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ORIGINAL

Biosafety education intervention for dental workers, Isla de la Juventud, 2019-2022

Intervención educativa sobre bioseguridad en trabajadores de estomatología, Isla de la Juventud, 2019-2022

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ABSTRACT

Biosafety is a doctrine of behaviours aimed at achieving attitudes and behaviours that reduce the risk of transmission of microorganisms in public health services, which has become a health problem, in addition to the lack of interest in the subject. An explanatory study was carried out with a quasi-experimental design with pre-test, post-test and a control group with the aim of developing an educational intervention on Biosafety in Stomatology workers belonging to the Teaching Polyclinics 'Orestes Falls Oñate' of Santa Fe and 'Leonilda Tamayo Matos' of Nueva Gerona, Isla de la Juventud, in the period from November 2019 to January 2022. The study universe was made up of all the Stomatology workers of these entities and the sample was made up of those who were active in this service, the sample being intentional. The following variables were taken into account: experimental groups, factors influencing non-compliance with biosafety standards, level of knowledge about biosafety, compliance with biosafety standards and educational software. It was found that the highest percentage was represented by the Stomatologists. At the beginning, the evaluation of fair was predominant, and after the intervention, notable improvements were found in the level of knowledge of the workers as well as in compliance with biosafety standards. The use of clothing was the parameter that was most evident in non-compliance with biosafety standards. A teaching tool was designed, not yet existing in Cuba, which provided information related to biosafety, and had a great impact on the development of educational activities for workers in stomatology departments, given that it is a novel and enjoyable way of transmitting information, allowing for an increase in the level of knowledge and the transformation of modes of action.

Keywords: Biosafety; Stomatology; Educational Intervention; Knowledge; Health Standards.

RESUMEN

La bioseguridad es una doctrina de comportamientos encaminados a lograr actitudes y conductas que disminuyan el riesgo de transmisión de microorganismos en servicios de Salud Pública, convirtiéndose en un problema de salud, sumado la falta de interés con respecto al mismo. Se realizó un estudio explicativo con diseño cuasi-experimental con pre-prueba, post-prueba y un grupo de control con el objetivo de desarrollar una intervención educativa sobre Bioseguridad en trabajadores de Estomatología pertenecientes a los Policlínicos Docentes

"Orestes Falls Oñate" de Santa Fe y "Leonilda Tamayo Matos" de Nueva Gerona, Isla de la Juventud, en el período de noviembre 2019 a enero 2022. El universo de estudio estuvo conformado por todos los trabajadores de Estomatología de estas entidades y la muestra estuvo constituida por los que se encontraron activos en este servicio, siendo la misma intencional. Se tuvieron en cuenta las variables grupos del experimento, factores que inciden en el incumplimiento de las normas de bioseguridad, nivel de conocimiento sobre bioseguridad, cumplimiento de las normas de bioseguridad y software educativo. Se evidenció que el mayor porciento lo representan los Estomatólogos, en un principio predominó la evaluación de regular y luego de la intervención se encontraron mejorías notables tanto en el nivel de conocimiento de los trabajadores como en el cumplimiento de las normas de Bioseguridad. El uso de prendas el parámetro que más se evidenció en el incumplimiento de las normas de bioseguridad. Se diseñó un medio de enseñanza, no existente aún en Cuba que brindó información relacionada con la Bioseguridad, y tuvo gran impacto en el desarrollo de actividades educativas que se realizaron a trabajadores de los departamentos de estomatología, dado que es una forma novedosa y amena de trasmitir información, permite el incremento del nivel de conocimiento y la transformación de los modos de actuación.

Palabras clave: Bioseguridad; Estomatología; Intervención Educativa; Conocimiento; Normas Sanitarias.

INTRODUCTION

The World Health Organization (WHO) defines biosafety as a set of standards and measures to protect the health of personnel from biological, chemical, and physical hazards to which they are exposed in the course of their daily duties, as well as to patients and the environment.[1] In 2000, Papone established that biosafety should be understood as a doctrine of behavior aimed at achieving attitudes and behaviors that reduce the risk of healthcare workers acquiring infections in the workplace. It also commits all other people in the healthcare environment, which must be designed within the framework of a risk reduction strategy.[2]

Tovar, in 2002, defined it as a paradigm shift in attitudes and behaviors that reduce the risk of acquiring infections in the workplace. It has rules and protocols designed to maintain, control, and reduce occupational risk factors, avoiding contact with pathogens in health services linked to accidents involving the handling of potentially infectious blood or body fluids.[3]

Splashes of contaminated biological products pose a risk of infection if they come into contact with mucous membranes or skin tissue. Protective barriers are all measures implemented to prevent contact with splashes of contaminated biological products of oral origin, as they pose a risk of infection when they come into contact with skin tissue or conjunctival mucosa that has a break in its continuity or inflammatory processes that facilitate the penetration of possible microbial agents into the dermis. These barriers have been increasingly implemented in the conduct of oral health workers, and their use, along with various techniques, provides a sterile and contaminant-free environment.[4]

Stomatology is a branch of health sciences that deals with the diagnosis, treatment, and prevention of diseases of the stomatognathic system, including the teeth, gums, tongue, palate, oral mucosa, salivary glands, and other anatomical structures involved, such as the lips, tonsils, oropharynx, and temporomandibular joint.[5] The term quality of life is often used in research, mostly in reference to patients. However, in the health-disease process, the quality of life of healthcare providers, non-professional healthcare workers, medical students, managers, and patient companions is no less important.

For years, dentists have been considered a high-risk group for hepatitis and other infectious diseases, whose epidemiological chain involves contact with blood, saliva, and other biological secretions, and therefore universal precautions must be observed. This method of infection control requires that administrators and employees assume that all blood and body fluids are infected with Human Immunodeficiency Virus (HIV) and Hepatitis B Virus (HBV) and other blood-borne pathogens. Traditionally, the criterion that infection control and patient protection measures are an important part of dental practice has been supported.

Biosafety was established worldwide in April 1987 with the aim of reducing risks that endanger the health or even the life of individuals, families, and communities. It can be applied in all areas, including the home, school, and workplace, among other activities.[2] In the health sector, it plays an important role because healthcare workers are in constant contact with sick people or contaminated material, which makes them vulnerable to infectious diseases.

This is where biosafety standards become a code of conduct, contributing to activities and behaviors that reduce risks to healthcare workers. At the same time, they enable healthcare workers to follow practices that help maintain epidemiological control of infected patients and prevent the spread of disease.

The main components of universal precautions are hand washing, careful handling of sharp objects, compliance with sterilization and disinfection processes, proper disposal of instruments, and the appropriate

use of protective equipment such as sanitary gowns, gloves, masks, sanitary caps, goggles, or face shields. Biosafety is a vital component of the healthcare quality assurance system.

The different opinions on the subject and compliance with established standards constitute a health problem in the Cuban and global dental community.[6] Science and technology have advanced in areas that improve quality of life; however, the thoughtless use of this knowledge poses threats to it. That is why biological safety has been a constant topic of public debate in many countries over the last 60 years.[4]

In recent decades, both nationally and internationally, a wide range of regulatory documents on biosafety and biological protection have been developed. The Ministry of Science, Technology and Environment (CITMA) has been the leading institution in this field in Cuba, and since the 1980s it has systematically held important international meetings, events and conferences with the aim of consolidating knowledge and designing strategies to create safe and secure environments. Environmental and biosafety planning is not a spontaneous or group activity today; it has a legal framework that regulates actions in this area.

