

***La bioseguridad insertada en el primer año de la carrera de
Medicina
The biosafety inserted in the first year of first year of the medical
degree program***

Dalila Chacón-Bonet; Luis Aníbal Alonso-Betancourt; Cándida Rosa Duran-González

Facultad de Ciencias Médicas, Universidad de Holguín, Cuba

Correo (s) electrónico (s)

dalilahlg@infomed.sld.cu

lalonso@uho.edu.cu

candida@infomed.sld.cu

ORCID: <https://orcid.org/0000-0002-4634-7195>

<http://orcid.org/0000-0003-0989-746X>

<https://orcid.org/0009-0008-6714-9025>

Recibido: 4 de agosto de 2023

Aceptado: 1 de noviembre de 2023

Resumen

El presente artículo propone la implementación de la bioseguridad en el primer año de la carrera de Medicina. A partir de la emergencia y reemergencia de enfermedades infecciosas, la formación profesional de las ciencias médicas se enfrenta a nuevos desafíos; para controlarlas es necesario la correcta implementación y cumplimiento de protocolos de bioseguridad. Se realizó una investigación de desarrollo, cuyo universo estuvo constituido por los estudiantes del primer año de la carrera de Medicina en el curso 2022. El curso propio explica cuatro unidades temáticas que abarcan sistemas de conocimientos y habilidades, a través de conferencias, y trabajos independientes vinculando la teoría con la práctica. Se logra familiarizar al estudiante de primer año de medicina con la Bioseguridad, lo cual permitirá el desarrollo de competencias profesionales que respondan a las necesidades de la salud.

Palabras clave: Accidentes biológicos; Seguridad biológica; Bioseguridad; Enfermedades infecciosas.

Abstract

This article proposes the implementation of biosafety in the first year of medical school. Since the emergence and reemergence of infectious diseases, the professional training of medical sciences faces new challenges; to control them it is necessary the correct implementation and compliance with biosafety protocols. A developmental research was carried out, whose universe was constituted by the first year students of the Medicine career in the course 2022. The course itself explains four thematic units that

cover knowledge and skills systems, through lectures and independent work linking theory with practice. It familiarizes the first year medical student with biosafety, which will allow the development of professional competencies that respond to health needs.

Keywords: Biological accidents; Biological Safety; Biosafety; Infectious diseases.

Introduction

With the emergence and re-emergence of infectious diseases, professional training in the medical sciences is facing new challenges; the SARS-CoV-2 virus and the disease it causes, COVID-19, has become one of the great enemies of mankind and has cost the lives of more than 6 million people, demonstrating that the main weapon to control the virus, so far, consists of the correct implementation and compliance with biosafety protocols, according to data from (Cobos, 2021).

According to the World Health Organization (WHO, 2005), "biosafety is a strategic and integrated approach to analyzing and managing risks relevant to human, animal and plant life and health and associated risks to the environment" (p.12). A better understanding of biosafety perceptions, attitudes, and knowledge facilitates the mastery of safe practices and techniques that minimize risk exposure.

For the purposes of this research, we will work with the concept stated in the National Biosafety Program for health institutions (Dotres et al., 2001), who define biosafety as:

A set of scientific-organizational measures, including human and technical-engineering measures, including physical measures, aimed at protecting the worker of the facility, the community and the environment from the risks involved in working with biological agents or the release of organisms into the environment, whether they are genetically modified or exotic, to minimize the effects that may occur and quickly eliminate their possible consequences in case of contamination, adverse effects, escapes or losses. (p. 28).

In correspondence with the above, the Ministry of Public Health of the Republic of Cuba, (Dotres et al., 2001), approves the National Program of Biological Safety for health institutions, where it states that the Vice-Minister in charge of Teaching and Research will be responsible for the training on Biological Safety that medical students exposed to risk should receive.

A review of the foreign scientific literature has made it possible to identify that there are differences in the teaching of this subject:

In Dominican Republic, according to (Butler, et al., 2022), to enter the Clinical Medical Sciences cycle, it is mandatory to attend the workshop Management of Biological Risk Accidents. In case of obtaining an unsatisfactory grade in the post-workshop evaluation, the student must be re-evaluated, otherwise, he/she will not be promoted to the next cycle.

In Argentina, studies carried out in nine universities show that the insufficient approach to biosafety at the undergraduate level in biomedical disciplines could contribute to explain the high number of biological accidents recorded, which reveals the importance of training future professionals in biosafety behavior in terms of the quality of their professional performance and health services (Ferrarotti and Jarne, 2021).

