

Healthcare students' knowledge about biosafety and prevention of COVID-19

Rafaela Martins de Farias*; Liliane Roskamp**; Patricia Maria Forte Rauli***; Isabela Roskamp Sunye*; Allan Abuabara****; Flares Baratto Filho*****; Natanael Henrique Ribeiro Mattos**; Maria Carolina Botelho Pires de Campos**; Camila Paiva Perin**

* Dental Student, Tuiuti University of Paraná (UTP), Curitiba, Paraná, Brazil

** Professor, Ph.D., Tuiuti University of Paraná (UTP), Curitiba, Paraná, Brazil

*** Director, Pequeno Príncipe Hospital and University, Curitiba, Paraná, Brazil

**** D.D.S, Joinville Municipal Authority, Joinville, Santa Catarina, Brazil

***** Professor, Ph.D., University of the Region of Joinville (Univille)

Received: 02/07/2022. Approved: 07/29/2022.

ABSTRACT

Because of the COVID-19 pandemic, people all over the world had to interrupt their face-to-face interactions. Health professionals were most affected, as they were at the forefront of combating this disease. Biosecurity measures had to be re-doubled to prevent the spread of the virus and thus help control the pandemic. Procedures in dentistry that generated aerosols were avoided, as saliva is one of the means of COVID-19 transmission. Complementary Personal Protective Equipment (PPE) was required to ensure protection, and environmental disinfection protocols had been modified. Thus, to assess the level of knowledge about biosafety and these new changes, particularly regarding COVID-19, a questionnaire was published for the community related to health courses in the city of Curitiba (PR, Brazil). This study included 159 students (dentistry, 107 (67.3%); medicine, 28 (17.6%); biomedicine, 17 (10.7%); and nursing, seven (4.4%)). Approximately 63.55% of dentistry, 100% of medicine, 64.71% of biomedical, and 85.71% of nursing students believe that undergraduate students are unprepared to provide urgent care to COVID-19 patients. Despite all the guidance on biosafety, students in healthcare must still develop skills in correct procedures for caring for patients with or without communicable diseases.

Descriptors: Coronavirus Infections. Health Personnel. Containment of Biohazards. Dentistry. Surveys and Questionnaires. Education, Dental.

1 INTRODUCTION

At the end of December 2019, cases of the severe acute respiratory syndrome of unknown etiology were observed, which began in China and rapidly spread throughout the world, becoming a pandemic. It was discovered that the disease was associated with coronavirus

(SARS-CoV-2; COVID-19), which belongs to the *Coronaviridae* family and can cause severe acute respiratory syndrome (SARS-2003) and Middle East respiratory syndrome (MERS-2012). These viruses are zoonotic and their initial transmission occurs from animals to humans¹. According to some studies, the

genome of this virus found in humans is identical to that found in bats, leading to the suspicion that bats are the virus's natural host and that the virus can be transmitted from these animals to humans via intermediate hosts².

The most common clinical manifestations are respiratory that appear after an average incubation period of five days. However, some patients can present with gastrointestinal symptoms such as diarrhea and vomiting. Aerosol-generating procedures during dental care increase the risk of exposure to SARS-CoV-2. Symptomatic patients are the main source of transmission; however, those who do not have symptoms can also be carriers of the virus, contaminating a large number of people^{1,3,4}. Experts agree that coronavirus can spread through talking, coughing, and sneezing. In addition, studies have shown that viruses can be transmitted through air. In this context, it is essential to differentiate between the two. Transmission through aerosols occurs with larger respiratory droplets that do not stay in the air for a long time, while transmission through air occurs with smaller droplets that remain for hours in the air and can be inhaled⁶.

Procedures that produce aerosols or exposure to body fluids or substances, including saliva or blood fluid, can be a means of propagation of viruses, bacteria, and fungi, both in the air and on surfaces. It is of great value that health professionals are always well-equipped and perform good aftercare cleaning of the environment to avoid contamination by contact⁶. The Sars-Cov-2 virus can survive on plastic, cardboard, and stainless-steel surfaces for up to 72 h and remain in an aerosol for at least 3 h, with a high power of infection. Therefore, it is important to carefully decontaminate the environment at the end of each dental or medical procedure^{7,8}.

