Conditioning Factors for Biosafety Practice in Health Personnel: Integrative Review

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Abstract

In their attention to patients of different specialties, health personnel are the most vulnerable to contagion, which has been evidenced by the COVID-19 pandemic. The working conditions or factors for biosafety practices in health personnel worldwide will make it possible to detect the necessary and less treated lines of investigation, deficiencies and to draw up lines of work for their solution. It should be noted that it is estimated that 2.78 million workers die because of occupational accidents and 374 million injuries caused by work are reported, thus increasing absenteeism, the risk of contracting a disease in the workplace has become more latent and 4% of the world's GDP is occupied by diseases. The objective of this study was to analyze the evidence that exists regarding the conditioning factors for the practice of biosafety in health personnel. The methodology: where a descriptive systematic review was performed with the search of databases in Scopus selected articles from 2019 - 2023 in English and Spanish languages. The results indicate that with regard to the conditioning factors of Biosafety practice, it is evident that of the 400 articles 50 mention that it is important to know how to do, 45 mention that it is important not only the training but also the equipment for these practices to be favorable, also 31 of the articles refer to that in COVID-19 period the infections among health personnel were due to the reuse of personal protective equipment.

Keywords: Conditioning factors, Biosafety.

1. Introduction

One of the most significant factors influencing the practice of biosafety in health personnel is their knowledge and training on biosafety measures (Diniz et al., 2023; La Espriella et al., 2023). Health personnel should be aware of the preventive norms that should be applied to avoid contagion due to exposure to agents (Sampaio-Oliveira et al., 2023). A systematic review

conducted by Abad et al. in 2021 found that knowledge of biosecurity measures in healthcare personnel is essential to prevent the spread of infectious diseases. Adequate training on biosafety measures can help healthcare personnel understand the risks involved in their work and the necessary precautions to take to protect themselves and their patients. Therefore, it is essential to provide regular training and education on biosafety measures to healthcare personnel to ensure their safety and the safety of those around them.

Another critical factor influencing the practice of biosafety in healthcare personnel is the availability and proper use of personal protective equipment (PPE) (Cecilio e Silva et al., 2022; Cespedes-Ramirez et al., 2023; Gonçalves et al., 2023). PPE is a type of clothing or equipment designed to reduce employee exposure to chemical, biological and physical hazards (Cespedes-Ramirez et al., 2023). However, limited availability of PPE may result in inadequate protection of healthcare workers (Gonçalves et al., 2023). A review by Servín Torres et al. in 2020 found that proper use of PPE, including masks, gloves, and gowns, is essential to prevent the spread of infectious diseases (Silva et al., 2023). Therefore, it is crucial to ensure that healthcare personnel have access to adequate and appropriate PPE and are trained on how to use it correctly.

Organizational support and implementation of biosafety guidelines are also crucial factors influencing the practice of biosafety among healthcare personnel (dos Santos et al., 2023). The implementation of biosafety guidelines and protocols in healthcare facilities can help ensure that healthcare personnel are aware of the necessary precautions and procedures to follow to prevent the spread of infectious diseases (Coelho et al., 2023). This may include measures such as hand hygiene, surface disinfection, and isolation precautions. A study by Loyola da Silva et al. in 2021 found that the pandemic imposed new working conditions on nursing staff, impacting personal and work issues that interrelate with the implementation of biosafety guidelines. Therefore, it is critical to provide organizational support to healthcare personnel and ensure that biosafety guidelines are effectively implemented to protect healthcare personnel and patients.

The practice of biosafety among healthcare personnel is influenced by a number of factors, including knowledge and training on biosafety measures, the availability and proper use of personal protective equipment, and organizational support and implementation of biosafety guidelines. It is critical that healthcare organizations prioritize the implementation of biosafety guidelines and provide adequate training and resources to their staff to ensure the safety of both healthcare workers and patients. By addressing these conditioning factors, healthcare organizations can promote a culture of safety and minimize the risk of infectious disease transmission.

In their attention to patients of different specialties, health personnel are the most vulnerable to contagion, which has been evidenced by the COVID-19 pandemic. The working conditions or factors for biosafety practices in health personnel worldwide will allow us to detect the necessary and less treated lines of research, deficiencies and to outline lines of work for their solution. For this integrative review, we will start by talking about biosafety or life safety, which is of vital importance today, since it is aimed at reducing the risk of contagion through the measures taken to avoid the transmission of microorganisms (Vicuña and Anelle, 2021). The use of preventive methods, which are implemented in all work areas to reduce the risk of contamination with various viruses and bacteria, which are latent in the different hospital centers, is why health

workers are constantly the most exposed to this danger (Aimara et al., 2023), 2023), it is for this reason that worldwide there are institutions such as Center Disease Control (CDC) and Occupational Safety and Health Administration (OSHA) which constantly make updates to improve biosafety, what we know as preventive methods to safeguard the safety in the workplace of health care personnel, in order to cope with the various biological, chemical, physiological and mechanical risks.

