

Knowledge, Behaviors, and Perceptions of Risk of COVID-19 Among Brazilian Nursing Students

A Cross-sectional Study

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ABSTRACT

Background: The COVID-19 pandemic presented important challenges for the education of nursing students to provide health care with competence, quality, and safety.

Objectives: The purpose was to analyze knowledge, behavior, and perception of risk regarding COVID-19 and associated factors.

Methods: A cross-sectional study was conducted among 2637 Brazilian undergraduate nursing students using a self-reported online survey.

Results: Students' knowledge about COVID-19 in general was considered inadequate. Students had limited knowledge about preventive measures in the hospital environment and recommendations for aerosol precautions. More than 90% of graduates adopted recommended prevention measures, and 86.1% perceived themselves to be at a greater risk of acquired SARS-CoV-2 during clinical practice.

Conclusions: The results show the need to rethink undergraduate nursing education regarding the prevention and control of infectious diseases, including the most appropriate strategies for COVID-19 prevention measures.

Keywords: COVID-19, infectious disease transmission, knowledge, nursing students, pandemic, preventive behaviors, SARS

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The new disease caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), responsible for COVID-19, was declared a pandemic by the World Health Organization (WHO) on January 20, 2020.¹ The pandemic reached Latin America after other continents, and since then, Brazil has become the most affected country in this region and the second in number of reported cases.²

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Rapid spread of the disease presented challenges in all spheres of human life, including health and education systems. In this context, face-to-face classes were paused with short-, medium-, and long-term impacts for all levels of education.³ As in other countries, face-to-face classes in undergraduate nursing courses in Brazil were suspended and replaced by remote learning, allowing the nursing education system to continue to function.⁴

In the context of undergraduate nursing education, COVID-19 presents challenges for the education of future nurses. There is an increasing need to train nurses to work in clinical practice. However, nursing students, when carrying out clinical learning, may be exposed to risks of contamination by SARS-CoV-2. Lack of adequate knowledge among students and training could result in the student to underestimate or overestimate risk situations, to increase stress and anxiety, and to contribute to the chain of transmission of infection.⁵

Given the growing number of pandemics that have been declared in recent years, the necessary knowledge and skills to confront pandemics must be incorporated as fundamental components of nursing education programs.⁶ Therefore, nursing academic programs and others in health care need to value the impact of emerging infectious diseases, such

as COVID-19, on quality of care and safety of the patient and health team. In response to COVID-19, practical training for undergraduate students on measures for the prevention and control of infectious diseases has been recommended, with an emphasis on hand hygiene, use of personal protective equipment (PPE), and how to wear and remove correctly.⁷

Studies have been conducted in several countries regarding the knowledge of students in health care fields about COVID-19,⁸⁻¹⁰ but there are gaps in the literature, and no study carried out in Brazil was identified in the literature. Therefore, this study aimed to analyze the factors associated with lack of knowledge, behavior, and risk perception about COVID-19 among Brazilian nursing undergraduate students.

Methods

This was a cross-sectional and correlational study using online surveys conducted with Brazilian nursing undergraduate students. The study included 2637 nursing undergraduate students from all 5 regions of Brazil (North, Northeast, South, Southeast, and Midwest). The inclusion criteria were as follows: being an undergraduate student in nursing, being 18 years or older, having enrolled in a Bachelor in Nursing program in a public or private university, and having access to the internet. In Brazil, the Bachelor in Nursing degree is an upper level education, lasting between 8 and 10 semesters done at a university or college, depending on the teaching institution. At graduation, nurses are able to serve as leaders of the nursing team at different levels of health care, including intensive care.

A questionnaire was adapted from WHO resources¹¹ and included 4 sections: (1) general information containing sociodemographic and professional training data; (2) questions related to knowledge about COVID-19, which included aspects related to the form of transmission, incubation period, signs and symptoms, and preventive measures for COVID-19; (3) preventive behaviors that demonstrated adherence to preventive strategies such as social isolation; and (4) perception of risk that included questions about how students perceived the risk of acquiring COVID-19. Data were collected from May to August 2020 through digital platforms (Facebook, Instagram), email, and the WhatsApp messaging application through a questionnaire created on virtual platform, with an access link and QR code generated for data collection.

This study was approved by the Ethics Committee of University of São Paulo at Ribeirão Preto College of Nursing under number 4.078.123/2020. All participants obtained online and signed electronically a free and informed consent form with information about the study.

Data Analysis

The responses from the participants were analyzed using measures of central tendency (mean and standard deviation). Data were analyzed using Statistical Software for Data Science (STATA 13; StataCorp LP, College Station, Texas). To analyze the association between knowledge and independent variables, univariate analysis was used, using χ^2 test for

the qualitative variables and Student *t* test for the quantitative variables. The knowledge variable was dichotomized into good knowledge or not. Good was an average number of correct answers equal to or greater than 14, because this was the average rate of correct answers for all participants. Next, a logistic regression model was used, with good knowledge (yes/no) as the dependent variable. The independent variables that were considered in the univariate analysis with *P* < .20 were included in the logistic regression model. Variables with a *P* value less than .05 with 95% confidence intervals were considered significant.