Today's dentists should not focus solely on restoring aesthetics, but should also study all phenomena occurring at the environmental level.[5] It is essential to have and manage the necessary knowledge, as dentists, together with staff working in dental departments, are exposed to a wide variety of microorganisms, including spores, bacteria, fungi, viruses, and protozoa that can be found in patients' blood or saliva. Any of these pathogens can cause infectious diseases through needle sticks or sharp instruments, or splashes from the air motor used in dental practice, caused indirectly when cleaning instruments or removing debris.

Many countries have an infection prevention and control program for dental services. The first recommendations of this type in the dental field were made in 1986 by the Center for Disease Control and Prevention (CDC) in Atlanta, United States. At that time, the recommendations and procedures were primarily aimed at protecting against the transmission of pathogens through blood and were called universal precautions. However, today's programs have a broad spectrum related to the type of microorganism and its possible route of transmission.

The practice of dentistry must be regulated by biosafety methods, techniques, and procedures that optimize patient care in dental offices. This involves improving the quality of clinical care for the benefit of both patients and professionals. In this regard, it is necessary to establish the concepts that facilitate understanding of biosafety regulations and the rationale that legitimizes the strict implementation of measures to protect those who work in and receive care in the healthcare setting.

From the perspective of dental teaching, biosafety can be understood as a set of organized measures that encompass and involve human, technical, and environmental elements, aimed at protecting all actors and the environment from the risks inherent in dental practice, with an emphasis on the teaching-learning process. On the other hand, peripheral actors are also considered, represented by dental care technicians, assistants, equipment and service maintenance technicians, and cleaning staff, in view of their collateral participation.

Antisepsis is the elimination of vegetative forms of pathogenic bacteria and much of the resistant flora on the skin and mucous membranes through the application of chemical substances. Asepsis refers to all the maneuvers and procedures that must be used to prevent microorganisms from being present in the operating room, doctor's office, surgical instruments, gauze, gloves, and masks.

Disinfection is the physical or chemical treatment that destroys microbial vegetative forms, but not the spores found on or in objects. Instruments and procedures are classified according to the risk of contamination as critical, which are instruments used to penetrate soft and bone tissue, i.e., they penetrate subepithelial tissue and reach the vascular system; these include those used in tooth extraction, such as chisels, syndesmotomes, and instruments for tartar removal.[7,8,9]

Semi-critical instruments are those that come into contact with intact mucosa or organic secretions such as saliva and therefore do not penetrate the tissues that make up the oral cavity. These include surgical instruments and those used in orthodontic and prosthetic treatments.[10] Non-critical instruments do not come into contact with organic secretions, only with the patient's intact skin, or they do not come into contact at all. These include perforating forceps, plaster spatulas, and others.

Since 1992, with the publication of the Manual of Biosafety Standards Applied in Cuba to Occupational Risk, ongoing training sessions, workshops, and educational conferences on biosafety have been held to motivate healthcare personnel and users of the system, with the aim of protecting our work, family, and community environments.[9] In 1995, the Pan American Health Organization (PAHO) established that the biosafety and infection control practices recommended by international organizations are applicable to all settings and all specialties in which dental treatment is provided. According to data provided by the WHO for the year 2000, there were 2 billion people infected with hepatitis B worldwide (38 % of the world's population) and 170 million infected with hepatitis C in the same year (3 % of the population). According to data from the UN/AIDS program, by the end of 2002 there were 42 million people infected with HIV worldwide, equivalent to 0,8 % of the world's population.

The biosafety chain is a dynamic and balanced process between agent, host, and environment. Most dental

procedures are invasive, and activities related to them are high risk for healthcare personnel and patients. Therefore, it is necessary to adopt a responsible attitude that generates behavioral changes and sound decision-making, both among dental personnel and health planners and managers, in the performance of the activities inherent to our profession.[11]

Among the basic principles of biosafety is universality, which assumes that everyone is a carrier of some infectious agent until proven otherwise. All personnel in all services must be involved, even if their serology is unknown, and must follow all standard recommendations to prevent exposure to risks. Protective barriers include the concept of avoiding direct exposure to blood and other potentially contaminating body fluids through the use of appropriate materials that prevent contact with them. Waste disposal methods include all appropriate devices and procedures through which materials used in patient care are deposited and disposed of without risk.

The National Committee on Biosafety in Oral Health, in collaboration with national and international technical experts and in accordance with its functions, presents the second revision of the Manual of Biosafety Standards. This manual is intended for oral health teams, planners, architects, engineers, administrators, biomedical professionals, occupational health personnel, merchants, and others, with the purpose of providing them with a tool that they can use as support to minimize the risks inherent in dental practice to the health of our patients, dental personnel, and the community.

When referring to the hospital environment, we generally mean the conditions of the water, air, temperature, food, waste, and physical conditions surrounding patients, staff, and the population that could affect their senses or body tissues.[12,13] Biosafety is extremely important, as it refers to measures designed to establish a barrier mechanism that prevents the transmission of infections in all health-related activities. Its importance lies in the prevention and control of infections.[14]

Work activities must be subject to a set of guidelines and standards that guarantee the health of workers. There are a whole series of strategies and procedures aimed at preventing accidents and illnesses. The area of knowledge that deals with all of this is biosafety. Its main objective is to reduce workplace accidents, making it necessary to have a safe working environment where occupational health laws promote the identification of potential risks in daily activities.

It is essential to implement the necessary biosafety measures, as otherwise the likelihood of workplace accidents in dentistry departments increases.[15,16] Effective control must be carried out to prevent cross-infections in dentistry departments, using appropriate methods of disinfection, sterilization, and instrument storage, scheduling patients appropriately, and keeping work areas clean.

At the end of each patient's treatment and at the end of each workday, furniture surfaces should be cleaned with water and disposable towels and disinfected with an appropriate solution with a medium bactericidal level or hospital-grade disinfectant.[17,18] Surfaces such as tables and trays that have come into contact with fluids, blood, or materials used inside the patient's oral cavity should be decontaminated with a hospital disinfectant solution (phenol and chlorinated compounds) and covered with sterile disposable cloths.

Aseptic technique refers to practices before or during a clinical or surgical procedure to reduce the risk of infection in the client by decreasing the likelihood of microorganisms entering areas of the body where they can cause infection.[19,20] Among the main aseptic techniques in surgical centers is hand washing, which reduces the risk of infection in the patient in case the gloves are perforated or broken. as the warm, moist conditions inside gloves promote the growth of microorganisms. Surgical washing with an antiseptic before removing gloves removes or eliminates many microorganisms and also helps prevent their growth.