Biosecurity measures that have always

been necessary to prevent any exposure to risks had to be modified during dental care to avoid the spread of the coronavirus and thus help control the pandemic. This highlights the use of N95, PFF2, or equivalent masks, reorganization of agendas, prioritization of the use of rubber dams, and preference for manual instruments^{9,10} with the aim of reducing aerosols, which contain a large amount of microorganisms¹¹⁻¹³.

Thus, it is necessary to expand biosafety measures to reduce the spread of the disease. The purpose of this study was to assess dental and other healthcare students' perceptions of biosafety standards during the coronavirus pandemic, identifying their level of understanding and shortcomings in these measures.

2 METHODS

This was a cross-sectional, quantitative study with a questionnaire built to measure health students' perceptions of biosafety standards, aiming to identify the differences before and after the beginning of the COVID-19 pandemic.

A total of 385 students were invited to participate in the research, including 125 students from the final two years of the Dentistry course at the Tuiuti University of Paraná (UTP), 100 from Medicine, 80 from Biomedicine, and 80 from Nursing from the Pequeno Príncipe Hospital and University.

When the survey was presented to students on 10/26/2020, the questionnaire was made available through a mobile message application or email. Those who voluntarily agreed to participate signed the free informed consent form and received a link to access the questionnaire (Google Forms, Google Inc., Mountain View, CA, USA). The form was available for receiving responses until 12/08/2020.

The identity of the participants was protected, and participation was optional, as they could choose whether or not to answer the questionnaire. All the answers were computed and analyzed. The Research Ethics Committee evaluated the research and approved it under CAAE number 38630520.9.0000.8040 and Opinion Number 4.782.968.

The questionnaire contained 19 multiple-choice questions (see figure 1). Two questions identified the course and university and 17 questions were about biosafety. The responses were automatically entered into a spreadsheet, thus ensuring patient confidentiality.

To assess the normality of the data, the Shapiro-Wilk and Levene tests were applied to assess homoscedasticity. Non-normal distribution was also observed. Thus, the non-parametric Kruskal-Wallis test was used to verify the difference between the rate of correct answers to questions related to biosafety, calculated by the percentage of correct answers for each course by considering all the answered questions. The frequency of correct answers was also compared among the different courses using the chi-square test. In addition, a descriptive analysis of the questions related to opinions on aspects of biosafety answered by the study participants was conducted. The significance level for all the analyses was set at 5% and was performed using the statistical software Jamovi v.1.6.

3 RESULTS

One hundred and fifty-nine participants collaborated with this study (107 (67.3%) from dentistry, 28 (17.6%) from medicine, 17 (10.7%) from biomedicine, and 7 (4.4%) from nursing courses) (table 1). The rate of adherence to the questionnaire was 85.6% among dental, 28% in medicine, 21.3% in Biomedicine, and 8.8% in nursing students.

Regarding the questions related to biosafety, the majority of responses from all courses were that dentistry professionals are constantly exposed to different risks, it is necessary to adopt several biosafety measures, and the use of personal protective equipment (PPE) helps to avoid exposure to the risk of contracting some diseases. Regarding the biosecurity measures adopted by the universities before the pandemic, 66 (61.68%) dentistry, 17 (60.71%) medicine, 12 (70.59%) biomedicine, and 3 (42, 86%) nursing students rated them as “good” (table 1).

Concerning the mandatory use of face shields following the occurrence of COVID-19, those who agreed were 90 (84.11%) students from dentistry, 17 (60.71%) from medicine, 10 (58.82%) from biomedicine, and 5 (71.43%) from nursing. Regarding the fact that the university should have visual alerts (signs, posters, and posters) about the correct hand hygiene, cleaning surfaces and the clinical environment, and garbage disposal, 104 (97.2%) dentistry and 26 (92.86%) medicine students agreed. In biomedicine and nursing, 24 (100%) responses supported these measures. For the question, “Do you think undergraduate students are prepared to provide emergency care to patients with COVID-19?”, 68 (63.55%) students of dentistry, 28 (100%) of medicine, 11 (64.71%) of biomedicine, and 6 (85.71%) of nursing answered “no” (table 1). There was no significant difference ($p>0.05$) in the responses among the courses evaluated or among the averages of correct answers (table 2).

Non-significant statistical differences ($p>0.05$) were observed for Questions 1, 4, 5, 6, 7, and 17 among the different courses. There was a statistically significant difference ($p<0.05$) among the courses in answers 2 and 3: “When should I wear gloves?” and “What are PPE?” (table 3).

