

# Biosafety: physiotherapy students' knowledge about techniques and behavior in cross-infection control

*Biossegurança: conhecimento dos estudantes de fisioterapia sobre técnicas e comportamento no controle de infecções cruzadas*

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## Abstract

**Introduction:** Biosafety consists in the set of measures applied to prevent the spread of infectious agents. Through biosafety, it is possible to avoid and inhibit the risks that compromise the health of the individual, animals and the environment. **Objective:** To evaluate the knowledge about biosafety in undergraduate physiotherapy students and physiotherapists. **Methods:** The work was a field study with a defined universe, and classified as descriptive, exploratory, quantitative-qualitative. The sample consisted of 93 physiotherapy students from the Universidade Estadual do Norte do Paraná (State University of Northern Paraná), Jacarezinho, Brazil, and 10 professionals working in the region. Data were collected through a questionnaire on knowledge about biosafety and cross-infections. A statistical analysis was performed using SPSS software version 25.0, and the data was evaluated by the Shapiro-Wilk normality test, and the variables expressed as median and interquartile range (25% -75%). The chi-square test was applied to determine statistically significant differences between the different years of the physiotherapy course and the trained professionals. Through content analysis, open treatment and analysis of qualitative data were chosen. The level of significance used was 5%. **Results:** There was a small deficit in the knowledge of biosafety; however, this knowledge increased to some extent with the evolution of students in the course ( $p < 0.05$ ). **Conclusion:** Most students and professionals have enough knowledge to control or even eradicate the risks of certain activities and prevent cross-infection in the practice of physiotherapy. The perceived deficit in knowledge in biosafety can be easily resolved with the adequate dissemination of knowledge on the subject.

**Keywords:** Biosafety. Health. Security.

## Resumo

**Introdução:** Biossegurança é o conjunto de medidas aplicadas para prevenir a propagação de agentes infecciosos. Por meio da biossegurança é possível evitar e inibir os riscos que comprometem a saúde do indivíduo, dos animais e do meio ambiente. **Objetivo:** Avaliar o conhecimento sobre biossegurança de estudantes de graduação em fisioterapia e fisioterapeutas. **Métodos:** O trabalho foi uma pesquisa de campo com universo definido, e classificado como descritivo e exploratório-quantitativo. A amostra foi composta por 93 alunos do curso de fisioterapia da Universidade Estadual do Norte do Paraná, em Jacarezinho, e 10 profissionais atuantes na região norte do Paraná. Os dados foram coletados por meio de um questionário sobre o conhecimento sobre biossegurança e infecções cruzadas. A análise estatística foi realizada no software SPSS versão 25.0 e os dados submetidos ao teste de normalidade Shapiro-Wilk, com as variáveis em mediana e intervalo interquartil (25% -75%). O teste qui-quadrado foi aplicado para buscar diferenças estatisticamente significativas entre os diferentes anos do curso de fisioterapia e os profissionais formados. Por meio da análise de conteúdo foram escolhidas questões abertas, tratamento e análise de dados qualitativos. O nível de significância adotado foi de 5%. **Resultados:** Constatou-se que existe um pequeno déficit no conhecimento em biossegurança, no entanto, esses conhecimentos de certa forma aumentaram com a evolução dos acadêmicos no curso ( $p < 0,05$ ). **Conclusão:** A maioria dos estudantes e profissionais possui conhecimentos suficientes para controlar ou mesmo erradicar os riscos de determinadas atividades e evitar a infecção cruzada na prática da fisioterapia. O déficit de conhecimento em biossegurança constatado pode ser facilmente resolvido com a disseminação adequada do conhecimento sobre o assunto.

**Palavras-chave:** Biossegurança. Saúde. Segurança.

## Introduction

Biosafety is related to the set of measures and forms of disease prevention.<sup>1</sup> This science is characterized by being responsible for decreasing and eliminating the risks of research, production, teaching, technological development and service provision activities that subject the individual and the environment to exposure to infectious agents, which can compromise health and well-being.<sup>2</sup>

In Brazil, the National Technical Biosafety Commission (CTNBio), created in 1995, establishes the national biosafety policy through normative instructions that must be complied at all levels.<sup>3</sup> Compliance with biosafety parameters is particularly critical in research and teaching environments, especially in university laboratories and clinics, due to the high turnover of users.<sup>4</sup>

Physiotherapists are health professionals who can work in different environments, some of which can be especially contaminated. Since, they are working in contaminated environments, such as intensive care unit (ICU), nursing home, physiotherapy clinic, basic health unit (BHU) and health center, they can develop various infectious diseases.<sup>5</sup> That said, preventive measures must accompany all these professionals' actions. The best way to avoid the necessity of drug treatments against infections is global biosafety measures that can guide the professional's steps in their workplace and ensure their safety and that of their patients.<sup>6</sup>

Knowledge about the types and methods of hygiene procedures is of paramount importance for all health professionals, so that there is no risk of self-contamination or cross-infection.<sup>7</sup> Therefore, the aim of this study was to determine the knowledge about biosafety of undergraduate physiotherapy students and physiotherapists, and how they contribute to the maintenance of a healthy clinical environment.

