

Original Article

Knowledge and practices of biosecurity measures in the students of the last year of the Nursing Career of an Ecuadorian university

Conocimientos y prácticas de las medidas de bioseguridad en los estudiantes del último año de la Carrera de Enfermería de una universidad ecuatoriana

Open Access






Citation

Toapanta S., Rueda-García D., Armas P., Borja-Cevallos L., Flores M. Knowledge and practices of biosecurity measures in the students of the last year of the Nursing Career of an Ecuadorian university. Original Article . INSPILIP. 2023; Vol. 7, Spec. Num.

Scientific magazine INSPILIP. Volume 7, Special Number November 2023

The author declares to be free of any personal or commercial association that may involve a conflict of interest in connection with the article, as well as having respected the ethical principles of research, such as having requested authorizations from the institution where the study was conducted, permission to use the data, informed consents and in the case of observational studies and clinical trials, authorization from a CEISH, ARCSA, Environment, among others, according to the category. In addition, the license to publish images of the person or persons appearing in the manuscript. Therefore, INSPILIP is not responsible for any affectation to third parties, neither INSPI as publishing entity, nor the Editor, the responsibility of the publication is of absolute responsibility of the authors.

Patricio Vega Luzuriaga
EDITOR-IN-CHIEF

-  Toapanta Iza Shirley Anabel ^a, satoapantail@uce.edu.ec
-  Rueda-García Dunia Ekatierina ^a, derueda@uce.edu.ec
-  Armas Freire Paulina Isabel ^{a,b}, piarmas@uce.edu.ec
-  Borja-Cevallos Lusi Tamara ^a, ltborja@uce.edu.ec
-  Flores Villacís Myriam Silvia ^{a,*}, msfloresv@uce.edu.ec

a. Central University of Ecuador. Faculty of Medical Sciences, Quito, Ecuador.

b. Indo-America Technological University, Faculty of Health Sciences and Human Welfare, Quito, Ecuador.

*Correspondence: Myriam Flores Villacís; Email: msfloresv@uce.edu.ec

Identification of the responsibility and contribution of the authors: The authors declare to have contributed in a similar way in the original idea (ST, DR.), design of the study (ST, DR), data collection (ST, DR, LB,PA), data analysis (ST,DR, PA, LB), writing the draft and writing the article (DR, LB,PA, MF).

Date of Entry: 17/8/2023.

Date of Approval: 31/10/2023.

Date of Publication: 27/11/2023.

Abstract

Introduction: Biosafety is currently the pillar where risk prevention converges, adopted not only by health teams, but also by the general population. **Objective:** To determine the level of knowledge and practice of biosafety measures among students in the last year of the nursing career at a public university in Quito, Ecuador. **Methodology:** A cross-sectional descriptive study was carried out, with a population of 140 students of the rotating internship of the Nursing career. Data were obtained relating the variables: knowledge of biosafety standards of rotating interns and the places where they performed their pre-professional internships, with a confidence level of 95%, considering $p < 0.05$ as significant, a previously validated and structured questionnaire was applied with 16 questions validated with a Cronbach's Alpha of 0.85, which covered the principles of biosafety. **Results:** It was evidenced that 100% of the students knew the hand washing procedure; 86% knew about the knowledge, norms, and principles of biosafety; with respect to waste management, only 76% were clear about the procedure; 54% knew how to proceed with the treatment of contaminated material. Regarding the use of personal protective equipment (PPE), 91% of the students used the surgical mask as protection in the places of practice and only 39% used the N95 respirator. The vaccination used before performing their practices it was evidenced that 100% of the participants had the COVID- 19 vaccine, followed by the Hepatitis B vaccine with 94%, the Diphtheria and Tetanus vaccine was used in 91% and 70% the influenza vaccine. **Conclusions:** It could be determined that biosafety knowledge was high in the evaluated students, on the other hand, biosafety practices, the use of personal protective equipment (PPE), depend on the complexity and level of care where the practices were performed, more emphasis should be made regarding waste management and treatment of contaminated material. In health careers, the evaluation of adherence to biosafety practices is of vital importance.

Keywords: Knowledge, Practices, Biosafety, Students, Nursing.