<p>1- Course:</p> <p>2- University:</p> <p>3- What is biosecurity?</p> <p>a. A set of rules and measures to protect professionals from all areas.</p> <p>b. A set of rules and measures aimed at protecting health professionals.</p> <p>c. A set of rules and measures aimed at protecting health professionals and the population.</p> <p>d. A set of rules and measures to protect professionals from all areas and the population.</p> <p>4- When should I wear gloves:</p> <p>a. I do not need to wash my hands before the procedure, only after.</p> <p>b. I need to wash my hands before the procedure but not after.</p> <p>c. I need to wash my hands before the procedure and also after.</p> <p>d. I do not need to wash my hands either before or after because the glove already protects and is enough for biosafety.</p> <p>e. Not applicable</p> <p>5- What is PPE?</p> <p>a. Gloves, masks, and sneakers (propé)</p> <p>b. Masks, hats, and face shields</p> <p>c. Sneakers (propé), goggles, and apron.</p> <p>d. All these alternatives</p> <p>e. None of these alternatives</p> <p>6- What are the main individual biosecurity measures?</p> <p>a. Just wash your hands.</p> <p>b. Hand washing and use of PPE</p> <p>c. Just use PPE</p> <p>7- What is cross-infection?</p> <p>a. It is the transmission of pathogenic microorganisms from patient to patient.</p> <p>b. It is the transmission of possible diseases from patients to professionals.</p> <p>c. It is the transmission of diseases from professionals to patients.</p> <p>d. None of the alternatives.</p> <p>e. All alternatives.</p> <p>8- The cross-infection:</p> <p>a. Occurs with person-to-person contact</p> <p>b. Occurs from objects to people</p> <p>c. Occurs from people to objects to people</p> <p>d. None of the alternatives.</p> <p>e. All alternatives.</p> <p>9- What are the sources of cross-contamination?</p> <p>a. Blood and saliva</p> <p>b. Saliva and contaminated surfaces</p> <p>c. Blood, saliva, and contaminated instruments</p> <p>d. None of the alternatives.</p> <p>e. All alternatives.</p>	<p>Regarding the following items, evaluate by selecting the option that best represents your answer: C – Agree, IN – Indifferent, D – Disagree, SO – No opinion, NA – Not applicable.</p> <p>10- Dental professionals are constantly exposed to different risks, so they must adopt several biosecurity measures. Do you agree that surface cleaning should be done with antimicrobial products such as 70 alcohol, sodium hypochlorite, among others? () C () IN () D () SO</p> <p>11- Do you agree that using personal protective equipment (PPE) helps to avoid exposure to risks of contracting any disease? () C () IN () D () SO</p> <p>12- In your opinion, in general, the biosecurity measures adopted by the University before the pandemic were: () Excellent () Good () Regular () Bad () Terrible</p> <p>13- Do you agree with the mandatory use of face shields after the incidence of COVID-19? () C () IN () D () SO () NA</p> <p>14- Do you agree that the university should have visual alerts (signs, posters, and posters) about correct hand washing, cleaning surfaces and the clinical environment, and waste disposal? () C () IN () D () SO</p> <p>15- Do you agree that the N95 mask is an ally to the face shield and should be used together? () C () IN () D () SO () NA</p> <p>16- Do you think that when using the face shield, goggles become unnecessary PPE? () C () IN () D () SO () NA</p> <p>17- Do you agree that it is necessary to disinfect shoes at the entrance door of clinics on disinfectant mats and check body temperature and oximetry readings before consultations? () C () IN () D () SO () NA</p> <p>18- Do you think undergraduate students are prepared to provide emergency care to patients with COVID-19? () YES () NO</p> <p>19- How is the correct sequence of undressing (removal of PPE) after each service? a. Face shield, lab coat/apron, mask, and hat B. Gloves, face shield, lab coat/apron, hat, and mask c. Gloves, face shield, mask, hat, a lab coat, and apron d. Not applicable</p>
---	--