In Colombia, (Díaz, 2021), works on Biosafety training in first year medical students through infographics as a didactic strategy.

In Spain, the Autonomous University of Barcelona UAB (2022), Biosafety training for medical students is facilitated and required both at the time of joining the organization (initial) and on an ongoing basis, in order to ensure constant improvements in individual capabilities.

In spite of recognizing the value of these proposals, when delving deeper into the reality studied, insufficient projection of biosafety from an integral approach that facilitates its insertion from the first year of the career during on-the-job education is identified.

In this sense, from the formative intentionality, the author conducts a historical-logical study on the presence of Biosafety as a discipline in the Study Plan of the Medicine career (MINSAP, 2019), at the University of Medical Sciences of Holguin, finding that the content of this discipline is limited.

In the subject of introduction to General Comprehensive Medicine, which is taught from the first year of the career, has among the main skills to develop, the invasive nursing procedures, where the biological risk is present, lacking students of this important knowledge for protection against exposure to biological agents. In addition, this study plan establishes on-the-job education as the fundamental principle of medical education; however, the content of biosafety is limited, and biosafety training is not based on the theory of didactics of medical education that cuts across the five years of the medical career. This makes it urgent to develop adequate competencies in students from the beginning of their career, in order to train professionals committed to the protection of their own health.

Therefore, the contradiction between what is stated in the National Biosafety Program and the presence of the Biosafety content in the current study plan of the medical career is evident.

The need and justification for this research to propose strategies to achieve a better management of biosafety in the medical career is based on the high mortality rates currently reported by infectious diseases worldwide. Studies estimate that 300 000 workers die worldwide each year from exposure to infectious diseases caused by biological agents, (Cobos, 2021).

That is why the World Health Organization (WHO, 2005) highlights the importance of biosafety in the control of infectious diseases, which was reaffirmed with the outbreak of the Ebola virus in 2015 and

with the pandemic initiated in 2019 by SARS-CoV-2, where this Discipline has played a fundamental role in the control of these infectious agents.

Based on these considerations, it is proposed for the first year of the Medicine career at the University of Medical Sciences of Holguín, to implement a course of its own with the basic elements on Biosafety, which should be integrated in such a way that there is an early familiarization of the student with Biological Safety, which throughout the career can be perfected until achieving the development of professional competences that respond to the health needs inside and outside the country.

Development

The interest in Biosafety training has been increasing over time due to the appearance of COVID-19, and other emerging and re-emerging infectious diseases, and microbial resistance; elements that necessarily imply a redesign of the curriculum so that future graduates of the Medicine career have from their basic cycle, the basic knowledge to be able to apply them from the different scenarios of their training, guaranteeing quality in services and improvement in the health status of the population.

Biosafety as a discipline deserves special attention, especially for medical students, who are in training and linked to medical guards, nursing processes, assistantships and research activities; they are a population vulnerable to biological accidents, due to their continuous exposure to blood and other body fluids, in order to develop new skills and abilities.

Systematizing several sources, among which stand out (Bell et al., 2020; Román, 2020; Terrado et al., 2020; and Verdecia et al., 2021), it is considered that violating Biosafety standards constitutes a threat to the health of students, professionals, patients, family members and the environment.

Based on the evaluations of the results provided by (Bello, Bustamante and Pizarro, 2020; Cobos, 2021; Dotres et al, 2001; WHO, 2005; World Health Organization, 2019, among others), it is considered that the knowledge of Biosafety corresponds to an academic and formative aspect in the student, it is of utmost importance for its application in the future health care work; however, it has been found that despite the existence of a national program for the management of this discipline, there are still insufficiencies in the training in biosafety for the Medical career.

According to Alvarez, (2017): "It is now or never, the time to undertake all the actions that are necessary to continue the rescue of the role of epidemiology in services, teaching and research in Cuba" (p. 6).

Sample and methodology

A developmental research was carried out for the Medicine career at the University Of Medical Sciences Of Holguín, in the 2022 course, with the objective of implementing a course on the basic elements of Biosafety. The universe was constituted by all the students of the first year of the Medicine career. The

research has as object the training process of the basic cycle of the career and defines, as a field, the training process in Biosafety for the basic cycle of the Medicine career.