For Eddy Segura Paucar, 2020, the Epidemiology Unit is in charge of the supervision, surveillance and control of diseases at national level, which currently affect the population, being the function of the unit to verify compliance with the biosecurity of health personnel in the institution, among others the delivery of personal protection supplies, hand washing, use of Gel, proper placement of Personal Protective Equipment (PPE), and other measures of Physical Barriers thus avoiding contact between people, so we can control Healthcare Associated Infections (HAI) and occupational accidents caused by non-compliance with Biosafety Standards due to lack of PPE and/or lack of knowledge of them(Espinoza and Olivera, 2019).

It is estimated that 2.78 million workers die as a result of occupational accidents and 374 million injuries caused by work are reported, thus increasing absenteeism, the risk of contracting any disease in the workplace has become more latent, so that 4% of the world GDP is occupied by occupational diseases, so it is currently increasing in Asia and Latin America, while in China the figure is 90,500 for the year 2001 compared to 73,500 in the year 2008. Brazil and Mexico also had an annual increase in occupational accidents caused by lack of biosafety from 29,500 to 39,500 in the same period in China (Dai et al., 2023).

While talking about biosafety is always present when hospital issues are discussed, even more so since December 31, 2019 when in the city of Wuhan unusual cases of pneumonia began to be reported, on January 10 the WHO released recommendations on how to act against the coronavirus, these recommendations reached different countries, subsequently a public health emergency was declared with 7818 confirmed cases, after a month of this, on March 11 a pandemic was declared (Józefacka et al., 2022). In Peru, on March 6, the first case of COVID-19 was detected, which increased as the months went by, the pandemic led health personnel to increase the number of patients to be attended, in addition to this, a deficit in the protection measures provided by health centers was revealed (Siegesmund et al., 2023).

During the COVID 19 pandemic, the deficiencies of the health system at the international level were revealed, among these deficiencies were biosafety measures, it should be noted that each institution, according to the services it provides, should have biosafety manuals specifying the risks (Furuyama et al., 2023), As is known, the COVID-19 pandemic has caused great concern in different sectors, so the international labor organization, in order to safeguard the safety of workers during the COVID-19 pandemic, proposed a series of standards which are aimed at safeguarding worker safety to avoid reducing exposure to contracting this virus.

It is of vital importance the biosecurity measures used by health personnel to reduce exposure, so it is essential to use appropriate protective barriers to prevent contact with the virus, within this is the hand washing with its five moments, use simple or surgical gloves as appropriate to perform the procedures, properly placed glasses, filter mask, NIOSH, NIOSH, and the use of a

mask with filter, NIOSH, The mask with filter, N95, or simple, disposable caps, aprons, also should be placed to health personnel preventive vaccines, provide them with adequate disinfectants, also must have a place where you can discard the contaminated material which should be organized and classified, at the time of taking a sample should be disposed of safely biological waste, all this in order to avoid risks of contagion (Wang et al. , 2023).

Currently, the problem is not the lack of knowledge of how to protect oneself, but rather that there is a shortage of personal protective equipment due to irrational use by the personnel or simply because they do not have it, which is why the study indicates that entities such as the WHO are providing training to health personnel in order to improve knowledge and ensure the safety of health personnel and patients (Padulles et al., 2022), 2022) Working conditions also play an important role in the compliance of biosafety measures as mentioned by the World Health Organization in its article: "Healthy environments: fundamentals and model in which the ILO estimates that every year 2 million men and women die as a result of accidents and diseases related to working conditions, and in turn that every year there are 160 million new cases of work-related diseases (Bravo-López et al., 2023). Safeguarding health, ensuring the integrity of workers, helps to improve the care provided to patients.

This integrative review aims to answer the following questions:

What evidence exists regarding the conditioning factors for the practice of biosafety in health personnel? The objective is to analyze the evidence that exists regarding the conditioning factors for the practice of biosafety in health personnel.

2. Materials and Methods

The present research work is of a design by integrative review , has a qualitative approach as it focuses on subjective information to give way to a theory ,with an inductive method forming a logical order that leads to a conclusion, for its particularity is descriptive level as it allows to gather information from multiple articles studied, obtaining coherent results to be able to explain them and is explanatory as it interprets and gives to know the causes of the problem to be studied (Hernandez, 2018).

It was given through scientific data which were selected and analyzed, these scientific data were articles that were taken from the Scopus database in the period from 2019- 2023. The Scopus database is always being updated.

The procedure was carried out in 4 phases, taking as a reference the Consort diagram, which is a guide for preparing reports (Moher et al., 2002):

a) the need for an integrative review of the conditioning factors for the practice of biosafety in health personnel was identified, then the search for information was carried out in the Scopus databases, yielding a total of 1385 articles in all, which were similar to the topic to be investigated in the study, and it was verified that they were not duplicated and that they had full text:

(b) Pre-selection phase, in this stage, the articles identified were screened, finding 400 articles.

c) Selection phase, here the total number of articles was identified, finally a total of 400 articles were found that met the selection criteria, indicating that the articles eliminated during the process were due to the fact that they were duplicated or did not have complete text. Accordingly, the PICO instrument was used to pose the research question.