Figure 1. Questionnaire with 19 multiple-choice questions

Table 1. Frequency of answers to each question by course

Question	Course (answer percentage)				
	Answer	Dentistry	Medicine	Biomedicine	Nursing
<i>Dental professionals are constantly exposed to different risks, so they must adopt several biosecurity measures. Do you agree that surface cleaning should be done with antimicrobial products such as 70 alcohol, sodium hypochlorite, among others?</i>	Agree	100	100	100	100
<i>Do you agree that using personal protective equipment (PPE) helps to avoid exposure to risks of contracting any disease?</i>	Agree	100	100	100	100
<i>In your opinion, in general, the biosecurity measures adopted by the University before the pandemic were:</i>	Excellent	11.21	3.57	23.53	14.29
	Good	61.68	60.71	70.59	42.86
	Regular	23.36	35.71	5.88	42.86
	Bad	3.74	0.00	0.00	0.00
<i>Do you agree with the mandatory use of face shield after the incidence of COVID-19?</i>	Agree	84.11	60.71	58.82	71.43
	Indifferent	3.74	14.29	11.76	14.29
	Disagree	6.54	14.29	29.41	0.00
	No opinion	3.74	10.71	0.00	0.00
	Not applicable	1.87	0.00	0.00	14.29
<i>Do you agree that the university should have visual alerts (signs, posters and posters) about correct hand washing, cleaning surfaces and the clinical environment, and waste disposal?</i>	Agree	97.2	92.86	100.00	100.00
	Disagree	1.9	7.14	0.00	0.00
	No opinion	0.9	0.00	0.00	0.00
<i>Do you agree that the N95 mask is an ally to the face shield and should be used together?</i>	Agree	87.85	85.71	64.71	71.43
	Indifferent	4.67	7.14	11.76	28.57
	Disagree	5.61	0.00	11.76	0.00
	No opinion	1.87	7.14	11.76	0.00
<i>Do you think that when using the face shield, goggles become unnecessary PPE?</i>	Agree	26.17	32.14	35.29	42.86
	Indifferent	11.21	10.71	11.76	14.29
	Disagree	56.07	50.00	35.29	42.86
	No opinion	4.67	7.14	17.65	0.00
<i>Do you agree that it is necessary to disinfect shoes at the entrance door of clinics on disinfectant mats and check body temperature and oximetry readings before consultations?</i>	Agree	99.07	82.14	94.12	100.00
	Indifferent	0.93	7.14	5.88	0.00
	Disagree	0.00	10.71	0.00	0.00
<i>Do you think undergraduate students are prepared to provide emergency care to patients with COVID-19?</i>	Yes	36.45	0.00	35.29	14.29
	No	63.55	100.00	64.71	85.71

Table 2. Average of correct answers to questions related to biosafety among the different courses

Dentistry		Medicine		Biomedicine		Nursing		p-value*
Mean	SD	Mean	SD	Mean	SD	Mean	SD	
76.2	17.4	69.2	14.6	75	15.9	75	15.9	0.230

*ANOVA one way, DP = Standard Deviation

Table 3. Comparison among the correct answers rate (%) to the different questions related to biosafety

Question	Dentistry (%)	Medicine (%)	Biomedicine (%)	Nursing (%)	p-value*
1	27.1 ^a	17.8 ^a	35.3 ^a	0.0 ^a	0.235
2	100.0 ^a	100.0 ^{ab}	100.0 ^{ab}	85.7 ^b	<0.001
3	96.2 ^a	100.0 ^a	88.2 ^{ab}	71.4 ^b	0,009
4	100.0 ^a	100.0 ^a	100.0 ^a	100.0 ^a	1.00
5	68.2 ^a	70.5 ^a	64.7 ^a	71.4 ^a	0.096
6	68.2 ^a	57.1 ^a	76.4 ^a	85.7 ^a	0.382
7	72.9 ^a	67.8 ^a	82.3 ^a	85.7 ^a	0.639
17	76.6 ^a	67.8 ^a	52.9 ^a	57.1 ^a	0.162

* Chi-squared test. Different letters on the same line indicate statistical significance (p<0,05).

4 DISCUSSION

This study aimed to analyze the knowledge of biosafety conditions witnessed before and during the COVID-19 pandemic. Some infectious diseases can be transmitted during contact with health professionals if biosecurity measures are not followed, among them is COVID-19 infection. The disease has a high impact on health professionals and students, as they are on the front lines of serving the public, owing to the high transmission rate and unpredictability of the disease¹⁴.

This study shows that the perception of health students regarding biosecurity conditions before the pandemic was considered only as “good” in the university. The findings also reinforce the need for universities to have visual alerts regarding adequate biosafety conditions, such as hand hygiene, cleaning, and disposal of environments and materials. Such statements emphasize the importance of implementing

improvements to transform university institutions into safer environments, especially after the aggravation of the COVID-19 pandemic, as this has been advocated by health bodies worldwide.