In the development of the research, different theoretical methods were used: historical-logical, for the study of the subject; analytical-synthetic, for the analysis of the different bibliographies reviewed; inductive-deductive, for the evaluation of the literature reviewed and the modeling in the design of the program for a course of five topics related to biosafety contents. Observation was used as the empirical method. The results of the research can be applied in the elective courses of the second, third, fourth and fifth years of the Medicine career, given the emerging situation with the pandemic caused by COVID-19 that demands that the future professionals of the Medicine career acquire the necessary knowledge for its confrontation; also taking into account that it is a limited subject in all the years of study of the Medicine career in the University of Medical Sciences of Holguin.

Results:

A didactic program was elaborated with an integral approach: academic, research, labor and extensionist. The methodological orientations are detailed in a general way, in the modality of face-to-face classes that can also be adapted to semi-face-to-face classes; as a form of teaching organization, it consists of four lectures whose contents will be applied to education at work. Below is the time background according to forms of teaching organization, adjusted to Study Plan E, as shown in Table 1.

Table 1 Thematic plan and time fund for the course.

Según programa		Según P-1		
No.	Tema	C	ET	Total
1	Bioseguridad. El proceso salud- enfermedad	1	4	5
2	Precauciones universales .Su repercusión sobre la salud	1	12	13
3	Accidentes e Incidentes biológicos que afectan la salud	1	12	13
4	Desechos hospitalarios y su control en el medio ambiente	1	12	13
Total		4	40	44

Source: Own elaboration

Legend: (C: Lecture) (ET: Education at work)

Topic I: Biosafety. The health-disease process

Objective: To identify the relationship between biosafety and the health-disease process, using basic and complementary bibliography.

System of contents: Knowledge: Emergence of biosafety in Cuba and the world. Concept of Biosafety, Biological Risk, Biocontainment, Bioprotection. Structure and Organization of Biosafety in Cuba. Regulatory Framework. Laws, Resolutions and decrees. Application of biosafety in social life. Its relation with the health-disease process.

Topic II Universal precautions. Their impact on health

Objective: To define universal biosafety precautions in terms of occupational, community and environmental health.

Content System. Knowledge: Universal Biosafety Precautions: Hand washing. Types. Use of personal protective equipment: gloves, mask, goggles, cap. Types. Biological Safety Chamber or Cabinet. Immunizations

Topic III Biological accidents and incidents affecting health

Objective: To recognize standard precautions before blood exposure accidents, linking them to real or simulated situations.

Content System. Knowledge: Blood exposure accident (in the care of patients with HIV/AIDS, HBV and HCV). Reporting and notification of the biological accident according to established protocol. Follow-up and treatment after occupational exposure.

Topic IV Hospital waste

Objective: To identify the management of hospital waste, according to the established norms.

System of contents. Knowledge: Hospital waste. Classification. Standards for storage, transportation, handling and final destination of hospital waste.

The following actions are proposed:

- Carry out methodological preparation in the first year collective of the Medicine career where the topics are presented (achieve interdisciplinarity).
- Present the didactic program in digital (Power Point) and printed format.
- Promote and demand the improvement of the teachers who teach the course.
- Stimulate student research on the topic in relation to the current epidemiological situation.
- The National Biosafety Program, the Biosafety Inspection Manual and articles published mainly in Infomed and journals such as BMJ, Lancet, Science, among others, will be recommended as basic bibliography.

All the proposed topics have independent work, which will be developed through exercises where theory and practice are linked so that the student obtains and develops skills that will be perfected throughout the career in the different scenarios of education at work.

Discussion

The interest in Biosafety training has been increasing over time due to the appearance of COVID-19, and other emerging and re-emerging infectious diseases, and microbial resistance, elements that necessarily imply a redesign of the curriculum so that future graduates of the Medicine career have from their basic cycle, the basic knowledge to be able to apply them from the different scenarios of their training, ensuring quality services and improvement in the health status of the population.

The course suggests four thematic units that address different systems of knowledge and skills, is developed through lectures whose contents link theory with practice in Education at Work for a total of 44 hours.

In the first session of the course, students will be asked to draw up a list of expectations regarding the course in which they have enrolled, so that at the end of the course they can compare their achievements and know the degree of satisfaction obtained.

Likewise, the schedule and the different scenarios to develop the lectures, education at work, bibliographies and evaluation of the course will be communicated; answers will be given to other aspects that could be of interest.