Currently, various comparative studies have shown that hand washing should last between 3 and 5 minutes. It is recommended that it be done 2 or 3 times, rinsing each time to remove contaminated soap. It is usually done with brushes that contain iodopovidone or chlorhexidine. It is recommended to focus on the fingers, folds, and nails.[21,22,23]

The aim of ventilating operating rooms is to reduce the concentration of particles and bacteria. Surgical clothing and drapes placed between sterile and non-sterile areas of the surgical field and personnel act as barriers and thus protect against the transmission of bacteria from one area to another. The most important characteristic of surgical clothing is its impermeability to moisture, as the capillary effect of a wet cloth or uniform will transmit bacteria from one side of the material to the other. Reusable surgical uniforms should be made of cotton with a fabric density of between 420 and 810 threads/meter.[24]

Today, given the epidemiological context, disposable gowns made from processed and treated cellulose fiber are used as an alternative, since gowns made from 810 threads/meter are effective as a barrier but have the disadvantage of losing this effect when washed more than 75 times. Various studies have found that in up to 15 % of cases, gloves break during surgery or have holes at the end of the procedure.

Masks must be worn because a significant percentage of operating room personnel are carriers of highly pathogenic germs in their nostrils or mouth. There are conflicting studies when attempting to demonstrate the effect of masks. While some find a decrease in infections with the use of masks, others have found similar

results with or without masks, although the latter studies were conducted on short-term procedures. A stable temperature should be maintained in the operating room between 20 and 24 degrees Celsius, while humidity should be in the range of 30 to 60 %.

Ventilation must be maintained at positive pressure in relation to corridors and adjacent areas, with a minimum of 15 air changes per hour, although values ranging from 16 to 20 changes, or 20 to 25 per hour, are described. Air should enter at the top of the operating room and exit at the bottom. The use of laminar flow is not recommended, as no significant benefit has been noted in its use.[24] The number of people entering the surgical area should be kept to a minimum, as the microbial level in the area is proportional to the number of people circulating in it, with beta-hemolytic streptococci and Staphylococcus aureus at high levels when too many staff are involved in procedures.

Dental staff providing clinical services should use isolated barriers, which are simply suitable materials that prevent contact with blood or other potentially contaminating body fluids. The use of such barriers does not prevent accidents involving exposure to these fluids, but it does reduce the consequences of such accidents. Gloves, considered a second skin, are the best mechanical barrier for the hands as a protective measure for professionals, technical staff, and patients.

Oronasal protection, or face masks, are extremely important for any dental procedure, as contamination of the oral and nasal mucosa with microorganisms present in the dental office is very common and can lead to various types of diseases. These must be made of material that is impervious to aerosols or splashes; if textiles are used, they must be sterile. The use of sanitary gowns is mandatory for all members of the healthcare team and must be changed when they show visible signs of contamination.

Given the current global epidemiological situation, particularly in the Special Municipality of Isla de la Juventud, long-sleeved sterile gowns that reach to the middle of the legs must be worn for all types of dental treatment. In addition, healthcare gowns should not be worn outside the dental office, as this contributes to the spread of microorganisms, and gowns should not be washed with other types of clothing. Caps should be an important part of staff attire, as they act as a barrier preventing scalp cells or loose hair from carrying resident bacteria to the surfaces of the operating field, or viruses such as SARS-COV-2 from being transmitted from aerosol droplets to the hair of dental staff.

Goggles prevent fluids from the patient from reaching the eyes of staff, so the use of goggles together with a mask increases the safety of the dentist. They should be cleaned routinely before attending to another patient.[25,26,27,28,29] In the new epidemiological context, this measure is particularly important in increasing the biological safety of dental staff and, in turn, in breaking chains of infection in this disease.

Shoes should be comfortable, with soft but thick soles that prevent a needle accidentally dropped on the floor from piercing the sole and pricking the surface of the foot. Surgical boots must be clean and, after use, must be placed in a suitable place for further processing.

The design of the surgical area must meet minimum requirements: floors and walls must be antistatic, made of flat, waterproof, unalterable, hard, and resistant material with rounded corners to facilitate cleaning; the ceiling must be 3 meters high from the floor; and there must be a specific area for the temporary storage of contaminated clothing or equipment.[28] All forms of surgical clothing serve a single purpose: they constitute a barrier between sources of contamination and the patient or staff. Standards of asepsis must never yield to individual comfort or fashion trends.

Dentists should avoid, as much as possible, sudden movements that expose participating staff to sharp injuries and excessive bleeding. In addition, they should handle tissues delicately, eliminate dead spaces, place appropriate drains, and reduce the duration of surgery as much as possible to eliminate risks of contact or transmission of noxious agents between professionals and patients or vice versa.

Healthcare personnel should avoid wearing jewelry and watches in the consultation room; the use of carpets, rugs, curtains, plants, or false ceilings should also be avoided in the consultation room. Eating, drinking, smoking, or applying cosmetics in work areas is not permitted, nor is walking around different areas with protective equipment on, or touching parts of the body or handling objects other than those in the work area while wearing gloves.[26] Cover surfaces that are difficult to disinfect, use thick gloves for disinfecting, wash laboratory equipment and materials with water and hypochlorite, and keep nails short and unpainted.

Sterilization is the process by which all living forms are eliminated from inanimate objects; it destroys the vegetative forms and spores of microorganisms and provides antibacterial protection for instruments and materials. Sterilization can be achieved through physical means, such as heat, and through chemical substances. Dry or moist heat should be used as a means of sterilization.

The authors indicate that, in dentistry, the most effective method is the combination of heat and pressure, which is achieved with the use of autoclaves, thus eliminating spores. We must bear in mind that the profile of dental care has undergone changes in recent years due to the emergence of new diseases and the incorporation of new treatment technologies. Social interest in the quality of health services, the importance of occupational health, the importance of environmental protection, and the widespread availability of information have

created a need to review and update infection control procedures in dental practice.

Various studies have shown that the incidence of percutaneous injuries and contamination with bodily fluids is high. This is due to the procedures performed during different pre-clinical and clinical treatments. Healthcare professionals in general are exposed to the transmission of multiple diseases through accidents with contaminated instruments, splashing of blood and saliva onto the conjunctival mucosa, or inhalation through the respiratory tract. Being aware of the problem, it is necessary to have knowledge of infection control to minimize the likelihood of contracting occupational diseases.

In dental clinics, in order to achieve a cleaner, more sustainable, and more economical environment that contributes to excellence and efficiency in service delivery, it is vital to implement Cleaner Production and the Energy Saving and Rational Use Program.[30,31,32,33] This study evaluates the level of knowledge that teachers have about Cleaner Production in Dentistry at the Gibara Teaching Dental Clinic. To prepare the study, a survey was conducted among all teachers at the health center. Cleaner Production is the continuous application of an integrated prevention strategy to processes, products, and services to increase efficiency and reduce risks to human life and the environment.[34]

In 2006, the WHO established four categories comprising the different factors in the health sector that influence the performance of staff, classified as individual, organizational, health sector, and environmental factors. Individual factors refer to the characteristics of the professionals themselves, including age, sex, marital status, professional training, length of service, knowledge of concepts, and training. Organizational factors are conditions that depend on and are inherent to the institution where the professional activity is carried out: institutional regulations, material and equipment in terms of operability and adequate number, sufficient staffing according to patient demand.[35]

Various studies are being conducted worldwide to assess the level of knowledge about biosafety, such as in Cuba, where the results have been unfavorable. In the population of Camagüey in 2008, a low level of knowledge about biosafety was evident.