Results

Participants

The study included 2637 undergraduate nursing students, with an average age of 23.11 years. Most respondents were from the Northeast (*n* = 1143, 43.3%), followed by the North (*n* = 520, 19.7%), South (*n* = 357, 13.5%), Southeast (*n* = 313, 11.9%), and Midwest (*n* = 304, 11.5%) regions of Brazil. Most students were in public schools (*n* = 1501, 57.6%), between the third and fifth year of their undergraduate program, and 2155 (82.4%) had experience in the health care before their nursing courses.

When students were asked whether they had any classes directed to specific content on the biosafety measures for the care of patients suspected with or given a diagnosis of COVID-19, only 539 (20.6%) reported that they had. In addition, 1994 participants (76.3%) reported that they did not feel safe to act in future clinical activities, with the education received during the pandemic regarding the protection measures against COVID-19.

Knowledge of Nursing Students

Regarding knowledge about COVID-19, from the total of 22 questions, the average number of correct responses was 14 (63.6%), and 1366 participants (52.2%) had a higher-than-average score. Table 1 shows the percentage of correct answers for each question. This table highlights correct response rates higher than 90% for 3 questions, which referred to the presentation of severe cases of COVID-19 in patients with preexisting chronic conditions, the correct positioning in the placement of the surgical mask, and hand hygiene as an effective measure for prevention against COVID-19. However, in 3 other questions, the percentage of correct answers was less than 25%, with items referring to the proper packaging of the N95-type respiratory mask or equivalent in conditions of reuse, common symptoms of COVID-19, and the protective garments recommended in situations that generate aerosols.

Students with adequate knowledge had a higher average age as well as those who had already participated in clinical practice, were between the sixth and seventh semesters, and had a class focused on the protective measures of COVID-19 (Table 2). Students who had clinical practice during their undergraduate courses were 1.43 (95% confidence interval [CI], 1.12-1.88; *P* = .003) times more likely to have above-average knowledge than those who did not

Table 1. Number and Percentage of Correct Responses to Questions on Knowledge of COVID-19, Brazil, 2020

Question	n (%)
COVID-19 is a respiratory infection caused by a new species in the coronavirus family. ^a	2412 (91.8)
All people are susceptible to COVID-19, but people with chronic comorbidities such as diabetes, hypertension, cardiovascular disease, and immunosuppression are more vulnerable to more severe symptoms and death. ^a	2602 (99.0)
The origin of COVID-19 is not clear, although it is known that it is transmitted through respiratory droplets, such as coughing and sneezing, and is not transmitted by contact with contaminated surfaces. ^b	2137 (81.3)
Common symptoms of COVID-19 are fever, cough, and shortness of breath and very often gastrointestinal symptoms, such as diarrhea. ^b	597 (22.7)
The incubation period for COVID-19 is up to 7 days, with an average of 5 days.	934 (35.5)
COVID-19 can be diagnosed by PCR testing on samples collected from nasopharyngeal and oropharyngeal secretion or from sputum and bronchial lavage. ^a	1889 (71.9)
SARS-CoV-2 is not transmitted through close contacts with an infected case (especially in families, crowded places, and health centers). ^b	2029 (77.2)
The disease can be prevented through social distancing, social contact such as handshaking and kissing, and frequent hand hygiene. ^a	2293 (87.3)
The disease can be treated with specific and effective antiviral drugs. ^b	1243 (47.3)
The use of 70% alcohol gel is not suitable for hand hygiene and cannot replace hand hygiene with soap and water. ^b	1892 (72.0)
The surgical mask is indicated for use by the health professional to prevent the spread of respiratory droplets during speech, coughing, and sneezing. ^a	2261 (86.1)
Patients suspected or diagnosed with COVID-19 should wear an N95 mask in health care facilities. ^b	968 (36.8)
The health professional, when using the surgical mask, should position it on the face to cover the mouth and nose and extend down to the chin. ^a	2578 (98.1)
The removal of the N95 mask or equivalent must be done using its elastic bands and you can touch its external surface. ^b	1639 (62.4)
The N95 mask must be packed in a specific place using airtight packaging such as a paper or plastic envelope to keep it intact, clean, and dry for the next use. ^b	631 (24.0)
The N95 mask is for single use and must be discarded after use.	1082 (41.2)
After fitting the N95 mask, it is necessary to perform the adjustment test to confirm that there is no air leak. ^a	2105 (80.1)
Hand hygiene with soap and water is an effective preventive measure for COVID-19. ^a	2584 (98.8)
The protective garments indicated for the care of patients with COVID-19 for situations that do not generate aerosol are disposable apron, N95 mask, goggles or face shield, and procedure gloves, before contacting the patient. ^b	322 (12.2)
When caring for patients with COVID-19, health care professionals should wear an N95 mask or equivalent during intubation, aspiration, bronchoscopy, and cardiopulmonary resuscitation. ^a	2301 (87.6)
The apron used to care for patients with suspected or diagnosed COVID-19 must be reusable and permeable. ^b	2252 (85.7)
The duration of the N95 mask is 30 days. ^b	1384 (52.7)