For Theme I, one hour of lecture and three hours of on-the-job education are proposed on the generalities of biosafety, whose objective is to protect people, society and the environment, creating and maintaining

Vol.9, No.23, enero-marzo, año 2024

in the facilities an effective defense against biological hazards. We will work in terms related to its conceptualization, taking care to maintain in these definitions, the essentially preventive and protective character, emphasizing that it is a crucial issue for future health professionals in the proper management and control of any infectious disease.

Two independent works will be oriented; one that deals with general knowledge of Biosafety, and the other that will serve as an example of measures to control compliance with the norms established in the country, in which they should inquire about the fines and measures established by Decree No. 14/ 2020 in view of the complex epidemiological hygienic situation due to the effect of Covid-19. The discussion of this work will lead to the second topic related to the universal precautions of Biosafety.

The second topic proposed, with one hour of lecture and four hours of on-the-job education, is related to universal biosafety precautions. The lecture will provide the theoretical elements to be developed in medical practice.

Universality, as a first principle, implies considering that any person can be infected. It also considers all body fluids as potentially contaminating.

The measures must involve all patients in all services, regardless of whether or not they know their serology. All personnel should routinely follow standard precautions to prevent exposure of skin and mucous membranes in all situations that may give rise to accidents, whether or not contact with blood or other body fluids of patients is foreseen. These precautions should be applied to all persons without exception or distinction.

The fluids considered as potentially infectious are: blood, semen, vaginal secretion, breast milk, cerebrospinal fluid, synovial fluid, pleural fluid, amniotic fluid, peritoneal fluid, pericardial fluid, any other fluid contaminated with blood.

The use of barriers as a second principle includes the concept of avoiding direct exposure to blood and other potentially contaminating organic fluids through the use of appropriate materials that interpose themselves in contact with them (personal and collective protection equipment). The use of personal protective equipment (PPE), specific according to the route of transmission of the disease, as well as hand washing will be discussed in depth, where the observation will be made that hand washing and the use of barrier techniques does not depend on the patient's diagnosis but on the intrinsic risk of the

procedure to be carried out with the patient. Proper hand hygiene at the right time and in the right way can make the difference between saving a life or not.

Immunization, sterilization of instruments, disinfection and cleaning of equipment and surfaces will be described as other barriers.

Topic III, accidents and biological incidents, begins with the discussion of the independent work of the previous class; this topic is of importance, especially for personnel who are in training where the insecurity in the processes increases the risk of contracting and spreading diseases.

This will be the ideal moment for the student to know that the national program of Biological Safety (Biosafety) in Cuba, establishes that the notification of events (exposure, accident or breakdown), occurred in workers exposed to microorganisms of biological risk, and that put at risk the health of the personnel of the institution, should be communicated immediately or within 24 hours to the immediate boss and the person responsible for the Biological Safety of the institution. Depending on the magnitude and seriousness of the problem, after analysis with the institution's management, it will be communicated to the corresponding higher level.

It will be emphasized that any accidental exposure with biological material must be attended by the doctor and nurse of the institution for dispensation, filling out a survey, investigation, follow-up and treatment as appropriate in each case. In addition, the cause should be investigated by the Occupational Health and Safety technician. The survey will be applied to every case of biological accident or occupational disease.

The independent work of this topic will consist of the review of a health service on the existence and use of the registry of notifications of biological accidents as established in the National Biosafety Program.

In the last topic, related to hospital waste, the concepts related to hazardous waste, its organization, transfer, storage and disposal will be addressed, since they constitute necessary knowledge for the intervention on waste generated in medical practice. The focus will be on sharps waste, which, although it corresponds to 1% of hospital waste, is the most dangerous.

Poor management of hospital waste increases the worker's risk of contracting diseases and can also facilitate the transmission of healthcare-associated infections (HAI), causing an increase in the number of days of hospitalization, treatment costs and in-hospital mortality.

As an independent work, it will be oriented to check in any health institution on-call department whether the disposal of sharps waste complies with the regulations of the National Biological Safety Program.

The evaluation system will consist of two evaluations, the formative one consisting of the evaluation of independent work, which will be checked orally and will be collected in digital format, and the educational aspects (attendance, punctuality, behavior and personal appearance).

The results of this research can be applied in all years of the medical career, given the emerging situation with the pandemic caused by COVID-19, which demands that future professionals of the medical career acquire the necessary knowledge for its confrontation; bearing in mind that it is a limited subject in all the years of study of the medical career, it can be extended to all the University of Medical Sciences of the country.