## Methods

We carried out a field study with a statistical universe, classified as descriptive, exploratory, quantitative-qualitative. It was submitted and accepted by the Ethics and Research Council (CAEE: 97995518.3.0000.8123, No. 2.929.079). The research was conducted between the months of July and December of 2019, and the data were collected using two questionnaires about knowledge on biosafety and cross-infection ([supplementary file](#)), answered by undergraduate physiotherapy students from Universidade Estadual do Norte do Paraná (State University of Northern Paraná), in Jacarezinho, Brazil, and 10 physiotherapists working in the region.

As an inclusion criterion, participants needed to be at least 18 years of age and be able to understand the questionnaire. All volunteers signed an Informed Consent Form (ICF).

The questionnaires were applied in person and individually. Questionnaire A was adapted from the work of Schroeder et al.,<sup>8</sup> and included questions related to the individuals' academic background and their level of information on biosafety in the field of activity. Questionnaire B, based on the work of Ferrari et al.,<sup>9</sup> assessed knowledge about biosafety practices, emphasizing and examining the importance of personal protective equipment (PPE) and hand hygiene for professionals during the pre- and post-care of patients. The reliability of the respondents' answers was ensured by anonymity.<sup>10</sup>

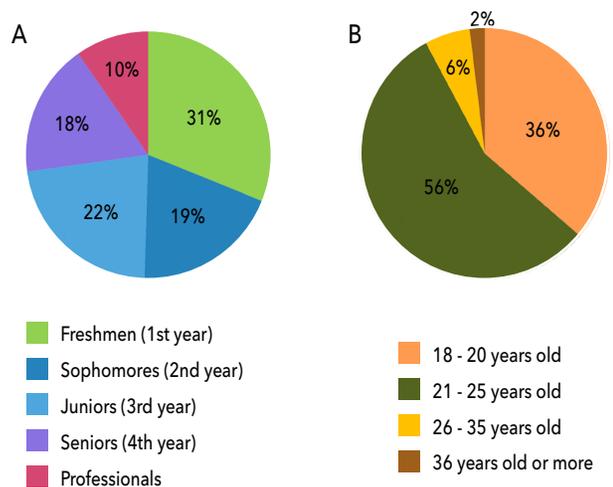
For statistical analysis, SPSS software version 25.0 was used. The data were submitted to the Shapiro-Wilk normality test, and the descriptive variables were presented as median and interquartile range (25% - 75%). Chi-square test was applied to search for statistically significant differences between the different years of the physiotherapy course and trained professionals. The open questions, the treatment and analysis of qualitative data were chosen through content analysis.<sup>11</sup> The level of significance was 5%.

## Results

One hundred three (103) volunteers participated in the study, where 9.7% were professionals and 90.3% were students in the undergraduate physiotherapy course, with ages ranging from 18 to 36 years old or more. Regarding the sex of the participants, the majority were women, representing 82.5%, while 17.5% were men. The results show that the largest share of participants (31.07%) corresponded to the 1st year of course, due to dropout during the course or failure, which occurred in the following years. The age of the participants was mostly between 20 and 25 years, followed by 18-20 years (Figure 1).

When comparing the results of the questionnaires, 66% of the participants considered having knowledge of biosafety, and 34% said they did not know (Table 1). Whether the participants knew the meaning of biosafety, students increased their knowledge (answer "yes") over the study years; for working professionals it was 90% ("yes" answer) ( $p < 0.05$ ; 0.001). This dependence on variables was also observed in the question whether the participants knew what PPE meant, with 65.6% - 1st year, 100% - 2nd year, 90.9% - 3rd year, 83.3% - 4th

year, and 88.9% - professionals ( $p < 0.05$ ; 0.016). The question about the participants knowing exactly how to take care of themselves if they have to see patients in the Faculty of Physiotherapy Clinic showed the reflection of the mandatory internship of the course, once the "yes" answers were higher according to the progress in the course. However, 20% of the trained professionals had difficulty and answered that they did not know how to behave in a clinical environment (Table 1).