Resumen

Introducción: La bioseguridad es actualmente el pilar donde confluye la prevención de riesgos a la salud, adoptada no solo por los equipos médicos, sino también por la población en general. **Objetivo:** Determinar el nivel de conocimientos y prácticas de las medidas de bioseguridad en los estudiantes del último año de la Carrera de Enfermería de una universidad pública de Quito Ecuador. **Metodología:** Se realizó un estudio descriptivo transversal, cuya población fue de 140 estudiantes del internado rotativo de la carrera de Enfermería. Se obtuvieron datos relacionando las variables: Conocimiento de las normas de bioseguridad de los internos rotativos y los lugares donde realizaron sus prácticas preprofesionales, con un nivel de confianza del 95%, considerando $p < 0.05$ como significativa, se aplicó un cuestionario previamente validado y estructurado con 16 preguntas validado con un Alfa de Cronbach de 0,85, que abarcaron los principios de bioseguridad. **Resultados:** Se evidenció que un 100% de los estudiantes conocían el procedimiento de lavado de manos; en cuanto a los conocimientos, normas y principios de bioseguridad un 86 % conocían de los mismos, en cuanto al manejo de desechos solo un 76 % tenían claro el procedimiento, en relación con el tratamiento del material contaminado un 54 % sabían cómo proceder con el mismo. Con respecto al Equipo de Protección personal (EPP) el 91 % de los estudiantes usaron la mascarilla quirúrgica como protección en los lugares de práctica y solo un 39 % utilizó el respirador N95. La vacunación utilizada antes de realizar sus prácticas se evidenció que el 100 % de los participantes contaba con la vacunada de la COVID-19, seguido de la vacuna de la Hepatitis B con un 94 %, la vacuna de la Difteria y la del Tétanos fue utilizada en un 91 % y un 70 % la vacuna de la influenza. **Conclusiones:** Se pudo determinar que el conocimiento en bioseguridad fue alto en los estudiantes evaluados, por otro lado, las prácticas de bioseguridad y el uso del equipo de protección personal (EPP), dependen de la complejidad y el nivel de atención donde se realizaron las prácticas, se deberá hacer más énfasis en lo que respecta al manejo de desechos y tratamiento de material contaminado. En las carreras de salud, la evaluación de adherencia a prácticas de bioseguridad es de vital importancia.

Palabras clave: Conocimiento, Prácticas, Bioseguridad, Estudiantes, Enfermería.

Introduction

Biosafety is the basic strategy for the protection of patients, personnel of health institutions, and the environment, and takes on special relevance in the prevention of infection risks, which is directly related to the prevention and protection of all persons who are exposed and involved in the health field. It is worth mentioning that biosafety is the starting point for the reduction and elimination of biological risk factors that may affect the health or life of people, it is for this reason that such measures should be assumed and applied by

all health professionals in their different areas of work or practice, which have been declared by the World Health Organization (WHO) as: "A set of standards and measures to protect the health of personnel, against biological, chemical and physical hazards to which they are exposed in the performance of duties, of all persons involved in the healthcare environment" (1,2).

Biosafety involves very broad aspects ranging from the physical design of the facilities, the proper use of equipment and protective material, the monitoring of appropriate strategies, such as immunization of personnel working in the different health areas, as well as the proper disposal of waste or waste generated, covering a series of standards that are aimed at protecting health personnel and achieve behaviors that reduce the risk to which they may be exposed during their care activities, which is the basis of this research (3).

The inappropriate application of biosafety in patient care can have serious consequences, due to an increase in infections associated with health care, as well as to health care personnel due to occupational accidents that can cause and trigger occupational diseases, affecting the cost of care to the state and putting the lives of health care workers and patients at risk (3).

The first is universality, which urges healthcare personnel to consider that all patients and their body fluids, regardless of diagnosis, should be considered as potentially pathogenic, so that all personnel should routinely comply with standardized norms to prevent accidents and exposure to disease.

The second principle is the use of barriers, which aims to avoid direct exposure to fluids such as blood and others, for which the use of Personal Protective Equipment (PPE) and the use of vaccines for health personnel fulfills this function of biological barriers. The third statement is the adequate waste management, being together the basis for maintaining a safe practice in the different health services (4).