Table 1 Question approach using the instrument. PICO

P= Participantes/ Población	I= Intervención	C= Comparación	O= Outcomes (Resultados)
Personal de salud y pacientes	Factores condicionantes	Artículos científicos que guarden relación con las variables estudiadas	prácticas de bioseguridad

Source: own elaboration

The proposed research problem was: What evidence exists regarding the conditioning factors for biosafety practices among health personnel? With the objective of analyzing the evidence that exists regarding the conditioning factors for the practice of biosafety in health personnel. Inclusion and exclusion criteria were taken into account:

We included.

✓ Articles comprised between 2019 and 2023.

✓ Free full-text articles.

✓ Articles included in the Scopus database.

✓ To be related to the variables.

Excluded were.

✓ Articles not included between 2019 and 2023.

✓ Articles without full text

✓ Articles not included in the Scopus database.

✓ Not related to the variables.

Ethical aspects

What is exposed in this systematic review is you will see, the necessary considerations and ethical aspects were taken, in the realization of this present investigation likewise there are no conflicts of interest.

3. Methodology

This article uses a mixed method approach using quantitative and qualitative research techniques. On the one hand, a quantitative analysis of information selected from Scopus is carried out using

a bibliometric approach of the scientific production relevant to the study of conditioning factors for biosafety practice in Latin American public health personnel.

On the other hand, some examples of research papers published in the aforementioned area of study are qualitatively analyzed, based on a bibliographic approach that allows characterizing the position of different authors in relation to the topic in question. It should be noted that the entire search was carried out through Scopus, which made it possible to establish the referencing parameters mentioned in Figure 1.

4. Methodological design

Figure 1: Methodological design

Source: Own elaboration

4.1.1 Phase 1: Data collection

The data collection was executed from the Scopus web page search tool, where 400 publications were obtained from the choice of the following filters:

EXCLUDE (AFFILCOUNTRY , "Switzerland") OR EXCLUDE (AFFILCOUNTRY , "Taiwan") OR EXCLUDE (AFFILCOUNTRY , "Thailand") OR EXCLUDE (AFFILCOUNTRY , "United Arab Emirates ") OR EXCLUDE (AFFILCOUNTRY , "Vietnam") OR EXCLUDE (AFFILCOUNTRY , "Austria") OR EXCLUDE (AFFILCOUNTRY , "Iran") OR EXCLUDE (AFFILCOUNTRY , "South Africa") OR EXCLUDE (AFFILCOUNTRY , "Turkey") OR EXCLUDE (AFFILCOUNTRY , "Denmark") OR EXCLUDE (AFFILCOUNTRY , "Greece") OR EXCLUDE (AFFILCOUNTRY , "Indonesia") OR EXCLUDE (AFFILCOUNTRY , "Indefinite") OR EXCLUDE (AFFILCOUNTRY , "Hungary") OR EXCLUDE (AFFILCOUNTRY , "United Kingdom") OR EXCLUDE (AFFILCOUNTRY , "South Korea") OR EXCLUDE (AFFILCOUNTRY , "Australia") OR EXCLUDE (AFFILCOUNTRY , "Canada") OR EXCLUDE (AFFILCOUNTRY , "Portugal") OR EXCLUDE (AFFILCOUNTRY , "Japan") OR EXCLUDE (AFFILPAIS , "Netherlands" AND (EXCLUDE (SUBJAREA , "ENGI") OR EXCLUDE (SUBJAREA , "SOCI") OR EXCLUDE (SUBJAREA , "EART ") OR EXCLUDE (SUBJAREA , "AGRI ") OR EXCLUDE (SUBJAREA , "COMP ") OR

EXCLUDE (SUBJAREA , "ENER ") OR EXCLUDE (SUBJAREA , "CENG ") OR EXCLUDE (SUBTASK , "PHYS ") OR EXCLUDE (SUBTASK , "NURS ") OR EXCLUDE (SUBTASK , "MATE ") OR EXCLUDE (SUBTASK , "ARTS ") OR EXCLUDE (SUBTASK , "MATH ") OR EXCLUDE (SUBTASK , "CHEM ") OR EXCLUDE (SUBJAREA , "BUSI ") OR EXCLUDE (SUBJAREA , "DECI ") OR EXCLUDE (SUBJAREA , "VETE ") OR EXCLUDE (SUBJAREA , "ECON ") OR EXCLUDE (SUBJAREA , "MULT ").

- Published papers whose study variables are related to conditioning factors for biosafety practice in health personnel, in hospital entities.
- Papers published in journals indexed in Scopus during the period 2019-2023.
- Limited to Spanish-speaking countries.
- No distinction in areas of knowledge.
- No distinction in type of publication.

4.1.2 Phase 2: Construction of analysis material.

The information collected in Scopus during the previous phase is organized for subsequent classification by means of graphs, figures and tables as follows:

- Word Cooccurrence.
- Year of publication.
- Country of origin of publication.
- Area of knowledge.
- Type of publication.

4.1.3. Phase 3: Drafting of conclusions and final document.

In this phase, we proceed with the analysis of the results yielded previously resulting in the determination of conclusions and, consequently, the obtaining of the final document.

5. Results

5.1 Cooccurrence of words: Figure 2 shows the cooccurrence of keywords found in the publications identified in the Scopus database.