In Matanzas in 2012, research showed that some dental services in Matanzas had difficulties complying with biosafety standards and maintaining a favorable work environment.[9] Similarly, in a study at the Teaching Dental Clinic in Gibara, Holguín, a survey was conducted in 2015 among all teachers at that health center, which found that there was a lack of knowledge about the term Cleaner Production.

In Quito, at the Central University of Ecuador in 2016, a study found that of 30 dentists and 4 dental assistants in the dentistry departments of the health operating units of district 17D03, 5 % had a good level of knowledge about biosafety measures, 90 % had a fair level, and 5 % had a poor level. On the other hand, in Peru in 2017, students at the School of Dentistry at the Alas Peruanas University in Arequipa revealed that the level of knowledge about biosafety measures was mostly average.

Students, dentists, specialists, and all workers in the health sector are ethically and legally bound to take appropriate action to implement all bi y measures that lead to safety, thus guaranteeing the integrity of the people involved. The consequences of poor implementation due to lack of knowledge trigger critical exposure to various pathologies that in one way or another threaten the health not only of the dentist, but also of auxiliary staff and patients themselves. Biosafety in dentistry is vital to achieving quality services. This issue, which is a problem in dental care not only in our region but throughout the country, must be given serious consideration.

The research being conducted is relevant, especially in the context of the COVID-19 pandemic, where it is necessary to take extreme biosecurity measures to ensure the health of patients and staff working in dental services due to the imminent risk to which they are exposed. At the Leonilda Tamayo Matos Teaching Polyclinic, five fines were imposed on workers in the dental area in 2017 for failure to comply with health and hygiene measures. In 2018, three fines were imposed for the same reasons, while in 2019 and 2020, none were imposed, and at the end of 2021, two were imposed for the use of clothing.

On the other hand, at the Orestes Falls Oñate Teaching Polyclinic, four fines were imposed in the Stomatology Department in 2017, and none in 2018. In 2019, five fines were imposed, three on dental assistants and two on dentists, for violations of biological safety standards. During 2020, already in the midst of the COVID-19 pandemic, two fines were imposed on dental assistants for the same reasons, and in 2021, two fines were imposed for not using protective barriers.

The main difficulties in complying with the established standards include: a shortage of material resources (gloves, drills, root canal files, and ultrasound equipment tips), which forces them to be reused; the use of clothing; the incorrect use of protective equipment; improper hand washing; poor hygiene in dental offices; poor ventilation and lighting, incorrect handling of sharp objects, lack of rigour and negligence on the part of administrative staff.

The above describes the problematic situation that prompted the following research, leading to the formulation of the following scientific problem: How can we contribute to improving the level of knowledge about biosafety among dental workers at the Orestes Falls Oñate and Leonilda Tamayo Matos Teaching Polyclinics

on Isla de la Juventud between November 2019 and January 2022?

The results of this research provided: a study on the relationship between the use of teaching aids (educational software) linked to direct methods in educational activities to increase the level of knowledge about biosafety.

The scientific novelty lies in the fact that, within the current epidemiological context, educational software that does not yet exist in the country is proposed to contribute to increasing the level of knowledge about biosafety among stomatology workers.

Objectives

General

To develop an educational intervention on biosafety for stomatology workers at the Orestes Falls Oñate and Leonilda Tamayo Matos Teaching Polyclinics, Isla de la Juventud, from November 2019 to January 2022.

Specific

1. Characterize the study sample according to the professional training of dentistry workers.
2. Identify compliance with biosafety standards in dental clinics before and after the educational intervention.
3. Determine the level of knowledge about biosafety among the dentistry workers in the study before and after the educational intervention.
4. Propose educational software on biosafety in dental clinics for dental workers.
5. Evaluate the impact of the educational software on biosafety among dentistry workers.

METHOD

An explanatory study with a quasi-experimental design was conducted with pre-test, post-test, and a control group of dentistry workers belonging to the " " and "Leonilda Tamayo Matos" teaching polyclinics in Nueva Gerona and "Orestes Falls Oñate" in Santa Fe, Isla de la Juventud Special Municipality, during the period from November 2019 to January 2022.

Universe and sample

The study universe consisted of 159 dentistry workers belonging to the Leonilda Tamayo Matos Teaching Polyclinics in Nueva Gerona and Orestes Falls Oñate in Santa Fe, Isla de la Juventud. The sample consisted of 130 workers who were active in stomatology services. It was intentional, divided into two groups, one experimental and one control, each made up of the same number of workers (65) to meet the requirements of initial equivalence and internal validity of any study with an experimental design.

An unloaded coin was used to assign the groups, and the side of the coin corresponding to each group (experimental and control) was designated.

Inclusion criteria

Dental workers who expressed their willingness to participate in the research and who belonged to the Dental Departments of the Orestes Falls Oñate and Leonilda Tamayo Matos Polyclinics.

Exclusion criteria

Dental workers who were on international missions, maternity leave, unpaid leave, or who did not wish to participate in the research.

The following methods were used during the research process.

Empirical methods

Scientific observation: of the activities, the stomatology system, and the working environment of the sample studied, from which theoretical generalizations were made that facilitated practice to enrich knowledge, and internal elements related to the biosafety conditions of workers in stomatology clinics on the Isle of Youth were analyzed.

Documentary analysis: a critical analysis was carried out of mandatory documents related to biosafety standards in dentistry.

Survey: An interview was conducted with the workers selected for the experiment to assess their level of knowledge of dental biosafety.

Experimental: this allowed us to verify the relationships between the elements of the scientific problem and determine with greater precision the cause-effect relationship between them.

Theoretical methods

These were used for the conceptual interpretation of the empirical data found, to explain the facts, and the essential relationships and fundamental qualities of the phenomenon under study; among these methods,

the following were used:

- Analytical-synthetic: this allowed the elements of the problem to be studied in relative independence from one another and also to discover the relationships between the elements, as well as the dialectical interaction established between them.
- Inductive-deductive: this allowed generalizations to be established on the basis of the study of singular phenomena, biosafety, which made it possible to arrive at certain generalizations that constituted starting points for inferring and confirming theoretical formulations.
- Historical-logical analysis: this allowed us to study the trajectory of events that have marked important aspects of biosafety in dentistry in the workplace, and to reveal the internal logic of the development of these phenomena, as well as the relationship between dental biosafety and teaching methods, and their progressive march towards a deeper, more complete, and more developed stage.
- System approach: provided general guidance for studying the overall reality, biosafety in the workplace, and the ways in which they interact.

Mathematical and statistical methods: these enabled the sample to be studied to be determined, as well as the processing of the information collected through the working instruments, facilitating the generalizations and interpretations that must be made from the empirical data found through measures such as absolute frequencies, relative frequencies, percentages, averages, and indices.

Selection of variables

Variables: experimental groups, professional training, compliance with biosafety standards, level of knowledge about biosafety, teaching methods (educational software).

Independent variables: teaching methods (educational software).

Dependent variables: compliance with biosafety regulations, level of knowledge about biosafety.

Extraneous variables: experimental groups, professional training.