With respect to the COVID-19 vaccines, it was implemented within the requirement scheme for all health personnel and the community in general, due to the pandemic, it is essential for each member of the health team to comply with such requirement as a means of prevention of

acquiring COVID-19, depending on the brands, it can be 2 doses or a single dose. The first dose confers only partial protection, in such a way that the second dose is the one that increases the protection, thus the maximum level of immunity is reached between the second and third week after the second dose. (5) Although it is true that the vaccines against

COVID-19 do not prevent 100% infection with the virus, but they do reduce the risk of mortality, being effective in preventing mortality by 80-86%, thus preventing a person from presenting a serious disease caused by this virus in 85% (5,6). (5,6). These vaccines are currently considered mandatory by the Ecuadorian Ministry of Health, in addition to the Hepatitis B, Diphtheria, Tetanus, Influenza, Varicella, Meningococcus, Pneumococcus vaccines; to be able to perform the pre-professional practice within the first, second and third level of care centers in Ecuador.

Personal protective equipment (PPE) is the set of elements used by healthcare personnel to protect them from risks that threaten their safety and/or health; however, its effectiveness depends largely on its correct use, selection, maintenance, and adequate provisioning. (3).

Among the chemical barriers we find hand washing, which consists of the mechanical removal and elimination of pathogens from the skin to prevent the transmission of microorganisms from person to person (3).

Contaminated material disposal measures are defined as: the set of appropriate procedures and devices through which the materials used in patient care are deposited and disposed of without risk, being important the application of safe practices from the site of waste generation (7).

This study shows how the nursing staff, who perform their professional work by providing direct care to the users of the health system, took biosafety as a daily and efficient practice, in the different places of practice in health institutions, by providing efficient care to the different groups of the population served, taking into account all the principles of biosafety.

Methodology

Type of study: a cross-sectional descriptive study was conducted, using as primary source a previously validated survey for the measurement of the variables: Knowledge of Biosafety Measures and places of practice in 140 students of the rotating internship of the nursing career, during the academic period 2021-2022. Data were obtained based on inferential statistics with a significance level of $p < 0.05$ and a confidence level of 95%. All participants signed the informed consent form and those who did not wish to participate in the study were excluded. Knowledge of biosafety measures and practice sites was established with a survey consisting of 16 questions, validated with a Cronbach's Alpha of 0.85, and then the information was processed.

Statistical analysis: the information obtained was entered into a database of the Microsoft Excel program (Microsoft Corp.). After reviewing and verifying the information with the SPSS program (IBM Corp.) version 26, the distribution of frequencies and the analysis of crossed tables with the study variables were carried out, using descriptive statistics.

Ethical considerations: The project was approved by the Ethics and Research Committee of the Universidad Central del Ecuador.

Variables: The following qualitative variables were evaluated in this research: knowledge of biosafety standards of rotating interns, physical barriers, biological barriers, and practice sites.

Procedure: After surveying the rotating interns of the Nursing career of the Universidad Central del Ecuador enrolled in the period 2021-2022 in the seventh and eighth semester of the career, data were obtained with the predetermined instrument.

Instrument: Knowledge of biosafety measures and practice sites was established with a survey consisting of 16 questions validated with a Cronbach's Alpha of 0.85, after which the information was processed.

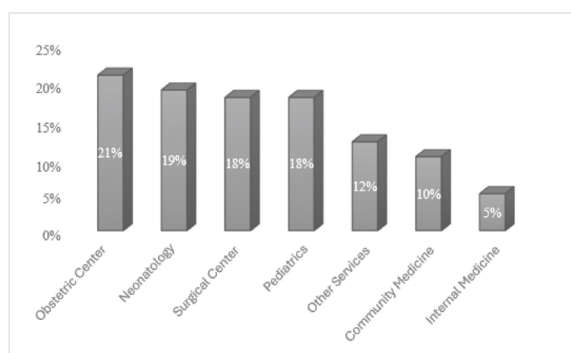
Ethical considerations: The project was approved by the Ethics and Research Committee of the Universidad Central del Ecuador.