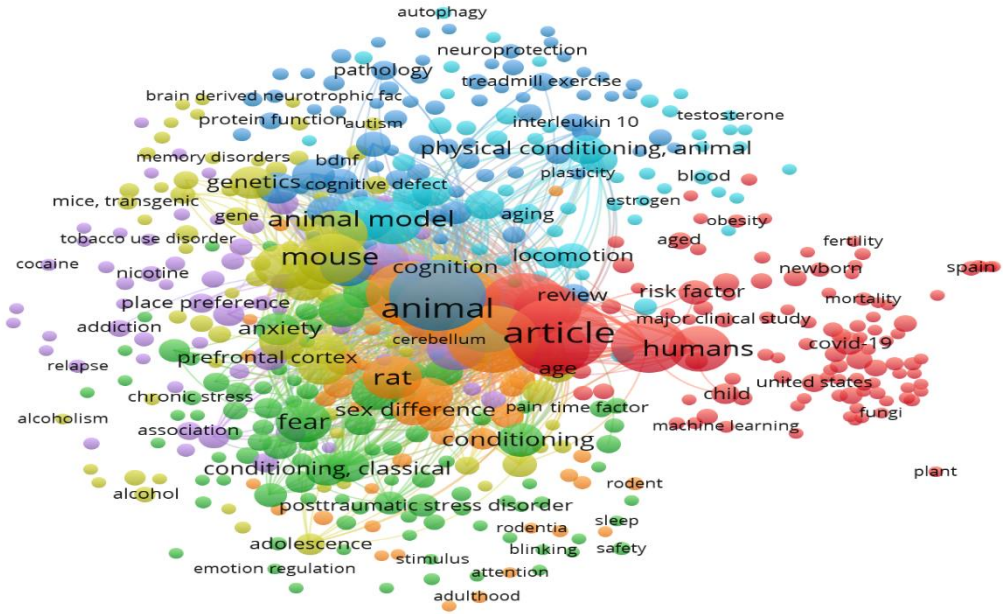

Figure 2. Cooccurrence of words

Source: Own elaboration (2023); based on data exported from Scopus.

Anxiety was the key word used most frequently in the studies identified through the execution of Phase 1 of the Methodological Design proposed for the development of this article. Education is also among the variables. The language used in biosafety training materials can provide valuable information on the coexistence of words related to biosafety practice in healthcare personnel (Bajjou et al., 2020; Martins et al., 2019). By analyzing these materials, researchers can identify common words and phrases that may be indicative of areas of strength or weakness in biosafety training and practice. For example, a study by Somocurcio Bertocchi et al. in 2017 found that hospital staff knowledge of biosafety measures was less than ideal, highlighting the need for improved training and education. Similarly, a 2018 study by Encinas emphasized the importance of knowledge and implementation of biosafety measures among healthcare facility staff. These studies demonstrate the value of analyzing the language used in biosafety training materials to identify areas for improvement in biosafety practice.

Through concurrent word analysis, researchers can identify keyword pairs that represent important concepts related to biosafety practices (Llapa-Rodriguez et al., 2017). For example, the phrase "avoid direct exposure to blood and other potentially contaminating organic fluids" is a key concept related to biosafety practices (WHO, 2010). Other important concepts may include appropriate use of personal protective equipment, proper hand hygiene, and safe handling and disposal of hazardous materials. By identifying these key concepts and the words and phrases

that commonly co-occur with them, researchers can better understand the language used in biosafety training materials and the priorities for biosafety practice in healthcare settings.

The implications of cooccurrence analysis for improving biosafety training and practice in healthcare settings are significant. By identifying areas of weakness in current training materials and practices, researchers can work to develop more effective training programs that prioritize key concepts and address common misconceptions or knowledge gaps (Llerena and Lopez, 2022). In addition, by using cooccurrence analysis to identify common words and phrases, healthcare organizations can develop standardized language and terminology for biosafety practice, promoting consistency and clarity in communication. Overall, co-occurrence analysis can play a valuable role in improving the effectiveness and consistency of biosafety training and practice in healthcare settings.

Biosafety practice in healthcare settings is influenced by several factors, including the importance of biosafety, knowledge and training on biosafety practices, and the availability of resources and equipment. The coexistence of words related to biosafety practice in healthcare personnel, identified through analysis of language used in biosafety training materials, highlights the need to improve biosafety training and practice in healthcare settings. By focusing on common words and phrases, healthcare organizations can develop more effective biosafety training programs that address the specific needs and challenges faced by healthcare personnel. Ultimately, improving biosecurity practices in healthcare settings can help protect both healthcare workers and patients from the spread of infectious diseases.

5.2. Distribution of scientific production by year of publication.

Figure 3 shows the distribution of scientific production by year of publication.