Table1. Operationalization of variables

Variable	Type	Scale	Description
Experimental groups	Qualitative Nominal	Experimental group	Workers who are grouped together in a group where the educational software was applied.
		Control group	Workers who are grouped together in a group where the educational software was not applied.
Professional training	Qualitative Nominal Polytomous	Dentists Degree holders in dental care Dental care technicians Prosthetic Rehabilitation Graduates Prosthetic Rehabilitation Technicians	According to the biosafety standards applicability observation guide carried out on workers in both the experimental and control groups.
Compliance with biosafety standards	Qualitative Nominal Polytomous	Protective barriers Hand washing Dental office hygiene Equipment disinfection Sterilization of instruments Change of burs for each patient No use of clothing Handling of sharp instruments. Handling of solid waste	According to the biosafety standards applicability observation guide carried out on workers in both the experimental and control groups.
Level of knowledge about biosafety	Qualitative Polytomous Ordinal	Good Fair Poor	According to a survey on biosafety knowledge among dental workers.
Teaching methods	Qualitative Non-metric Nominal Dichotomous	Yes No	Workers who used the educational software. Workers who did not use the educational software.

Techniques and procedures

Bibliographic searches were conducted on the research topic in both national and international texts, in digital and hard copy formats, to define the problem and provide the basis and justification for the research.

The sources of information used during the research were:

- Guide to the applicability of biosafety standards for dental workers.
- Survey on the level of knowledge about biosafety for dentistry workers.

With prior informed consent from the workers selected for the research, a scientific observation was carried out using an observation guide before and after the intervention to identify their professional training and determine the main factors that influence non-compliance with biosafety standards. This allowed the educational work with these workers to be targeted.

A biosafety knowledge survey was administered to the 130 workers in the study sample before and after the educational intervention. The survey was validated by Antonio Suárez Rodríguez, who holds a degree in psychology and higher education. It consisted of 10 questions and was rated as Good, Fair, or Poor as follows:
Survey rating

- The correct answer to question 1 is (Yes). One point is awarded.
- The correct answer to question 2 is (Yes). One point is awarded.
- The correct answer to question 3 is (Yes). One point is awarded.
- The correct answer to question 4 is (a, b, e). One point is awarded for each correct answer.
- The correct answer to question 5 is (c). 1 point is awarded.
- The correct answer to question 6 is (all of the above). 1 point is awarded for each answer marked.
- The correct answer to question 7 is (Yes). 1 point is awarded.
- The correct answer to question 8 is (d). 1 point is awarded.
- The correct answer to question 8.1 is (a). 1 point is awarded.
- The correct answer to question 9 is (g). 1 point is awarded.
- The correct answer to question 10.1 is (Yes). One point is awarded.

The total evaluation of the biosafety knowledge survey is 18 points, distributed as follows:

- Good (13 to 18 correct answers)
- Fair (6 to 12 correct answers)
- Poor (fewer than 6 correct answers)

Educational software on Biosafety in Stomatology was developed and applied in a participatory manner to workers belonging to the experimental group. It was applied in the IT department of the health institution once a week for 4 months. Workers belonging to the control group were only given the biosafety knowledge survey before and after.

The educational software was designed using Mediator Software, which has a gallery of templates from which you can select the one you want, use it, or design a new one, depending on the characteristics of the material. The image editor Photoshop 8.0 was used, with approximately 10 megabytes of disk space. Each of the linked pages was designed using a central page (also called the home page, cover page, index, or homepage), on which the structure of the directory or folder tree directly depends. It hosts documents from other programs which, once linked, are displayed in the browser window, provided that the appropriate software is available.

This software facilitates the acquisition of knowledge as workers can learn through stimuli in the learning environment, the use of images, animations, and videos, elements that enable and motivate learning.

The surveys applied to the sample were validated by Antonio Suárez Rodríguez, who holds a degree in Psychology and a Master's degree in Professional Pedagogy. The educational software was validated by the following specialists: Yasser Álvarez Ferrer, Bachelor of Computer Science; Antonio Suárez Rodríguez, Bachelor of Psychology; Rosa María Montano Silva, PhD in Stomatology; Sehyla Arlettys Matos Arias, PhD in Stomatology; Yunaisy Pantoja Caraballo, PhD in Stomatology; Yaima Pupo Martínez, PhD in Stomatology; and Reynaldo Lugo Angulo, DrC. Reynaldo Lugo Angulo.

Information collection

Information was collected using the observation guide and the aforementioned knowledge survey to determine the factors that influence non-compliance with biosafety standards. It also allowed us to validate the teaching methods used.

All the information collected was processed digitally using a computer with Windows 10 as the operating system and Word and Excel, both from the Microsoft Office 2016 suite, to prepare the text and statistical tables. The results were presented in tables and graphs, which were summarized and expressed as percentages.

This was followed by analysis and discussion with other studies reflected in the bibliographies consulted, in order to achieve the proposed objectives, reach conclusions, and issue the relevant recommendations.

Ethical considerations

Informed consent was obtained from the workers who participated in the intervention. The data obtained in the study were used confidentially, demonstrating respect for the principle of autonomy of the international code of bioethics for intervention in human beings. They were not used for personal purposes, nor were details of this research published that could compromise the integrity of researchers, workers, or entities. The

information obtained was used by the author for research purposes. The results were presented collectively and not individually.

RESULTS AND DISCUSSION

Table 2. Distribution of the professional training of stomatology workers according to experimental groups. Isla de la Juventud 2019-2022.

Professional training of dentistry workers	Experimental groups				Total	
	Experiment		Control			
	No	%	No.	%	No.	%
Dentists	32	24,6	33	25,4	65	50
Degree in Dental Care	12	9,2	11	8,5	23	17,7
Dental Technicians	14	10,8	13	10	27	20,8
Prosthetic Rehabilitation Graduates	5	3,8	4	3	9	6,9
Prosthetic Rehabilitation Technicians	2	1,5	4	3	6	4,6

Table 2 shows the distribution of professional training among stomatology workers according to experimental groups, where it is evident that the highest percentage is represented by stomatologists with 50 % of the total, distributed as 24,6 % corresponding to 32 stomatologists in the experimental group and 25,4 % in the control group with 33 stomatologists. followed by dental technicians with 20,8 % of the total, 10,8 % corresponding to the experimental group and 10 % to the control group. In addition, there are 14 and 13 technicians in each group of the experiment, followed by dental care graduates with 17,7 % of the total, represented by 12 graduates from the experimental group and 11 from the control group, for 9,2 % and 8,5 %, respectively. Next are the Prosthetic Rehabilitation Graduates with a total of 9 workers, representing 6,9 % of the total, with 3,8 % corresponding to the experimental group and 3,1 % to the control group. Finally, prosthetic rehabilitation technicians accounted for 4,6 % of the total, with a total of 6 workers, 1,5 % of whom were in the experimental group and 3,1 % in the control group.