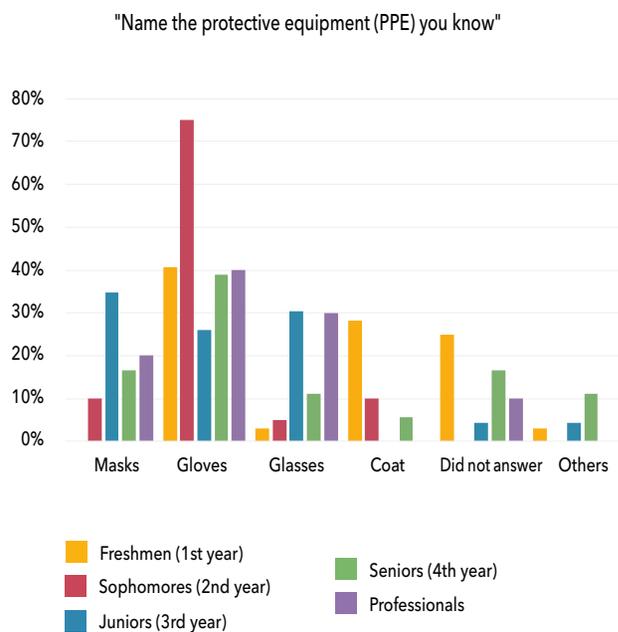
**Figure 1** - (A) Percentage of participants (n = 103) and age (B).

About the knowledge of biosafety standards and CTNBIO, the result of the  $p > 0.05$  showed that there was no significance without dependence between the variables. Thus, being more advanced in the course or being trained does not guarantee knowledge about biosafety. This result showed the lack of information on the subject, which could be remedied in the classroom.

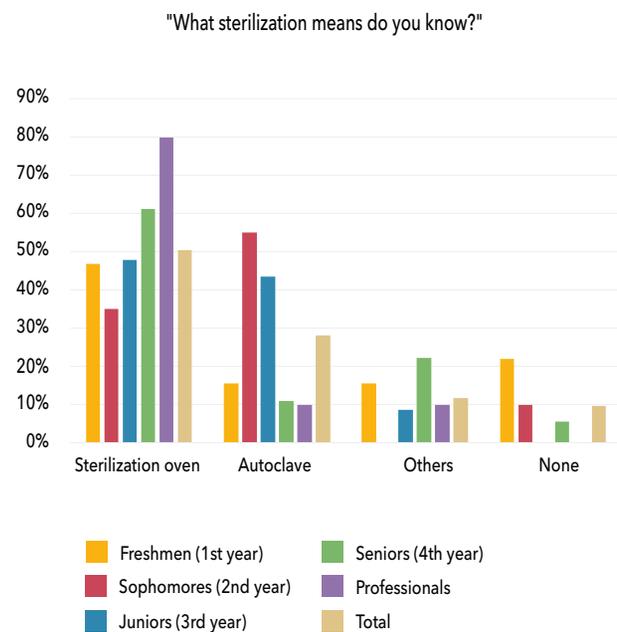
About properly cleaning appliances, stretchers and treatment tools beforehand, as well as doing hand hygiene before and after each appointment, the results were unsatisfactory for senior students. Meanwhile, 1st and 2nd year students, who did not see patients yet, obtained better results. When the volunteers were asked to state the PPE (Figure 2) and sterilization methods (Figure 3) they knew, the  $p$  value was shown to be significant ( $p < 0.05$ ) for both. Therefore, the variables were dependent, which means that the knowledge of more PPE and forms of sterilization mentioned by the participants is related to the years and the experience of students and professionals.

**Table 1** - Analysis of the knowledge about biosafety of undergraduate physiotherapy students and active professionals

Questions	Category	Participants (%)					Total
		Professionals	Freshmen (1st year)	Sophomores (2nd year)	Juniors (3rd year)	Seniors (4th year)	
Do you know the meaning of biosafety?	Yes	90.0	46.9	60.0	60.9	100.0	66.0
	No	10.0	53.1	40.0	39.1	0.0	34.0
Do you know what protective equipment (PPE) means?	Yes	88.9	65.6	100.0	90.9	83.3	83.2
	No	11.1	34.4	0.0	9.1	16.7	16.8
If you have to see patients in the Faculty of Physiotherapy Clinic, do you know exactly how to take care of yourself?	Yes	80.0	31.3	65.0	78.3	100.0	65.0
	No	20.0	68.8	35.0	21.7	0.0	35.0
Do you know any biosafety laws in physiotherapy?	Yes	60.0	34.4	15.0	39.1	29.4	33.3
	No	40.0	65.6	85.0	60.9	70.6	66.7
Do you know what the acronym CTNBIO stands for?	Yes	10.0	0.0	0.0	8.7	5.6	3.9
	No	90.0	100.0	100.0	91.3	94.4	96.1
Do you properly clean appliances, stretchers and treatment tools beforehand?	Yes	90.0	81.3	80.0	78.3	38.9	73.8
	No	10.0	18.8	20.0	21.7	61.1	26.2
Do you do hand hygiene before and after each appointment?	Yes	90.0	96.9	95.0	95.7	77.8	92.2
	No	10.0	3.1	5.0	4.3	22.2	7.8