National and international recommendations have been published to reduce the risk of the spread of pathogenic microorganisms¹⁵. Every patient should be considered infected with the coronavirus, even without the signs and symptoms. Biosafety protocols must be strictly followed for all patients, including handwashing with soap and water and maintaining proper hygiene. Professionals must cover more parts of the body using disposable aprons over lab coats, caps, protective eye wear, face shields, gloves, and shoe covers to prevent exposure, prevent microorganisms from passing from an infected environment to another person, and provide better protection. Similarly, the patient must be

protected with caps and disposable impermeable surgical drapes¹⁶. The measurement of the patient's body temperature before dental treatment is recommended. The patient's body temperature should not exceed 37.5 °C. A patient with elevated body temperature should be immediately referred for medical treatment. In this case, emergency and urgent dental care was provided. Appointments should be scheduled sufficiently far apart to minimize possible contact with other patients in the waiting room and all recommendations for disinfection should be carried out^{16,17}.

Regarding dental professionals, our findings corroborate data from the literature that point to constant exposure to various risks. Dentists are the professionals who are in most contact with saliva and use instruments that generate aerosols. For this reason, a dental office is a place with a high risk of cross-infection¹³. Saliva can host several types of microorganisms, including SARS-CoV-2, which is a possible means of transmission of viruses¹⁸. Saliva is involved in the initial digestion of food, lubricating, cleaning, and protecting the mucosa and oral cavity, inducing homeostasis, and it prevents the excessive growth of pathogens. Several types of proteins with antiviral properties are present in saliva, such as lysozyme, mucins, cathelicidin (LL-37), lactoferrin, peroxidase, sIgA SLPI, salivary agglutinin (gp340, DMBT1), alpha and beta-defensins, and cystatins, some of which are likely to prevent or reduce virus replication¹⁸.

Angiotensin II-converting enzyme (ACE-2) is the main cellular receptor for SARS-CoV-2. A higher mean ACE-2 enzyme expression was identified in the minor salivary glands than in the lungs, indicating that the oral mucosa may be a potentially high-risk path for SARS-CoV-2 infection, even in asymptomatic patients¹⁹. These droplets can be either large or small in

size. The small droplets remained suspended in the air for the longest time¹⁹. Faced with this, dentists are alerted because they often use instruments that generate aerosols and expose themselves, their team, and patients at risk²⁰.

Recommendations for safe dental care include using PPE, scheduling appointments to limit the number of patients in waiting rooms, following cleaning and disinfection protocols, and increasing air circulation. SARS-CoV-2 cannot replicate unless it is absorbed by cells in the body. However, on different surfaces, they can survive or persist for an extended period, from several hours to days. The virus can be inactivated using disinfectants, such as 70% alcohol, 1% sodium hypochlorite, 1% povidone-iodine, and 0.5% hydrogen peroxide. After performing procedures that produce aerosols, it is necessary to clean these areas with one of these products to reduce the risk of infections in dental offices and hospitals. Windows and doors should be wide open, preferably allowing air circulation. It is best to leave some time between one patient's arrival and the arrival of the next in the care room²¹.

The most intensive aerosol and splatter emissions occur during the work of the ultrasonic scaler tip, air/water sprays, and high-speed handpieces. When aerosol comes into contact with the body fluids of the oral cavity, such as blood and saliva, it produces bioaerosols^{6,22}.

The potentially pathogenic capacity of aerosols produced in dentistry depends on the combination of in-service compressed air and water spray with tooth and material debris, plaque, blood, calculus, and saliva mixture, especially with respect to patients' airborne disease dynamics. If contaminated, aerosols can transmit diseases and cross-infections. The Council on Scientific Affairs of the American Dental Association (ADA) published

recommendations for controlling dental aerosols and splatters. Studies based on induced experimental simulations have shown that SARS-CoV-2 can remain viable in aerosols for at least 3 h despite decreasing its infection potential¹⁰. Therefore, careful organization of patients' schedules must be implemented with large intervals between them. They recommend that patients rinse with antimicrobial mouthwashes prior to dental procedures, use a rubber dam in the procedures that allow it, and prefer the use of manual instruments that avoid the formation of aerosols, as well as rigorous cleaning of surfaces before, during, and after each treatment^{9,10}.

Regarding the use of face shields and N95 face masks, the data shows the assertiveness of dental students when they indicate the mandatory use of these devices, reinforcing guidelines from various health and safety control bodies.

