf

LASC
Latin America Preanalytical Scientific Committee

BD