These results coincide with the work carried out by Dr. Jonathan Mauricio Bolaños Endara in Quito, Ecuador, where the largest percentage of the sample studied was made up of dentists (88,2 %) and dental assistants (11,8 %) from the dentistry departments of the health units in district 17D0317. They are similar to those obtained by Solangel Jiménez González and Maribel Salgado Izquierdo in Marianao, where 58,9 % of the units analyzed were dentists and 41,1 % were dental technicians. They also correspond to those carried out by Maidelis Guilarte Cuenca, Ruth Samón Cruz, and Reinaldo Fernández Justiz at the Julio Antonio Mella Teaching Clinic in Guantánamo, where 61,5 % of the workers studied were stomatologists and 38,5 % were dental technicians.On the other hand, they differ from the studies by Fernando Martín Álvarez Barahona and Christian Fernando Juna Juca carried out in a health center in Latacunga, Ecuador[36] and from the study by Enrique Augusto Velásquez Cuentas in Valle del Alto Mayo, San Martín region, Venezuela, where 100 % of the workers studied were dentists.[37]

The author considers that these results were obtained because in the departments and dental clinics, the vast majority of the staff have professional training as dentists, which is why when research is carried out that takes professional performance into account, more than half of the workers are dentists by profession. This is because the raison d'être of a stomatology department or clinic is to provide comprehensive care to patients, a task that, although carried out by an entire team, is fundamentally linked to the dentist, as they are the person with the necessary knowledge to diagnose, treat, and rehabilitate pathologies affecting the stomatognathic system.

Table 3 shows the distribution of compliance with biosafety standards by stomatology workers according to experimental groups before and after the educational intervention, where it is evident that the biggest problem before the educational intervention was the use of clothing, with only 30 % of workers not wearing clothing when providing comprehensive care to patients, followed by solid waste management, where 58,5 % did so correctly. followed by solid waste management, where 58,5 % did so correctly. Seventy-six point nine percent of workers performed comprehensive dental treatment on patients in consultations with proper hygiene, 78,5 % correctly disinfected surfaces in the consultation room and the dental unit, 80 % washed their hands before attending to each patient, 85,4 % handled sharp instruments correctly, 90,8 % used protective equipment, and 98,5 % changed burs for each patient. 73,4 % of the experimental group complied correctly with biosafety standards in general, as did 78,2 % of the control group.

Table 3. Distribution of compliance with biosafety standards by stomatology workers according to experimental groups before and after the educational intervention. Isla de la Juventud 2019-2022.

Compliance with biosafety standards	Before the intervention				Total		After the intervention				Total	
	Experiment		Control				Experiment		Control			
	No	%	No	%	No	%	No	%	No	%	No	%
Protective barriers	56	43.	62	47,7	11	90,8	65	50	63	48,5	128	98,5
Hand washing	53	40,8	51	39,2	104	80	64	49,2	53	40,8	117	90
Dental office hygiene	46	35,4	54	41,5	100	76,9	63	48,5	55	42,3	118	90,8
Equipment disinfection	52	40	50	38,5	102	78,5	63	48,5	56	43,1	119	91,5
Sterilization of instruments	53	40,7	56	43,1	109	83,8	64	49,2	57	43,8	121	93,1
Change of burrs per patient	63	48,5	65	50	128	98,5	65	50	63	48,5	128	98,5
No use of clothing	14	10,8	25	19,2	39	30	53	40,7	35	26,9	88	67,7
Handling of sharp instruments	56	43,1	55	42,3	11	85,4	64	49,2	60	46,2	124	95,4
Solid waste management	36	27,7	40	30,8	76	58,5	56	43,1	46	35,4	102	78,5

These results coincide with those obtained by Jenny Camargo, María Camila Sierra, and Yesenia Vera at the Santo Tomás de Floridablanca Dental Clinics in 2016, which found numerous shortcomings in the use of protective barriers that directly affect operators, patients, and assistants. Of the 104 people evaluated, including students, teachers, and assistants, it was established that although the vast majority of those evaluated used protective barriers, not all did so in the proper manner.[19]

Another coincidence with the results of the present study was the findings of Hernández Montoya and Simancas, who, in addition to describing the knowledge of a group of dentistry students, described their practices and attitudes toward biosafety. This study revealed statistically significant relationships that compromised the semester completed by the students, taking into account their knowledge of protocols to follow in the event of accidents and their attitudes toward biosafety.[38]

In another study conducted by Dr. Solangel Jiménez González and Dr. Maribel Salgado Izquierdo on the implementation of preventive measures, it was found that the highest percentage, 72,7 %, received a poor evaluation, distributed as follows: dentists with 39,6 % and technicians with 33,1 %.[29] On the other hand, Fernando Martín Álvarez Barahona and Christian Fernando Juna Juc, in their study, showed that 42,9 % of professionals exhibited poor practices regarding the correct use of protective equipment for patient care. With regard to hand washing, 93 % of dentists washed their hands before and after the workday, but only 50 % of the study subjects washed their hands before and after each procedure. In all of the district's centers, sharp objects were found to be handled in special containers.[36]

In a study conducted by Moreno Puente, María Monserrath Bastidas Vargas, and Andrea Soledad on students at the Graduate Institute of the Faculty of Dentistry of the Central University of Ecuador, mixed results were found regarding the disinfection of equipment and materials, which became reservoirs of pathogenic microorganisms and potential sources of infection for patients who come to this institute for care.[39] These results also coincide with the results of this research.

After the educational intervention was implemented, the percentage of compliance with biosafety standards rose to 95,1 % in the experimental group. The greatest weakness is still found in the use of clothing, but at a lower percentage, with 67,7 % not wearing clothing when caring for patients, 78,5 % handle solid waste correctly, 90 % wash their hands after each patient, 90,8 % have good hygiene in the dental office, 95,4 % handle sharp instruments properly, and 98,5 % change the drill bit for each patient and use protective barriers.

These results coincide with a study conducted by Carlos Ramón Bazurto Marcillo and José Ramón Moreira García from December 2011 to May 2012 on clinical laboratory staff at the Verdi Cevallos Balda Hospital in Portoviejo, using a purely field-based methodology, with direct observation as the technique, which demonstrated that the level of knowledge possessed and applied by this staff largely meets the biosafety quality standards required by the WHO. The results of this study also coincide with those obtained by Oscar Rubén Silva Jiménez, where the level of practices and attitudes of the students evaluated was high, as they were aware of the risks of infection with any disease within the dental office.[22]

In a study on solid waste management conducted by Maidelis Guilarte Cuenca, Ruth Samón Cruz, and Reinaldo Fernández Justiz, it was found that only 23,1 % of those evaluated demonstrated sufficient practice, while 76,9 % performed inadequately,5 differing from the results obtained in this study. , a study conducted by Enrique Augusto Velásquez Cuentas found that an observation test revealed poor compliance with biosafety standards among the workers evaluated.[37] Nor do they correspond to Mauricio Jonathan Bolaños Endara in a study in the health operating units of district 17d03 in Quito, Ecuador, where, in relation to practices, it was observed that most of the staff did not adequately comply with biosafety standards in relation to hand washing and the use

of barriers in invasive procedures.[32]

The author considers that it is necessary to bear in mind at all times that minor bleeding may occur during dental procedures and that spontaneous bleeding is not uncommon. If we also take into account that the oral cavity is a carrier of a multitude of microbial agents, including SARS-COV-2, we can conclude that stomatologists can become infected or accidentally infect patients in the course of their work. For these reasons, it is considered that dentists should have a detailed knowledge of biosafety principles and incorporate them into their daily practice, thus preventing cross-contamination and the spread of infectious diseases such as COVID-19.

These principles include universal precautions, which are a set of measures that must be applied systematically to all patients without distinction, considering that anyone may be at high risk. Likewise, all bodily fluids must be identified as potentially contaminating.[40] Biosafety measures must involve all patients,[41] regardless of whether or not they have visible signs or symptoms of a disease that could lead to an imbalance in the health-disease process.