The Occupational Safety and Health Administration of the Department of Labor, USA, has classified dentists as professionals who are at high risk owing to their services. Therefore, PPE has been changed to add waterproof or semi-impermeable aprons, goggles or face shields, N95 respirators, and PPE already used for many decades⁷. Protective equipment must be used to provide better safety to professionals and patients. Facial shields are used to ensure greater effectiveness, and disinfection must be carried out after each patient has been treated, as blood and saliva spills can remain there and promote contamination²³.

During the coronavirus pandemic, some clinical care was increased, such as instructing the patient to wash their hands and asking them to store their belongings in plastic bags, wearing face masks, and removing them only when beginning dental care. Prior rinsing with an

antiseptic mouthwash was recommended for any dental care, and high-performance intraoral suction should preferably be used during the procedure. Patients should be instructed to wash their hands before and after each treatment and to refrain from using electronic devices such as smartphones while receiving treatment because they can become a vector of infection¹⁷.

A study carried out in public health settings in Curitiba, PR collected surface samples from outpatient areas, dental units, doctors' offices, COVID-19 evaluation areas, and hospital units²⁴. This study identified the places with the highest presence of the virus in dental offices, highlighting the dental saliva ejector, dental reflector, dental triple syringe, dental disposable kit, and dental chair as places where viruses persisted even after decontamination. Thus, it was evident that there was a greater risk of cross-infection in this environment. In medical offices, the SARS-CoV-2 virus was detected in items that were most touched, such as pens, notebooks, door handles, mice, armchairs, thermometers, and X-ray bucky walls. This study showed that the frequency of environmental contamination was higher in primary care units than in hospital settings²⁴. According to the authors, primary care units present the circulation of a greater number of people, and the use of PPE is less frequent, which can cause higher contamination. During this study²⁴, environmental cleaning of surfaces was undertaken by applying water and detergents with commonly used hospital-level disinfectants such as sodium hypochlorite (0.1–0.5%), ethanol (62–71%), and disinfectants based on alkyl dimethyl benzyl ammonium chloride (benzalkonium chloride) 5.2%, and polyhexamethylene biguanide (PHMB) 3.5%. These products were selected based on the areas and surfaces to be disinfected. Benzalkonium chloride and PHMB are the most commonly

used disinfectants in intensive care units and wards²⁴.

Regarding participants' biosecurity knowledge, there was no significant difference between the answers to the multiple-choice questions, such as "What is biosecurity?", "What are the main individual biosecurity measures?", "What is infection cross-infection?", "What are the sources of cross-contamination?", "What is the correct sequence of undressing (removal of PPE) after each service?". Most participants demonstrated knowledge about the content presented in the questions, demonstrating success in transmitting knowledge through professors and different media, and highlighting the importance of care in maintaining health.

When comparing the answers among different courses, there was a significant difference only in the answers to questions 2 and 3 "When should I wear gloves?" and "What is PPE?" Nursing professionals are present in greater numbers in hospital environments. These professionals are also constantly exposed to communicable diseases, in addition to working in direct contact with the disease during the COVID-19 pandemic, often without knowing the severity of the disease²⁵. These professionals are subject to significant exposure to biological materials and sharp instruments and are more involved in accidents with these materials¹⁴.

In addition to using PPE for patient care, it is also necessary to wear them during the washing and disposal of materials and disinfection of the environment to avoid contamination. The basic rules of hand hygiene, correct use of protective equipment, immunization of professionals, and correct disposal of sharp instruments should be used for any patient regardless of their diagnosis and treatment^{15,25}.

In healthcare environments, gloves have been the most commonly used PPE since the acquired immunodeficiency syndrome epidemic in the 1980s. Gloves prevent direct contact of the professional's hands with non-intact tissues, lesions, fluids, and mucous secretions²⁶.

Hand hygiene is a critical factor for the entire population. For health professionals, it reduces the transmission of microorganisms, increases patient safety, and decreases healthcare-associated infection. Effective and timely hand hygiene prevents and controls infection transmission in patients and health professionals¹⁵.

The strength of this research was the higher participation of dental students. This can be explained by the encouragement of dental professors. Medicine, biomedicine, and nursing students received the questionnaire electronically without a direct request from professors.

Health professionals must be up-to-date on biosafety standards, use PPE correctly, and respect the steps of dressing, undressing, storage, and correct disposal of these materials to avoid contamination²⁷.