Analysis of results: The students had an average age of 24 years; the minimum age was 20 years, and the maximum age was 51 years. Of the population, 80.7% (n=113) were female and 19.3% (n=27) were male.

From the information collected, it was found that most of the rotating interns of the Nursing Career were doing their pre-professional internships in the following services: Obstetric Center with a total of 21% (n=30), followed by Neonatology with 19% (n=26), Pediatrics with 18% (n=25), followed by Surgical Center with 18% (n=25), community medicine 10% (n=14), other services 9% (n=12), internal medicine 5% (n=8) with a 95% CI with a significance of p<0.05.

with a 95% CI, 76% (n=106) with a 95% CI, and 76% (n=106) with a 95% CI, also know about the percentage of protection of the N95 mask and its duration in 71% (n=99) with a 95% CI, finally 54% (n=76) recognize the treatment process to be followed with contaminated material, with a 95% CI with a significance of p<0.05,0,05.

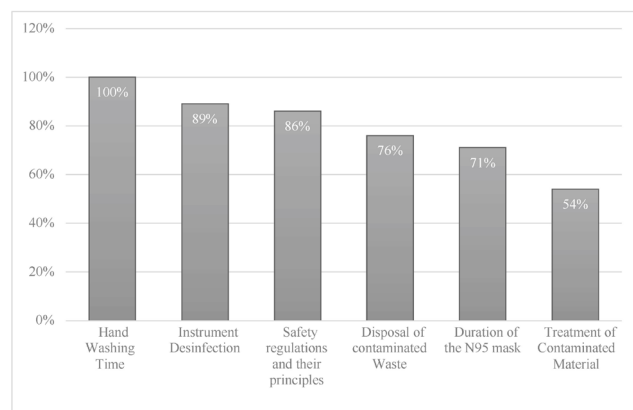
Figure N°1. Rotational Internship Rotation Services



Note: The services described correspond to the practice that the nursing students were performing at the time of the research.

Figure N 2

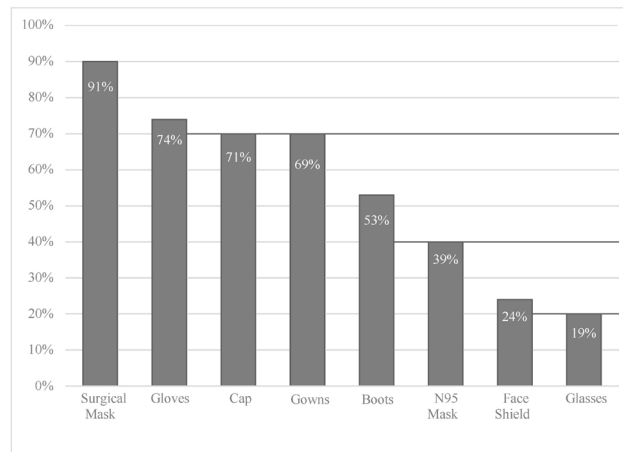
Level of knowledge of biosafety measures



Regarding the more general knowledge of biosafety, 100% (n=140) of the students in the last year of the Nursing Career know the time and procedures of hand washing, with a 95% CI, followed by the definition of disinfection of instruments in 89% (n=124) with a 95% CI, as well as the biosafety regulations and its principles in 86% (n=120)

Figure N°3

Protective equipment used by students.



It is evident that the most used personal protective equipment was the surgical mask in 91% (n=127) with a CI of 95%, followed by the cap in 77% (n=109) with a CI of 95%, gloves were used by 74% (n=104) with 95% CI, followed by gown by 69% (n=97) with 95% CI, boots by 53% (n=74) with 95% CI, followed by N95 respirator by 39% (n=55) with 95% CI; with a significance of p<0.05 in the related data.