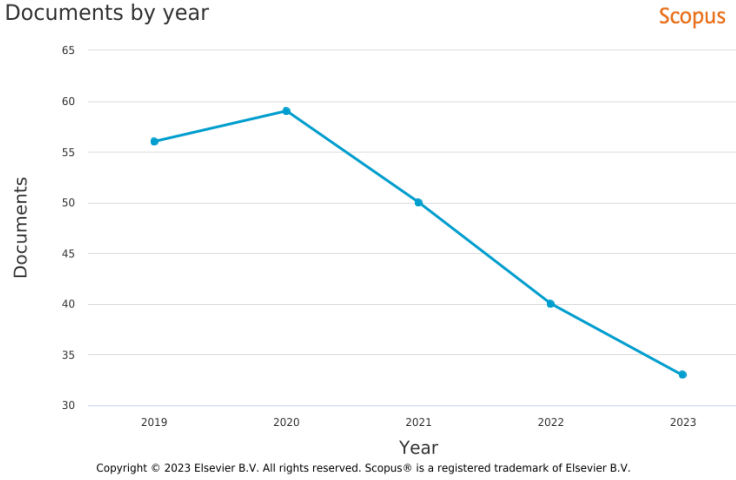

Figure 3. Distribution of scientific production by year of publication.

Source: Own elaboration (2023); based on data exported from Scopus.

The distribution of scientific production on biosafety practices among health personnel from 2019 to 2023 has shown an increasing trend in research on individual factors (MSP Manual, 2019). With the highest research output being 2020 with a number of 59 Spanish-speaking researches. This includes studies that examine the knowledge, attitudes and behaviors of healthcare workers with respect to biosafety practices. These studies aim to identify gaps in knowledge and practice and develop interventions to improve biosafety practices among individual healthcare workers. The relevance of this research is highlighted in Goal 1 of ASSA2030, which seeks to promote the training and updating of high-level specialists in scientific research (He et al., 2023). By improving individual biosecurity practices, health care workers can protect themselves, their patients, and the community at large from the spread of infectious diseases.

In addition to individual factors, research has also focused on organizational factors that influence biosecurity practices among healthcare workers. This includes studies examining the role of leadership, organizational culture, and policies and procedures in promoting biosafety practices (Vieira-Meyer et al., 2022). The 2020-2025 Strategic Plan seeks to be an organizational expression that effectively reflects the path to health system transformation (WHO, 2019). By addressing these organizational factors, healthcare organizations can create a culture of safety that prioritizes biosecurity practices and supports healthcare workers in their efforts to maintain safe work environments.

Finally, research has also examined environmental factors that impact biosafety practices among healthcare workers. This includes studies examining the physical work environment, such as the availability of personal protective equipment and the design of healthcare facilities (Diniz et al., 2023). Lessons learned from the management of the crisis generated by the COVID-19 pandemic have highlighted the importance of ensuring that healthcare workers have access to the resources and equipment necessary to maintain their biosecurity practices (La Espriella et al., 2023; Vergara et al., 2022). The proposed European Parliament Resolution on the COVID-19 pandemic also emphasizes the need to ensure that healthcare workers have access to appropriate protective equipment (Sampaio-Oliveira et al., 2023). By addressing these environmental factors, healthcare organizations can create safe work environments that support the biosafety practices of their workers.

The distribution of scientific output from 2019 to 2023 on conditioning factors for biosafety practice in the healthcare workforce has shed light on the various factors that affect biosafety practices. Research has identified individual, organizational, and environmental factors as key determinants of biosecurity practices among healthcare personnel. Trends in research on these factors have shown that there is growing interest in understanding the role of organizational and environmental factors in promoting biosecurity practices. This research can help inform policies and interventions aimed at improving biosafety practices among healthcare personnel, ultimately leading to better outcomes for both patients and healthcare workers.

5.3. Distribution of scientific production by country of origin.

Figure 4 shows how scientific production is distributed according to the nationality of the authors.

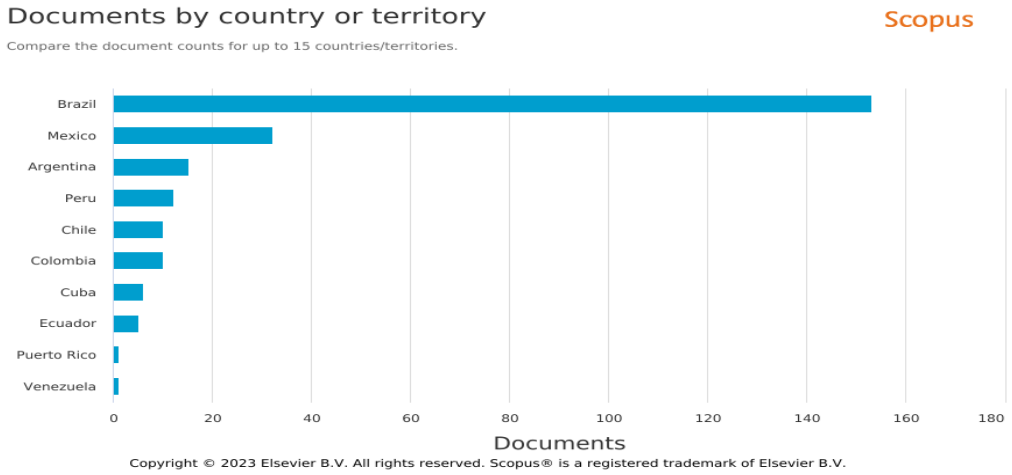

Figure 4. Distribution of scientific production by country of origin.