Conclusions

The proposal allows training oriented to professional competences since the first year of the medical career and which have to be incorporated to their natural way of professional performance. It facilitates a more effective education for the application of Biosafety norms in their future health care work, contributing to reduce the spread of diseases. It favors the approach of the future physician to his professional field from the beginning of his training with attitudes and knowledge about Biosafety.

Referencias bibliográficas

- Álvarez, R. (2017). Plan de estudio de medicina: ¿nueva generación? *Revista Habanera de Ciencias Médicas* 16(5). http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S1729-519X2017000500001
- Bell, J. I., Moya, Y., George, W. y George, M. G. (2020). Modelo de formación integradora en COVID 19 en la complejidad emergente del contexto. *Revista Electrónica para Maestros y Profesores: Maestro y Sociedad* (Número Especial 1). <https://maestroysociedad.uo.edu.cu/index.php/MyS/article/view/5189>.
- Bello, O., Bustamante, A., Pizarro, P. (2020). *Planificación para la reducción del riesgo de desastres en el marco de la Agenda 2030 para el Desarrollo Sostenible*. Comisión Económica para América Latina y el Caribe. https://www.cepal.org/sites/default/files/publication/files/46001/S2000453_es.pdf.
- Butler, M., Payano, R., Calderón, K., Mosquera, S. y Pacheco, M. (2022). *Manual de Bioseguridad*. <https://medicina.pucmm.edu.do/wp-content/uploads/sites/5/2020/08/Manual-Bioseguridad.pdf>.

- Cobos, D. (2021). Bioseguridad en el contexto actual. *Revista Cubana Higiene y Epidemiología*. 58 (0). <http://www.revepidemiologia.sld.cu/index.php/hie/article/view/192>.
- Díaz, M. (2021). Aprendizaje significativo de bioseguridad a través de infografías interactivas. *Revista de Educación Médica Superior* 35 (2) <http://ems.sld.cu/index.php/ems/article/download/2736/1187>.
- Dotres, C., Sola, F., Paneque, A., García, V., Rodríguez, A., Díaz, R., et al. (2001). Programa Nacional de Seguridad Biológica para Instituciones de Salud Pública. <http://www.sld.cu/galerias/pdf/sitios/insat/progsegbiologica.pdf>.
- Ferrarotti, N. F. y Jarne A. R. (2021). La Bioseguridad ¿Una asignatura académica pendiente?, una revisión en tiempos de COVID. *Revista Argentina de Ciencia y Tecnología*. 1(7). <http://revistas.untref.edu.ar/index.php/innova/article/view/1111/919>
- Ministerio de Salud Pública (2019). *Plan de estudio "E"*. Dirección Nacional de docencia. Universidad de Ciencias Médicas de la Habana. Comisión Nacional de Carrera. <https://aulavirtual.sld.cu/pluginsile.php/229785/mod>
- Organización Mundial de la Salud (2005). *Manual de bioseguridad en el Laboratorio*. 3ed. Ginebra: https://www.who.int/topics/medical_waste/manual_bioseguridad_laboratorio.pdf
- Román, J. J. (2020). La pandemia y las personas: la clave está en el riesgo. *Revista Cubana Higiene y Epidemiología*, 57(0). <http://www.revepidemiologia.sld.cu/index.php/hie/article/view/1017>
- Terrado, S. P., Elías, Y. H., Cantalapiedra, A., Barbeito, I. (2020). Estrategia de enfrentamiento a la COVID-19 en la Universidad de Ciencias Médicas Guantánamo. *Revista de Información Científica* 99(2): http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S1028-99332020000600518.
- Universidad Autónoma de Barcelona UAB. (2022). *Formación en Bioseguridad*. <https://www.uab.cat/web/formación-en-bioseguridad-1345767064843.html>.
- Verdecia, M., Alonso, L. A., Mendoza, L. L., Leyva, P. A., Verdecia, O. (2021). Sugerencias metodológicas para la evaluación de la competencia laboral. Prevención de la COVID-19 en estudiantes de Medicina. *Revista Correo Científico Médico*, 25(1) <http://www.revcoemed.sld.cu/index.php/cocmed/article/view/3729>.
- World Health Organization. (2019). *Laboratory biosafety guidance related to the novel coronavirus (2019-nCoV). Interim guidance*. [La guía del biosafety del laboratorio guardó relación con los coronavirus nuevos (2019-nCoV). La guía interina]. <https://apps.who.int/iris/handle/10665/331138>