Table 1

Relationship between practice area and use of N95 masks

		N95 Respirator		Total
		No	Yes	
Obstetric Center	Count	18	12	30
	of total	12,9%	8,6%	21,4%
Surgical Center	Count	14	13	27
	of total	10,0%	9,3%	19,3%
Emergency	Count	3	1	4
	of total	2,1%	0,7%	2,9%
Clinical Hospitalization	Count	2	1	3
	of total	1,4%	0,7%	2,1%
Community Medicine	Count	9	4	13
	of total	6,4%	2,9%	9,3%
Practice area in which you are located.	Count	1	4	5
	of total	0,7%	2,9%	3,6%
Internal Medicine	Count	16	10	26
	of total	11,4%	7,1%	18,6%
Neonatology	Count	6	1	7
	of total	4,3%	0,7%	5,0%
Others	Count	15	10	25
	of total	10,7%	7,1%	17,9%
Pediatrics	Count	84	56	140
	of total	60,0%	40,0%	100,0%

When analyzing the relationship between the area of practice and the use of the N95 mask, the following results were obtained: in the Surgical Center it was used in 9.3% (n=13) with a 95% CI, followed by the Obstetric Center in 8.6% (n=12) with a 95% CI, in the Neonatology and Pediatrics services it was used in 7% (n=10) with a 95% CI.

It is evident that the most used personal protective equipment was the surgical mask in 91% (n=127) with 95% CI, followed by the cap in 77% (n=108) with 95% CI, gloves in 74% (n=104) with 95% CI, followed by the gown with 69% (n=97) with 95% CI, and finally the use of boots 53% (n=74) with 95% CI; with a significance of $p < 0.05$ in the related data.

Table 2
Qualitative level of biosafety knowledge and use of full PPE

		Count	Full PPE (6 to 8 items of PPE)	Incomplete PPE (<6 PPE garments)	Total
Qualitative level of biosafety knowledge	High level of knowledge	7	5,0%	13,6%	18,6%
	Low knowledge	11	7,9%	25,0%	32,9%
	Average level of knowledge	23	16,4%	32,1%	48,6%
Total		41	29,3%	70,7%	140
			of total	of total	of total

When analyzing the qualitative level, it was found that 5% (n=7) with a 95% CI of students who have a high level of knowledge, comply with 100% of the use of PPE, compared to 95% (n=133) with a 95% CI of students who use PPE incompletely.

Figure 4
Other vaccines used by students.

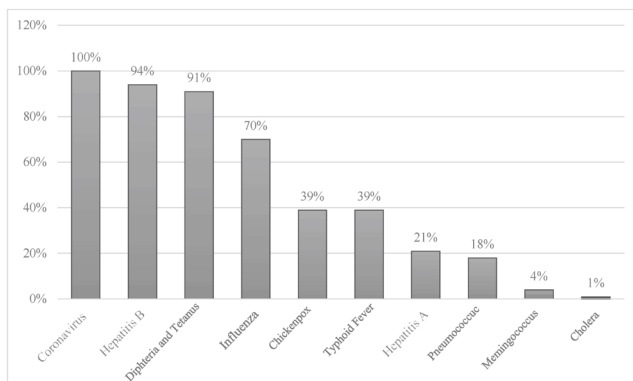
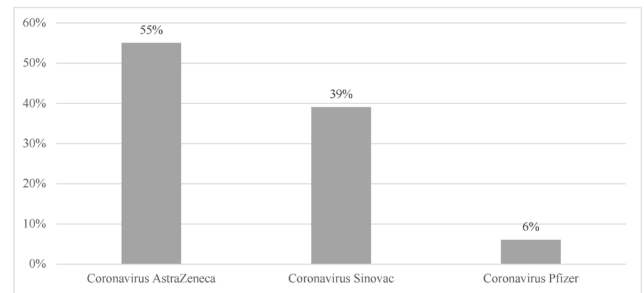


Figure 5
Coronavirus Vaccines



The most used vaccine, due to the pandemic situation, was the Coronavirus vaccine, within these the most used in 55% (n=77) was AstraZeneca, followed by 39% (n=55) Sinovac and finally only 6% (n=8) was Pfizer, with a 95% CI. Hepatitis B vaccine was the second most used vaccine in 94% (n=132) with 95% CI, Diphtheria and Tetanus vaccine in 91% (n=127) with 95% CI, followed by Influenza vaccine in 70% (n=98) with 95% CI, being these the most used by the group of interns in their pre-professional practices, the data obtained had a statistically significant relationship with a $p < 0.05$.