Source: Own elaboration (2023); based on data provided by Scopus.

Investment in research and development is a decisive factor influencing the distribution of scientific production on biosafety in health personnel by country (Narváez et al., 2022). Brazil is the country with the highest scientific production with a total of 153 documents, followed by Mexico with a scientific production of 32 documents. Countries that invest more in research and development tend to have a higher scientific production. This investment can come from both the public and private sectors, and government funding and support play an important role. In Latin America, for example, there is significant inequality between countries in terms of scientific production of vaccines for the COVID-19 pandemic, with some countries having more resources and infrastructure to conduct research than others (Cecilio et al., 2022). Investment in research and development is essential to ensure that countries can keep up with the latest advances in biosafety research and implement best practices to protect the health and safety of their citizens.

The availability of resources and infrastructure is another critical factor that influences the distribution of biosafety scientific output in the health workforce by country (Cespedes-Ramirez et al., 2023). Countries with more resources and better infrastructure are better equipped to conduct research, implement biosafety measures and produce scientific publications. For example, in Cuba there is a significant emphasis on science, technology and innovation for health, with a collective of authors highlighting the country's achievements in these areas (Gonçalves et al., 2023). However, resources and infrastructure are lacking in many developing countries, making it difficult to conduct high-quality biosafety research. This can lead to a significant disparity in scientific output between countries.

Government policies and priorities toward biosafety research also play a crucial role in the distribution of biosafety scientific output in the health workforce by country (Adams et al., 2022;

Coelho et al., 2023; de Lima e Silva et al., 2023; dos Santos et al., 2023; Reyes-Mendoza et al., 2022; Salazar-Gonzalez et al., 2022). Governments can prioritize funding and support for biosafety research, implement regulations and guidelines to ensure the safety of health personnel, and promote the training and education of specialists in the field. For example, in Mexico, the National Council for Science and Technology (CONACYT) has identified biosafety as a priority objective, promoting the training and updating of high-level specialists in scientific, humanistic and technological areas (Vega et al., 2023). In contrast, in some countries biosafety may not be a priority, leading to a lack of funding and support for research in this area. Government policies and priorities may significantly impact the distribution of scientific output on biosafety in the health workforce by country.

Biosafety practices in healthcare settings are crucial to protect the health of both healthcare workers and patients. This article provides an overview of the scientific production on biosafety in healthcare workers, highlighting the importance of research in this field. Analysis of scientific output by country of origin reveals that investment in research and development, availability of resources and infrastructure, and government policies and priorities toward biosafety research are key factors influencing the distribution of scientific output on biosafety in the health workforce by country. As such, it is important that governments and institutions prioritize biosafety research and invest in resources and infrastructure to ensure the safety of health workers and patients.

5.4. Distribution of scientific production by area of knowledge

Figure 5 shows the distribution of scientific publications by the area of knowledge through which the different research methodologies are implemented.

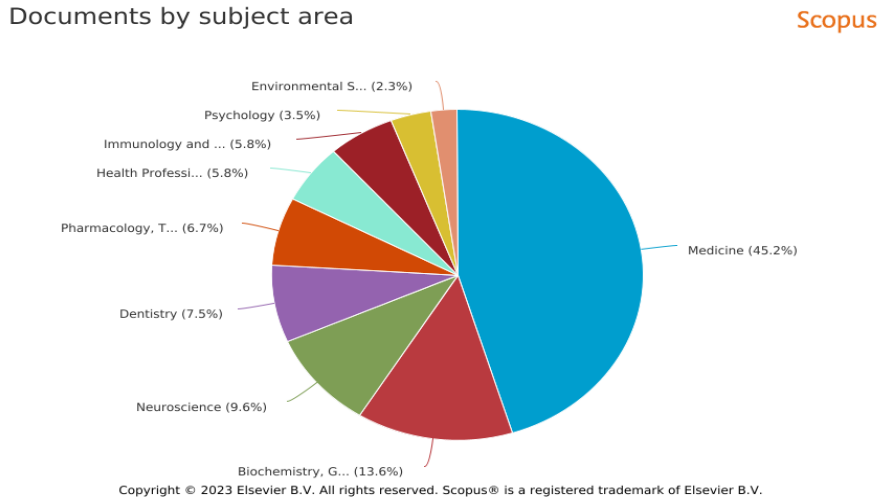

Figure 5. Distribution of scientific production by area of knowledge.

Source: Own elaboration (2023); based on data provided by Scopus.

Microbiology and infectious diseases are crucial areas of knowledge related to biosafety in health personnel (Feige et al., 2022). These fields involve understanding the transmission, prevention, and treatment of infectious diseases, as well as the proper handling and disposal of potentially infectious materials. Healthcare personnel working in microbiology and infectious diseases should be well versed in biosafety practices, including the use of personal protective equipment, proper hand hygiene, and safe handling of biological specimens. By following these practices, healthcare workers can minimize the risk of infection and prevent the spread of disease to patients and colleagues.