Hand washing techniques vary according to the length of time the professional is in contact with the antiseptics and disinfectants used to achieve cleanliness, i.e., the elimination of all pathogenic microorganisms found on the hands. Hand washing techniques have been classified as short or clinical, medium, and long or surgical.[42] There are also methods for eliminating microorganisms, which are considered to be all procedures designed to ensure the elimination or reduction of microorganisms from inanimate objects used in patient care, with the aim of interrupting the chain of transmission and providing a safe practice for the patient.[43]

Sterilization is the process by which all living forms are eliminated from inanimate objects; it destroys the vegetative forms and spores of microorganisms and provides antibacterial protection for instruments and materials.[44]

The author considers personal hygiene to be one of the most important biosafety standards. Within this standard, special importance should be given to the following aspects:

- Hair must be tied back and a cap worn at all times during dental procedures.
- Cuts and wounds on operators must always be covered with waterproof dressings before starting work. Skin lesions on the hands must be covered with dressings and gloves.
- Do not wear jewelry during working hours.
- Wash hands before putting on gloves and after finishing treatment with each patient.
- Do not touch any part of your body while wearing gloves.
- Gowns should be long-sleeved and changed daily, or more frequently if visibly contaminated.
- Keep nails clean, unpainted, and short, not extending beyond the fingertips. Do not wear acrylic nails.
- Wear closed shoes.

Workers with open sores, weeping dermatitis, or similar lesions, especially on the hands, should avoid contact with patients until they are healed. For hand washing, use liquid antimicrobial soap with a dispenser or, when conditions do not allow, hydroalcoholic gel.[8] It is imperative to wash the forearms, palms, backs of the hands, between the fingers, and around the nails, paying special attention to the folds, which accumulate the most bacteria.[45,46]

In the author's opinion, hand washing should be carried out with dermatological soap that has antimicrobial properties by all professionals who provide comprehensive care to patients in the dental office. A hand brush should be used to remove as many pathogenic microorganisms as possible, and this should be done in the following situations:

- Upon arrival at the dental office.
- Before and after treating each patient.
- Before putting on gloves and after taking them off.
- When accidentally touching any object that may be contaminated with blood, saliva, or secretions.
- Before and after eating.
- After using the restroom.
- In case of visible contamination with blood, wash hands immediately with plenty of water and disinfectant soap.

After washing your hands thoroughly, rinse them with plenty of water to remove all soap residue, dry them well with paper towels, disposable towels, or automatic drying devices to prevent fungal infections due to moisture or dermatitis caused by soap residue. After washing your hands, use paper towels to turn off the water and apply moisturizing lotions after washing your hands to prevent dermatitis or irritation.

In the author's opinion, it is extremely important to use protective equipment, especially in the current epidemiological situation to which dental staff are exposed on a daily basis. The essential protective equipment

is: sanitary gowns, goggles, face masks, caps, face shields, boots, and gloves. A medical gown must be worn when entering the dental clinic or, alternatively, other clothing that covers street clothes, taking care to cover cuffs and remove neck scarves. Upon arrival at the clinic, a long-sleeved gown must be worn, which must be sterile to prevent contamination of normal clothing in the dental office.

In addition, wearing glasses prevents eye infections and injuries caused by particles projected toward the operator's eyes. Although they protect against frontal impacts and splashes, their side protection is limited unless they have side shields.[47] In the author's opinion, glasses should be large and fit snugly to the face to provide effective protection. Currently, they should be worn with protective face shields over them to achieve maximum protection, especially considering the contagiousness and transmissibility of microorganisms such as SARS-COV-2 found in the oral cavity, which can enter the human body through the conjunctiva of the eyes.

Masks that protect the nasal and oral mucosa should be used to prevent contamination from aerosols originating from the rotary instrument used in surgical procedures. The face mask should be disposable and large enough to cover the nose and mouth, and the use of the mask recommended by the WHO in the current COVID-19 pandemic is recommended for greater protection.

One that fits the operator's face well should be selected to minimize the passage of unfiltered air. Ideally, it should be changed between patients. If this is not possible, caution should be exercised and it must be changed when it is damp or dirty. In the current epidemiological context, the author considers that the face mask recommended by the WHO should be used, but given the economic situation in Cuba and the shortage of material resources in health institutions, a sterile cloth face mask may be used and changed between patients. This also prevents environmental contamination from solid waste, which has increased due to the pandemic, as cloth face masks can be reused after sterilization.

In the author's opinion, the use of caps and sanitary boots should be mandatory, not only in invasive procedures, but in all procedures performed in the dental office. The theoretical basis for this is the COVID-19 pandemic and the high contagiousness of the virus that causes it.

There are various types of materials for gloves, such as latex, vinyl, synthetic polymer, and nitrile.[49] In Cuba, latex is generally used, which must be worn properly, fitted to each operator's hand, and discarded between patients. Surgical gloves must be used in invasive procedures. Patient protection is also of particular importance and yet, in the author's opinion, it is one of the aspects that is least effective in Cuba. Eye protection should be provided by using protective goggles that cover the patient's eyes. In Cuba, this is not done because dental clinics do not have the necessary equipment. It is therefore necessary to instruct the patient to close their eyes during procedures where there is a risk of contamination or injury. Chest protection should be provided using napkins or bibs. Bibs are easy to make from fabric and can be sterilized properly, but they are lacking in dental offices, and when they are available, there are not enough to use one for each patient.

In the author's opinion, the main difficulties in complying with biosafety standards include the shortage of material resources such as gloves, bibs, burs, root canal files, and ultrasonic equipment tips, which must be reused. Other difficulties included the use of clothing, the incorrect use of protective equipment, incorrect hand washing, poor hygiene in the dental office, and poor ventilation and lighting, caused by a lack of knowledge, irresponsibility on the part of healthcare personnel, and a lack of standards and negligence on the part of administrative staff.

Table 4. Level of knowledge about biosafety among dental workers according to experimental groups before and after the educational intervention. Isla de la Juventud 2019-2022.

Level of knowledge about biosafety	Before the intervention				Total		After the intervention				Total	
	Experiment		Control				Experiment		Control			
	No	%	No	%	No	%	No	%	No	%	No	%
Good	14	10,8	18	13,8	32	24,6	54	41,5	20	15,4	74	56,9
Average	28	21,5	27	20,8	55	42,3	9	6,9	32	24,6	41	31,5
Poor	23	17,7	20	15,4	43	33,1	2	1,5	13	10	15	11,5
Total	65	50	65	50	130	100	65	50	65	50	130	100

Biosafety is a set of technical and engineering measures and provisions, some of which are sufficient to be the subject of law, whose main objective is the protection of humans, animals, plants, and the environment.[42] The right to life and its preservation is a fundamental principle that humanity has embraced. Science and technology have advanced in pursuit of a better life, but the unthinking use of this knowledge poses threats to life, which is why biological security has been a hot topic in public opinion in many countries over the past 60 years.[43]