Discussion

In the present study it was possible to establish that knowledge and conceptualization of biosafety principles are high (86%), which indicates that most of the rotating interns of the C.

Ethical considerations: The project was approved by the Ethics and Research Committee of the Universidad Central del Ecuador.

The nursing staff has extensive knowledge of biosafety measures.

From this perspective, it is valid to consider several similar studies, among them the one conducted by Chero in his research "Level of knowledge about biosafety measures and their use by students in a Peruvian University", where it was determined that the knowledge about the concept of biosafety was high in 66.7%, compared to the present study where 86% was obtained. (8).

In a study conducted in Bucaramanga Colombia in 2017 by Carrascal "Evaluation of adherence to biosafety standards in the nursing staff of the San Camilo Psychiatric Hospital" the result of his research evidenced that 98% of the staff working there know about biosafety measures and they are

correctly applied. (9).

In another study conducted in Colombia by Salcedo in 2014, "Knowledge and attitudes in the application of biosafety of nursing service personnel", indicates that 80% of the nursing staff know about biosafety measures, therefore, it is related to the results of the present study (10).

In the work done by Rojas in 2019 "Biosafety in nursing interns in hospital practice at the National University of Chimborazo", it was found that 100% of respondents say that they have complied with the vaccination schedule to perform hospital practices. Ninety-six percent affirmed that during their internships in health institutions, they were administered the influenza vaccine, which is similar to the vaccination coverage of the nursing interns in the present study. (11).

In the study conducted by Espinoza in 2019, "Immunization in health personnel", he determined that the most frequently applied vaccines were: Hepatitis B, Measles, Rubella, Mumps, Influenza and Varicella, being related to the present study (12).

It is important to point out that within the results obtained about the concepts of biosafety, 100% of the students of the Rotational Nursing Internship know the time and procedures of hand washing. These results are consistent with the study conducted by Montaña in 2016

"Level of knowledge and practices in biosafety in nursing students of a higher education institution in Tuluá, in the second semester", where he describes that 89.4% of nursing students always perform hand washing before and after performing a procedure. (13).

Similar to the study conducted by Rojas "Biosafety in nursing interns in hospital practice. Universidad Nacional de Chimborazo, 2019", 88% of students know the technique for proper hand washing within the institutions where services are provided, in addition to maximizing hygiene levels. (11).

Regarding the correct management of contaminated waste disposal, the proper handling of contaminated waste is considered of great importance. In the present study, the level of knowledge about this parameter was considered, and the results showed a high level of knowledge, represented by 76%, on the part of the nursing interns.

The study conducted by Montaña in 2016 "Level of knowledge and practices in biosafety in nursing students of a higher education institution in Tuluá, in the second semester", refers that 89.4% of students eliminate contaminated waste in appropriate containers, similar to the present study (13).

Likewise, the study conducted by Rojas "Biosafety in Nursing Interns in Hospital Practice. Universidad Nacional de Chimborazo, 2019", the interns comply with discarding sharps waste correctly in a percentage of 100%, that is to say that all sharps are being disposed of properly, which coincides with the present study 76 % (11).

Conclusions

The results obtained in the present research showed that the knowledge about biosafety in the Nursing Interns was high, in the places where they did their pre-professional practices, the use of Personal Protective Equipment (PPE) was used partially and varies according to the place where they did their pre-professional practices. Regarding vaccination coverage for the prevention of infectious diseases, it could be specified that it was quite wide, mainly regarding the COVID-19 vaccines, where the coverage was 100%, which were provided by the Ministry of Health.

The practice areas where biosafety standards were most adequately met were: Obstetric Center, Neonatology, Pediatrics and Surgical Center.

It is evident that most of the places are familiar with the biosafety protocols, depending on the area and its complexity, and that personal protective equipment (PPE) is used.

The evaluation of biosafety knowledge and practices in health career students is essential in order to follow the protocols established by the Ministry of Health, which may vary in each of the medical services where the pre-professional practices are performed according to the level of care and complexity of these.