5 CONCLUSIONS

In general, students had adequate knowledge of biosafety standards. However, the results showed that it is necessary to develop skills for the correct procedures for caring for patients with or without transmissible diseases.

RESUMO

Conhecimento dos estudantes da área da saúde sobre as condutas de biossegurança e prevenção da transmissão da COVID-19

A pandemia de COVID-19 impôs a interrupção de atividades presenciais coletivas e os profissionais de saúde foram os mais afetados, por estarem na linha de frente no combate desta

doença. Medidas de biossegurança tiveram que ser redobradas para evitar a propagação do vírus e assim ajudar a controlar a pandemia. Procedimentos que geram aerossóis na Odontologia foram evitados, pois é de conhecimento que um dos meios de transmissão é a saliva. Alguns Equipamentos de Proteção Individual (EPs) foram adicionados para garantir a proteção, e protocolos de desinfecção do ambiente foram modificados. O objetivo deste estudo foi avaliar o grau de conhecimento sobre biossegurança entre estudantes da área da saúde. Foi aplicado um questionário eletrônico para a comunidade relacionada aos cursos da área da saúde na cidade de Curitiba/PR. Cento e cinquenta e nove alunos responderam ao questionário, sendo 107 (67,3%) estudantes da Odontologia, 28 (17,6%) da Medicina, 17 (10,7%) da Biomedicina e 7 (4,4%) da Enfermagem. Entre os participantes, 63,55% dos alunos de Odontologia, 100% de Medicina, 64,71% de Biomedicina e 85,71% de Enfermagem acreditam que os alunos da graduação não estão preparados para fazer atendimentos de urgência em pacientes com COVID-19. Apesar de toda a orientação sobre biossegurança, os alunos da área da saúde ainda devem desenvolver habilidades quanto aos corretos procedimentos para atendimento de pacientes portadores ou não de doenças transmissíveis.

Descritores: Infecções por Coronavírus. Pessoal de Saúde. Contenção de Riscos Biológicos. Odontologia. Inquéritos e Questionários. Educação em Odontologia.

REFERENCES

1. Ather A, Patel B, Ruparel NB, Diogenes A, Hargreaves KM. Coronavirus Disease 19 (COVID-19): Implications for Clinical Dental Care. *J Endod.* 2020;46(5):584-95.
2. Guo YR, Cao QD, Hong ZS, Tan YY, Chen SD, Jin HJ, et al. The origin, transmission and clinical therapies on coronavirus disease 2019 (COVID-19) outbreak - an update on the status. *Mil Med Res.* 2020;7(1):11.
3. Odeh ND, Babkair H, Abu-Hammad S, Borzangy S, Abu-Hammad A, Abu-Hammad O. COVID-19: Present and Future Challenges for Dental Practice. *Int J Environ Res Public Health.* 2020;17(9):3151.
4. Sabino-Silva R, Jardim ACG, Siqueira WL. Coronavirus COVID-19 impacts to dentistry and potential salivary diagnosis. *Clin Oral Invest.* 2020;24(4):1619-1621.
5. Lewis D. Why the WHO took two years to say COVID is airborne. *Nature.* 2022;604(7904):26-31.
6. Ge ZY, Yang LM, Xia JJ, Fu XH, Zhang YZ. Possible aerosol transmission of COVID-19 and special precautions in dentistry. *J Zhejiang Univ Sci B.* 2020;21(5):361-8.
7. Umer F, Haji Z, Zafar K. Role of respirators in controlling the spread of novel coronavirus (COVID-19) amongst dental healthcare providers: a review. *Int Endod J.* 2020;53(8):1062-7.
8. Koletsi D, Belibasakis GN, Eliades T. Interventions to reduce aerosolized microbes in dental practice: a systematic review with network meta-analysis of randomized controlled trials. *J Dent Res.* 2020;99(11):1228-38.
9. Conselho Federal de Odontologia (CFO). Recomendações para atendimentos odontológicos em tempos de Covid-19. [Acesso em 24 jul. 2022]. Disponível em: <https://website.cfo.org.br/wp-content/uploads/2020/03/Material-CDs-Coronav%C3%ADrus-CFO-1.pdf>.
10. Franco JB, Camargo AR, Peres MSM. Cuidados Odontológicos na era do COVID-19: recomendações para procedimentos