**Figure 2** - Knowledge of personal protective equipment (PPE) by study volunteers.



**Figure 3** - Response given by physiotherapy students and professionals on sterilization methods.

## Discussion

It was possible to see that through the analysis of the database that there was a small deficit of knowledge in biosafety, but this knowledge had, in a way, increased as the course progressed.

This study had 103 participants, and the results showed significance for several questions. Figure 1 corresponds to the frequency of volunteers in the year of course and professional training, and the age of the participants. Of these, 31.07% were from the first year, and 17.48% were from the 4th year, which indicated that the frequency was consistent with the reality of higher education. The age group included for the most part (55.88%) those between 20 and 25 years. Such information was essential for a sample to be characterized. Although marked by social inequality, Brazil has become a modern country with an emerging economy.<sup>12</sup> Regarding access to higher education, adherence is still low, but for those who are enrolled, the age group of young is between 18 and 24 years old. It is important to note that the number of professionals included did not represent the number of physiotherapists in the city, so further studies are necessary.

As presented, of the undergraduates and professionals trained in physiotherapy, when asked about biosafety, 66.0% said they knew about its meaning, while 34.0% did not know, being proportional to the years in the course. These results are worrisome and coincide with the work of Gomes et al.,<sup>13</sup> which showed that students about to finish their undergraduate course have greater mastery of knowledge on biosafety.

In the current global context, there is unparalleled need to prevent cross-infection and the transmission of contagious diseases, as is the case with the new coronavirus (SARS-CoV-2) pandemic.<sup>14</sup> Accordingly, it is essential to ensure that laboratories, hospitals and citizens in general use appropriate biosafety practices. Health professionals, especially physiotherapists, need special care such as the use of gloves, masks (N95) and lab coat to prevent contact and contamination during the treatment of inpatients.<sup>15</sup> National biosafety guidelines must be respected in any and all circumstances,<sup>16</sup> and only with a deep knowledge of biosafety will health professionals be able to act safely and effectively.

Figures 1 and 2 demonstrate that knowledge about PPE proved to be linked to the year of course. In the studies by Neto et al.,<sup>17</sup> students in health courses confirmed this

relationship about knowledge about PPE, where among the respondents, 100% of dental students considered themselves to be aware of the subject, like 98.3% of nursing students and 80.3% of medical students, while knowing the need to use PPE was reported by 100% nursing and dentistry students, in contrast to only 82% of the medical students interviewed. The failure to mention the lab coat as PPE by 3rd year students and by trained professionals caused concern, considering that the lab coat is an important tool for physical therapy practice, as it helps to significantly reduce the risk of occupational accidents and cross-infections.<sup>18</sup> However, taking into account that the lab coat is a work uniform, it is often unnecessary to mention it, because without it there are no appointments.

The importance of using PPE was shown to be a crucial factor in reducing SARS-CoV-2 transmission (Covid-19) from patients to medical staff and other patients, through physical contact, air or droplets.<sup>19</sup> These devices are for individual use, designed to protect the physical integrity and health in general of health professionals, acting as barriers to the spread of infections.<sup>18</sup>

When asked if they would know how to behave in the face of a service at the physiotherapy clinic, 68.8% of the freshmen answered that they did not know, while 65.0% of the sophomores, 78.3% of the juniors and 100% of the seniors said they knew how to behave, being consistent with the progress of academic training. However, 20% of the trained professionals had difficulty and answered that they did not know how to behave in a clinical environment. Taking into account that humanized care emphasizes values linked to the defense of life and the possibility of expanding the degree of disalienation, in addition to the reform of care for patients and staff, as well as health responsibility, it allows the use of powerful and essential instruments in physical therapy work.<sup>20</sup>

Questions on biosafety standards were brought up, and among the participants, 66.7% said that they did not know about them, while 33.3% said they did. It was found that knowledge about biosafety law is low and that it is not dependent on level in the course, which is detrimental to the safety of the workplace that depends on everyone involved.