Peer review

The manuscript was peer-reviewed and approved in a timely manner by the INSPILIP Editorial Team.

Availability of data and materials

The data supporting this manuscript are available upon request to the corresponding author.

Conflict of Interest

The authors declare that they have no conflicts of interest.

Authors' contribution

The different phases of the research were carried out by the authors, who contributed equally throughout the process.

Acknowledgments

The authors appreciate the collaboration of the different hospitals of the state health network of Quito Ecuador.

Financing

Authors owns.

References

- Sanchez JD. Pan American Health Organization / World Health Organization. 2011 [cited August 24, 2021]. Biosafety and maintenance. Available from: https://www3.paho.org/hq/index.php?option=com_content&view=article&id=5460:2011-biosafety-maintenance&Itemid=3952&lang=in.
- Labsom. Laboratory Biosafety Standards according to WHO [Internet]. Labsom | Cleanroom Design and Construction. 2020 [cited 2021 Aug 24, 2021]. Available from: <https://labsom.es/blog/rules-of-biosecurity-in-laboratory-according-to-OMS/>.
- Ministry of Public Health. Biosafety for health facilities [Internet]. Publiasesores; 2016 [cited 2016 Sep 8, 2021]. Available from: <chrome-extension://efaidnbmnmnibpcajpcglclefindmkaj/https://hospitalgeneralchone.gob.ec/wp-content/uploads/2018/03/Biosafety-manual-02-2016-1.pdf>.
- Blanco D. Camaleón. 2017 [cited 2021 Sep 8]. Standards and procedures in biosafety occupational health. Available from: <https://www.calameo.com/read/002158988732277859710>
- WHO. Theoretical efficacy, actual efficacy, and protection of vaccines [Internet]. 2021 [cited 2021 Sep 9, 2021]. Available from: <https://www.who.int/es/news-room/feature-stories/detail/vaccine-efficacy-effectiveness-and-protection>.
- Spanish Association of Pediatrics. Efficacy and effectiveness of covid vaccines: systematic review [Internet]. 2021 [cited 2023 July 5]. Available from: <https://vacunasaep.org/profesionales/noticias/covid-19-vacunas-eficacia-y-efectividad>.
- Ministry of Public Health. Regulations for the management of waste generated in health facilities [Internet]. Publiasesores; 2019 [cited 2021 Sep 8]. Available from: <chrome-extension://efaidnbmnmnibpcajpcglclefindmkaj/https://hospitalgeneralchone.gob.ec/wp-content/uploads/2018/03/Manual-de-Bioseguridad-02-2016-1.pdf>
- Pacheco VHC. Level of knowledge about biosafety measures and their use by students in a Peruvian University. *Rev Scientific Agora*. December 22, 2016;3(2):361-4.
- Carrascal B, Castro L, Peña A. Evaluation of Adherence to Biosafety Standards in the Nursing Staff of the ESE San Camilo Psychiatric hospital [Internet] [Specialty thesis]. [Colombia]: University of Santander; 2017 [cited 2022 Feb 13]. Available from: <https://repository.udes.edu.co/bitstream/001/856>.
- Echeverri M del P, Cifuentes MS. Knowledge and attitudes in the application of biosafety standards of nursing service personnel. *Rev Colombian Occupational Health*. March 1, 2014;4(1):15-21.
- Lara García YE, Rojas Meza MJ. Biosafety in nursing interns in hospital practice. [Internet] [bachelor Thesis]. National University of Chimborazo; 2019 [cited 2022 Feb 13, 2022]. Available from: <http://dspace.unach.edu.ec/handle/51000/6106>.
- Espinoza-Mora M del R, Lazo-Páez G, Schauer C. Immunization in health personnel. *Acta Médica Costa Rica*. June 22, 2017;61(1):6-12.
- Montaño López MA, Osorio Ramírez DA. Level of knowledge and practices in biosafety in nursing students of a higher education institution in Tuluá, in the second semester of

2016. [Internet] [master's thesis]. [Colombia]: Universidad del Valle; 2018 [cited 2016 Feb 13, 2022]. Available from: <https://bibliotecadigital.univalle.edu.co/handle/10893/12553> .