- odontológicos e profissionais. *Rev Assoc Paul Cir Dent.* 2020;74(1):18-21.
11. Fiocruz. Fundação Oswaldo Cruz. Biossegurança, o que é? 2014. [Acesso em 12 jun. 2021]. Disponível em: <https://portal.fiocruz.br/noticia/biosseguranca-o-que-e>.
 12. Campos CAS, Guimarães Neto GSC, Pereira RS, Costa MO, Santos WB, Rocha WG, Peixoto FB, et al. Biosafety in dentistry: literature review. *Braz J Heal Rev.* 2020;3(2):1656-62.
 13. Botta SB, Teixeira FS, Hanashiro FS, Araújo WWR, Cassoni A, Salvadori MCBS. Ultraviolet-C decontamination of a dental clinic setting: required amount of UV light. *Braz Dent Sci.* 2020;23(2):2275.
 14. Chehuen Neto JA, Lima MG, Santos JLCT, Costa LA, Estevanini GM, Freire MR et al. Conhecimento e adesão às práticas de biossegurança entre estudantes da área da saúde. *BJSCR.* 2018;21(2):82-7.
 15. Barbosa ASAA, Salotti SRA, Silva SMUR. Nível de conhecimento sobre Hepatite B, estado vacinal e medidas de biossegurança entre profissionais de enfermagem. *R Epidemiol Control Infec, Santa Cruz do Sul.* 2017;7(2):107-12.
 16. Moraes G, Harmann R, Luiz A, Vinholes J. Biossegurança e retorno das atividades em odontologia: aspectos relevantes para enfrentamento de COVID-19. *Stomatos.* 2020;26:1-16.
 17. Moraes DC, Galvão DCDF, Ribeiro NCR, Oliveira LMS, Azoubel MCF, Tunes UR. Atendimento odontológico em tempos de COVID-19: compartilhando boas práticas protetivas e de biossegurança. *J Dent Public Health.* 2020;11(1):73-82.
 18. Baghizadeh Fini M. Oral saliva and COVID-19. *Oral Oncol.* 2020;108:104821.
 19. Xu R, Cui B, Duan X, Zhang P, Zhou X, Yuan Q. Saliva: potential diagnostic value and transmission of 2019-nCoV. *Int J Oral Sci.* 2020;12(1):11.
 20. Peditto M, Scapellato S, Marciandò A, Costa P, Oteri G. Dentistry during the COVID-19 epidemic: an italian workflow for the management of dental practice. *Int J Environ Res Public Health.* 2020;17(9):3325.
 21. Ren YF, Rasubala L, Malmstrom H, Eliav E. Dental care and oral health under the clouds of COVID-19. *JDR Clin Trans Res.* 2020;5(3):202-10.
 22. Kerawala C, Riva F. Aerosol-generating procedures in head and neck surgery - can we improve practice after COVID-19? *Br J Oral Maxillofac Surg.* 2020;58(6):704-7.
 23. Tuñas ITC, Silva ET, Santiago SBS, Maia KD, Silva-Júnior GO. Doença pelo Coronavírus 2019 (COVID-19): Uma abordagem preventiva para Odontologia. *Rev Bras Odontol.* 2020;77:e1766.
 24. Vicente VA, Lustosa BPR, Grisolia ME, Pavini Beato C, Balsanelli E, de Souza Gubert Fruet V, et al. Environmental detection of SARS-CoV-2 virus RNA in health facilities in brazil and a systematic review on contamination sources. *Int J Environ Res Public Health.* 2021;18(7):3824.
 25. Vasconcelos LDS, Moreira AS, Ferreira JMB, Gomes YML, Costa RCC, Silva JVS et al. Profissionais da saúde e as condições de biossegurança no enfrentamento da COVID-19. *Res Soc Devel.* 2021;10(12):e342101220497.
 26. Rio C, Roseira CE, Perinoti LCSC, Figueiredo RM. O uso de luvas pela equipe de enfermagem em ambiente hospitalar. *Rev Bras Enferm.* 2021;74(2):e20200972.

27. Silva DM, Marques BM, Galhardi NM, Orlandi FS. Higiene das mãos e uso de luvas pela enfermagem em hemodiálise. Rev Bras Enferm. 2018;71(4):1963-9.

Correspondence to:

Flares Baratto Filho

e-mail: fbaratto1@gmail.com

Universidade Tuiuti do Paraná

Rua Sydnei Antonio Rangel Santos, 238

82010-330 Curitiba/PR Brazil