Occupational safety and health is another critical area of knowledge related to biosafety in healthcare personnel (Marcos-Pasero et al., 2023). This field involves identifying and mitigating hazards in the workplace that may put the health and safety of employees at risk. Healthcare workers must be aware of the potential hazards they may encounter in their work environment and know how to protect themselves and others. This includes understanding the proper use and disposal of hazardous materials, such as chemicals and sharps, as well as the importance of ergonomic practices and injury prevention.

Epidemiology and public health are also essential areas of knowledge related to biosafety in the healthcare workforce (Sanchez-Rivero et al., 2022). These fields involve understanding the spread and control of infectious diseases, as well as the promotion of the overall health and well-being of populations. Health personnel working in epidemiology and public health must understand the principles of infection control, including the importance of vaccination, surveillance, and outbreak response. They must also be able to communicate these principles effectively to patients and the public, promoting awareness and understanding of biosecurity practices (Ferdinandy et al., 2023).

By integrating these areas of knowledge into their practice, healthcare personnel can ensure the safety and well-being of both themselves and their patients.

Factors affecting the distribution of scientific production on biosafety among healthcare personnel the distribution of scientific output on biosafety in the health workforce is affected by several factors, including funding and resources for research (Siegesmund et al., 2023). Research requires significant financial and material resources, and the availability of these resources can influence the quantity and quality of scientific output in a particular area of knowledge (Furuyama et al., 2023). Inadequate funding and resources can limit the scope and depth of research, leading to a lower volume of scientific output. Therefore, ensuring adequate funding and resources for biosafety research can contribute to the generation of novel scientific knowledge and the advancement of the field.

National and international priorities and policies may also play an important role in the distribution of biosafety scientific output in the health workforce (Bravo-Lopez et al., 2023; Padulles et al., 2022; Puche-Juarez et al., 2023; Wang et al., 2023). Government policies and initiatives can influence the focus and direction of research, as well as the allocation of resources. For example, the Program for the Development of Biosafety and Biosecurity (PDBB) incorporated into PECiTI 2021-2024 seeks to promote biosafety research in Brazil (Miklin et al., 2022). Similarly, the mandatory Standard for the manufacture and/or importation of drugs for

human use in Mexico may influence research priorities in the country (Bloch-Trojnar, 2023). Therefore, aligning national and international priorities and policies with research objectives can improve the distribution of scientific output on biosafety in the health workforce.

Collaboration and networking among researchers and institutions can also contribute to the distribution of scientific output on biosafety in the healthcare workforce (Dai et al., 2023; Escobar-Avaria et al., 2022; Józefacka et al., 2022). Collaborative research projects involving multiple institutions and investigators can lead to the pooling of resources and expertise, resulting in a higher volume and quality of scientific output. In addition, networking among researchers and institutions can facilitate the sharing of knowledge and best practices, leading to a more efficient and effective research process. Therefore, fostering collaboration and networking among researchers and institutions can improve the distribution of scientific output on biosafety in the health workforce.

The distribution of scientific output on biosecurity in the health workforce is influenced by several factors, including research funding and resources, national and international priorities and policies, and collaboration and networking among researchers and institutions. Areas of expertise related to biosafety in the healthcare workforce include microbiology and infectious diseases, occupational safety and health, and epidemiology and public health. To improve biosafety practices in healthcare settings, it is essential to address these factors and promote interdisciplinary collaboration among researchers and institutions. In doing so, we can improve our understanding of biosafety practices and develop effective strategies to protect the health and safety of healthcare workers and patients alike.

5.5. Type of publication

In the following graph, you will observe the distribution of the bibliographic finding according to the type of publication made by each of the authors found in Scopus

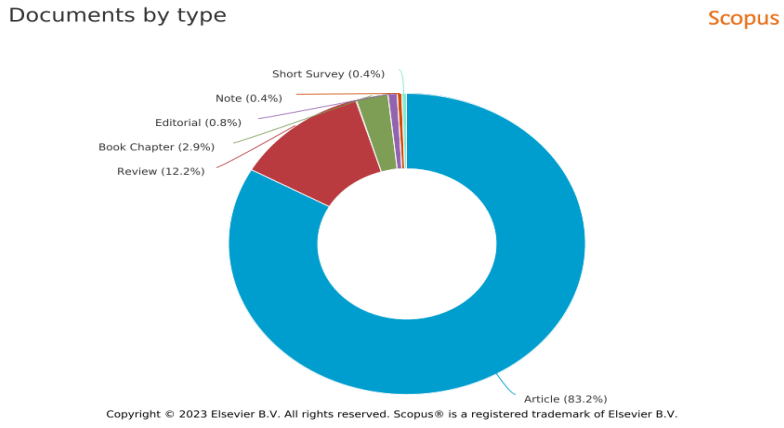

Figure 6. Type of publication.

Source: Own elaboration (2023); based on data provided by Scopus.

Research articles are an important type of publication that can contribute to improving biosafety practices among health personnel. These articles provide up-to-date information on the latest biosafety guidelines and best practices, which helps healthcare providers stay informed about the most effective ways to prevent healthcare-associated infections (HAIs) and other complications (Sanchez-Muñoz, 2022). For example, the fourth edition of Biosafety in Microbiological and Biomedical Laboratories (BMBL) provides detailed guidance on basic biosafety requirements and enhanced control measures (Garcia-Salazar et al., 2023). By staying informed about the latest research, healthcare providers can implement evidence-based biosafety measures that are more likely to be effective in preventing the spread of infectious diseases.