Biosafety consists in actions that aim to prevent and protect against the adverse risks of exposure, manipulation and use of living organisms, to benefit the health of humans, animals, and to preserve the environment.<sup>21</sup> Thus, the techniques are part of several

areas, both in the clinic and laboratory, which are constantly exposed in their activities and work environments,<sup>22</sup> and do not escape the actions of physical therapists.<sup>23</sup> Therefore, it determines norms and effective measures in the prevention of accidents and in the reduction of the risks of cross infections.

Biosafety is part of the daily routine of physiotherapy professionals, as in hospital practice and care.<sup>15</sup> The physiotherapist's action in this sector encompasses both the infirmary, outpatient clinic and intensive care units.<sup>24</sup> Therefore the use of PPE is extremely important since patients are weak, and any cross-contamination can be fatal as, for example, in the treatment of COVID-19 with procedures that generate aerosol particles, such as endotracheal aspiration, non-invasive mechanical ventilation and orotracheal intubation.<sup>25</sup>

This study obtained a low rate of volunteers with knowledge about CTNBI, which has the function of supervising, formulating and implementing the national biosafety policy, aimed at the protection of human health.<sup>26</sup>

Knowledge about the mode of transmission of the infectious agent provides support and a scientific basis for determining and stipulating appropriate control measures for public health actions, with the aim of containing and limiting the spread of pathogenic diseases, with high virulence, such as the SARS-Cov-2 virus.<sup>27</sup> One of the forms of microbiological control is proper hygiene; therefore, measures are adopted for hand washing with soap and water or the use of sanitizing products, such as 70% alcohol gel and the practice of disinfecting recommended surfaces as a barrier to viruses.<sup>27</sup> It will then be possible for health professionals to be able to act safely, both for themselves and for patients.

General hygiene precautions are crucial to minimize the risk of contamination. The use of a mask, apron, lab coat, eye protection and gloves is recommended and indispensable in personal care, bearing in mind that an infected health professional is a potential vehicle for the spread of many viruses, such as COVID-19.<sup>28</sup>

It was evident that there was a high rate (73.8%) of adequate and proper sanitizing of the materials used before, during and after the treatment of patients, but the 26.2% who did not perform hygiene shows a lack of knowledge or preparation to enter the job market which could be remedied through pre-training on biosafety, as stated by Chehuen Neto et al.<sup>17</sup> and Silva

and Mastroeni,<sup>29</sup> proving that professionals need to be more ethical and careful with training before acting.

Neglecting to clean utensils for everyday use by health professionals disconnects from the main objective of biosafety. For that, one of the forms of prevention is adequate cleaning before and after each use of these devices, such as a stretcher, stethoscope and sphygmomanometer.<sup>30</sup>

The answers given about hand hygiene before and after each service revealed that 92.2% perform it and 7.8% do not, being among the seniors the highest rate of non-compliance with this procedure. It was found that even though hand hygiene is recognized worldwide as a primary measure and important for the prevention and control of infections in health services,<sup>26</sup> students and health professionals still do not show full adherence.

In relation to the means of sterilization, it was observed that as the course progressed, students exhibited knowledge about the process of eliminating microbes.<sup>31</sup> The result is understood, as we can consider the immersion of the students in stages and their clinical actions.

The results of this work, as well as in other works in the literature, presented some unsatisfactory points, which demonstrate the need to take urgent measures. For example, the implementation of teaching, practices and observations that involve biosafety and, with this, present daily procedures to students and professionals that help them to reflect on and adopt skills and attitudes that correct bad habits. Only with an improvement in training can the spread and risk of cross-infections and occupational diseases be properly managed in health and work. Furthermore, along with education, strict supervision in stages is essential, so knowledge application is more effective.

The limitation of this study was the small sample, which makes a very low parameter to be taken into account.

## Conclusion

This study found that most students and professionals have enough knowledge to control or even eradicate the risks of certain activities in the practice of physiotherapy and health. Although there is a small deficit in knowledge in biosafety, it can be easily resolved with the adequate dissemination

of knowledge on the subject. Therefore, strategies such investing more hours in biosafety practice and improving the knowledge of undergraduate health courses students could result in greater efficacy in the aspects of biosafety and safe care to themselves and their future patients.

### Authors' contributions

THMS and AYS were responsible for the writing, research, data collection, analysis and discussion. LVO conducted the research, data collection and analysis. VPCJ and MDGLP were responsible for the review and analysis of the data obtained. DFS worked on the writing, research, data collection, analysis and discussion, and provided guidance.

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