Table 4 shows the level of knowledge about biosafety among dental workers according to the experimental

groups before and after the educational intervention. Before the educational intervention, the predominant rating was fair in both the experimental and control groups, with a total of 42,3 %, followed by poor with 33,1 %. Only 15,4 % were self-trained in biosafety standards, and 55,3 % knew that all patients should be treated as potentially infected, but did not do so correctly. Most respondents reported that on occasion, knowing that it was wrong, they wore clothing while caring for patients. The greatest deficiency found was that workers did not recognize biosafety standards. Studies demonstrate the consequences of ignorance and/or non-compliance with preventive measures involving sharp objects, as reported in the United States by Hernández Montoya in a 2012 study of a hospital cleaning employee who contracted staphylococcal bacteremia and bacterial endocarditis after injuring himself with a needle.[39] Sharp objects are probably the greatest occupational hazard in the waste management sector , due to the damage they can cause and the transmission of diseases. It is estimated that between 600 000 and 800 000 needle stick injuries occur annually in the United States, although half remain unreported.[44]

The initial results were compared with other studies, coinciding with the work carried out by Dr. Jonathan Mauricio Bolaños Endara, which determined that of thirty dentists and four dental assistants, 5 % had a good level of knowledge about biosafety measures, 90 % had a fair level, and 5 % had a poor level.[17] The results obtained in this study coincide with a study conducted by Dr. Enrique Augusto Velásquez Cuentas, which found that the level of knowledge about biosafety is average among 29 dental surgeons in the Alto Mayo Valley, San Martín region, Peru, in 2016.[36]

This also coincides with the results obtained in Holguín in 2012 by Dr. Rivera and Dr. Licea, published in the journal Ciencias Médicas, with those carried out at the Faculty of Stomatology of Camagüey in 2013,[48] and with those obtained by nursing graduates Emma Hernández Valdez, Magda Acosta González, Betty Nadal Tur, Marilin Pijuan Pérez, Yilka Fon Abreu, and Dr. Nurys Armas Rojas in Havana, in 2016, where they carried out an educational intervention with the aim of increasing the level of knowledge about biosafety among nursing staff at the Institute of Cardiology and Cardiovascular Surgery, The results showed that 35 % of nursing staff were unaware of universal biosafety precautions and 23,3 % reported being unaware of precautions in the handling of needles and/or sharp instruments.[38]

These results are consistent with those obtained by Dr. Yarelis Almaral Rodríguez* in a study conducted at the Stomatological Teaching Clinic in Nueva Gerona, Isla de la Juventud, between 2014 and 2016, where the level of knowledge about biosafety measures was assessed through a questionnaire. Of the ten stomatologists evaluated, 40 % had a good level of knowledge, 50 % had a fair level of knowledge, and 10 % had a poor level of knowledge.[22] The study recognized the need for training courses for all healthcare personnel to strengthen their knowledge of biosafety.

The results of this research also coincide with the study conducted by Dr. Oscar Rubén Silva Jiménez on 347 undergraduate students at the Professional School of Stomatology in Ica, North Lima, and Chorrillos in 2017, which found that the level of knowledge was low. Similarly, the work carried out by Dr. Maidelis Guilarte Cuenca, Dr. Ruth Samón Cruz, and Dr. Reinaldo Fernández Justiz found that the majority of dental staff surveyed had insufficient knowledge about the proper handling of dental waste.[5]

After implementing the educational software on biosafety, notable improvements were found in the experimental group of sixty-five workers; Of these, 54 (41,5 %) were rated as good, responding satisfactorily to the knowledge surveys, 6,9 % were rated as fair, and only two respondents were rated as poor because they did not consider biological safety to be important. No significant changes were observed in the control group. Many of the workers did not acquire the knowledge and therefore do not apply it in their daily practice, leaving thirteen workers with a poor rating and 32, corresponding to 24,6 %, with a fair rating.

The results of this research do not coincide with the study conducted by Drs. Hernández Montoya and Simancas in 2012 in Washington, which described the knowledge, practices, and attitudes toward biosafety among 6th- to 10th-semester dentistry students. These authors conducted a cross-sectional, descriptive observational study with a sample of 83 students, who were given a survey designed by the researchers, finding a high level of knowledge among students about biosafety issues.[39]

Nor do they agree with the study conducted by Tapias, Fortich, and Castellanos in 2013, which evaluated knowledge and practices regarding biosafety measures in relation to the prevention of adverse events and occupational accidents among students in the Dentistry Program at the Rafael Núñez University Corporation. In this study, the sample consisted of 90 students attending the comprehensive clinic from the seventh to tenth semesters, and they concluded that approximately 50 % of the students obtained a high level of knowledge.[41]

Nor do they resemble those obtained by Dr. Solangel Jiménez González and Dr. Maribel Salgado Izquierdo, where 119 dentists and 83 dental technicians were evaluated in Marianao, Havana, during the period 2015-2016, found that their level of knowledge for the prevention of communicable diseases was satisfactory, with 69,7 % and 71,4 %, respectively.[29] Similarly, Fernando Martín Álvarez Barahona and Christian Fernando Juna Juc conducted a study in centers in Health District 05D01, Latacunga, Ecuador, in 2017, which showed a high percentage of professionals who are knowledgeable about protective equipment for patient care.[49] However,

they agree with the findings of Rosado, Calderón, and González in 2011, which found that more than 50 % of a group of students at a public university in Madrid did not have an adequate level of knowledge about biosafety. (44)

The risk of contracting, transmitting, and spreading numerous infections during professional practice in dental clinics has led Cuba to create an infection prevention and control program for dental services and to rigorously enforce biosafety standards, adapting them to the existing conditions in the country from both an epidemiological and economic standpoint. In the author's opinion, these results are due to the fact that most workers are not aware of or responsible for the importance of the various biosafety issues. This could also be because dentists, being immersed in patient care, do not fully comply with biosafety measures, despite having some knowledge on the subject, or because they do not take into account the importance of these standards and the danger they are exposed to by not complying with them. This fact has countless consequences, as these issues are not given the attention they deserve due to a lack of risk perception.

The cognitive component is only one link in the process of behavioral change. Individuals need to develop an adequate perception of risk, which is an incentive to continue educational efforts on the subject and thus reinforce strategies aimed at improving biosafety practices. In the author's opinion, dentists do not give enough importance to the risks of contracting a disease or infecting the patient, since the risk is for both of them. This is because they do not have an adequate level of knowledge on these issues to be able to act effectively with regard to biosafety. The results obtained in the research process highlighted the need to increase research on biosafety and to massively promote activities aimed at raising awareness on this issue, particularly given its importance in preventing cross-contamination in the current pandemic crisis.

CONCLUSIONS

Dentists predominated in both groups of the experiment according to the professional training of workers in the Stomatology Departments.

The use of protective clothing was the parameter that predominated in non-compliance with biosafety standards in both groups of the experiment before the educational intervention, with a positive change in the experimental group after using the educational software.

The level of knowledge about biosafety among the dentistry workers studied was average in both groups before the educational intervention, but increased significantly in the experimental group after the intervention.

The differences observed before and after the educational intervention allow us to evaluate the impact of the educational software on the development of biosafety activities carried out in the dentistry departments as positive and significant.

RECOMMENDATIONS

Promote the educational software through the media in waiting rooms and computer labs in polyclinics.

Continue to explore the topic of biosafety in greater depth so that the information provided by the media for use in educational activities can be updated.

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