Case studies are another valuable type of publication that can help healthcare providers improve their biosecurity practices. These studies highlight successful implementations of biosecurity measures in healthcare settings and provide real-world examples of how biosecurity guidelines and best practices can be effectively applied. For example, a study by Somocurcio Bertocchi et al. in 2017 determined the level of knowledge of biosafety measures in professional staff at a national hospital, providing insights on how to improve biosafety practices in healthcare settings (Gutierrez-de-Rozas et al., 2023). Similarly, a study by Camacuari et al. in 2020 explored factors related to the implementation of biosafety measures by nursing professionals, providing valuable information on how to improve biosafety practices in this specific group of healthcare providers (Lee et al., 2022). By examining successful case studies, health care providers can gain practical knowledge and strategies for implementing effective biosafety measures in their own workplaces.

Review articles are a third type of publication that can contribute to improving biosafety practices in the healthcare workforce. These articles summarize the current state of biosafety practices in healthcare settings and provide a comprehensive overview of the most important issues and challenges facing healthcare providers. For example, a publication prepared by the Centers for Disease Control and Prevention (CDC) and the National Institutes of Health provides guidance and recommendations specifically for human clinical diagnostic laboratories and other healthcare settings (Obukhov and Brovelli, 2023). By reading review articles, healthcare providers can gain a broader understanding of the current state of biosafety practices and identify areas for improvement in their own workplaces (Obaco et al., 2023).

The practice of biosafety in healthcare personnel is influenced by a variety of factors, including knowledge and awareness of biosafety guidelines, the availability and adequacy of personal protective equipment, and the work environment and organizational support. To improve biosafety practices, different types of publications can be used, such as research articles on the latest biosafety guidelines and best practices, case studies on successful implementation of biosafety measures, and review articles summarizing the current state of biosafety practices in healthcare settings. By utilizing these resources, healthcare organizations can ensure the safety of their staff and patients and ultimately improve the quality of care provided.

6. Discussion

The integrative review allowed us to visualize a lacking health care system, which was exposed during the COVID-19 pandemic, a pandemic that has changed and affected the lives of people worldwide. Thus, León and Duharte in 2020 tell us that aerosols in Stomatology are a very important factor to take into account, since they facilitate bacterial transmission to health care workers and the office environment through the dispersion of tiny droplets. In the presence of the COVID-19 pandemic, it is a danger to human life, which leads us to see the importance of using biosecurity measures. But what biosecurity measures would be used if the necessary supplies such as masks, aprons or protective eyewear are not available.

In the studies taken into account in the integrative review, with regard to the conditioning factors of biosafety practices, it is evident that of the 400 articles, 50 mention that it is important to know how to do, 45 mention that it is important not only to have training but also equipment for these practices to be favorable, and 31 of the articles refer to the fact that during the COVID-19 period, infections among health personnel occurred due to the reuse of personal protection elements. Therefore, it is essential to use adequate protection barriers to avoid contact with the virus, including hand washing with its five moments, use of simple or surgical gloves as appropriate to perform the procedures, proper use of glasses, filter mask, N95, or simple, disposable caps, aprons, Likewise, health personnel should be provided with preventive vaccines, adequate disinfectants, a place where contaminated material can be discarded, which should be organized and classified, and biological waste should be safely disposed of when taking a sample, all of this in order to avoid the risk of contagion (Vicuña and Anelle, 2021).

Currently, the problem is not the lack of knowledge of how to protect oneself, but rather that there is a shortage of personal protective equipment due to the irrational use of the personnel or simply because they do not have it, which is why the study indicates that entities such as the WHO are providing training to health personnel in order to improve knowledge and ensure the safety of health personnel and patients.

Finally, it is important to study the factors involved in biosafety practices in order to prevent occupational accidents and provide quality care, which is why it is important for health personnel to be trained and have the necessary material to comply with the protocols established by the institution.

7. Conclusion.

At present, there are biosafety protocols for patient care, but in some cases they are not applied due to lack of knowledge on the part of health personnel and lack of personal protective equipment because some health institutions do not have the necessary budget and adequate management to be able to have such equipment.

Before, during and after the COVID 19 pandemic, health professionals were concerned about the availability of protective supplies due to the worldwide shortage of personal protective equipment, increased purchasing power and low production.

With regard to COVID-19 and biosecurity as the pandemic accelerated, the collapse of the economy, health systems and access to personal protective equipment (PPE) for health care workers is evident in developing countries. On the other hand, according to the studies consulted in some countries, there have been cases of infection due to the fact that patients who may have been infected were treated with inappropriate PPE or with PPE that may not meet the necessary requirements for transmission containment.

It is necessary to place greater emphasis worldwide on the health issue and to take measures for an adequate practice of Biosafety, not only in terms of protocols and paperwork, but also in terms of supplying the necessary supplies to adequately comply with what the protocols dictate.

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