PCR, polymerase chain reaction.
Feedback: ^a Agreed; ^b Not agreed.

have these field experiences. Those who studied in a public school and received a class with specific content on the safety measures recommended to health professionals for the care of patients with suspected or diagnosed COVID-19 had, respectively, 1.86 (95% CI, 1.55-2.21; $P < .001$) and 1.39 (95% CI, 1.14-1.71; $P < .001$) times greater likelihood to have knowledge above the average of others (Supplemental Digital Content, Table 1, <http://links.lww.com/NE/B5>).

Preventive Behaviors of Nursing Students

As for preventive behaviors in the face of COVID-19, the average of correct answers for the questions was 7 (95% CI, 7.13-7.0). Regarding the prevention of COVID-19, most students did not frequent other places ($n = 2597$,

98.4%) or places with people gathering in large groups ($n = 2588$, 98.1%) and stayed away from people with respiratory symptoms ($n = 2597$, 97.7%) (Supplemental Digital Content, Table 2, <http://links.lww.com/NE/B6>). They also went shopping less frequently ($n = 2546$, 96.5%), which shows adequate preventive behavior when confronted with the disease. Therefore, most students who had above-average knowledge ($n = 1041$, 76.2%) also adopted preventive behaviors that reflected recommendations; however, no statistical association of above-average knowledge with preventive behaviors was found ($P = .096$).

Regarding the perception of risk in relation to COVID-19, 988 students (37.4%) answered that they can be infected with COVID-19 more easily than other people, and 2078

Table 2. Univariate Analysis of Possible Factors Associated With Adequate Knowledge of COVID-19 Among Undergraduate Nursing Students, Brazil, 2020

Variable	Knowledge		P
	Adequate	Inadequate	
Mean (SD) age, y	23.3 (5.3)	22.8 (5.0)	.008 ^a
Experience in the health area before the undergraduate course, n (%)			.481 ^b
Yes	223 (16.3)	191 (15.3)	
No	1,143 (83.7)	1,056 (84.7)	
Practical activities in the course, n (%)			< .001 ^b
Yes	1,180 (86.4)	975 (78.2)	
No	186 (13.6)	272 (21.8)	
Course type			< .001 ^b
Public	875 (64.1)	632 (50.7)	
Private	491 (35.9)	615 (49.3)	
Course semester			.001 ^b
From the first to fifth semester	538 (39.4)	574 (46.0)	
From the sixth semester	828 (60.6)	673 (54.0)	
Class containing specific content on the safety measures recommended to health professionals for the care of patients with suspected or diagnosed COVID-19			.030 ^b
Yes	304 (22.2)	235 (18.8)	
No	1,062 (77.8)	1,012 (81.2)	
Feeling secure to act in future practical activities, with the education received on COVID-19 protection measures, n (%)			.285 ^b
Yes	312 (22.8)	307 (24.6)	
No	1,054 (77.2)	940 (75.4)	

^a Student t test. ^b χ^2 Test.

(78.8%) responded that they were afraid of being infected. Moreover, 2272 (86.1%) disagreed that the risk of being infected during clinical practice activities in health care was low. For participants with above-average knowledge concerning COVID-1 (n = 1620, 78.4%) there was a statistically significant association (P = .004) between knowledge and perception of risk of infection.

Discussion

This study evaluated the knowledge, behaviors, and perception of risk of nursing students in Brazil with regard to COVID-19. Researchers have recognized the need to assess the knowledge, attitudes, and risk perception of nursing students in relation to outbreaks of infectious diseases.⁶ In this study, students had inadequate knowledge regarding the signs and symptoms of the disease, incubation period, and effectiveness of treatment with antivirals. Therefore, this study identified the need to teach nursing students about this infectious disease and nursing care.

Higher knowledge of students with scores greater than 99% was identified for aspects related to the presentation of severe cases of COVID-19 in patients with preexisting chronic disease, as also observed in a study with medical

students in Jordan.¹² Other aspects with more than 90% correct responses related to the placement of the surgical mask and hand hygiene. Most students agreed that hand hygiene is a preventive measure against COVID-19; however, a lower percentage was correct on the use of 70% alcohol gel. Although hand hygiene is widely considered to be the most important preventive measure to reduce the spread of pathogenic microorganisms to patients and health professionals,¹³ low levels of compliance with hand hygiene, despite the numerous interventions and campaigns carried out to promote this action,¹⁴ show the continuing challenge for training in health care, mainly with the advent of COVID-19. Disinfectant formulations containing 70% alcohol are effective, simple, and low cost. They have been recommended as an essential measure for hand hygiene against the cross-transmission of COVID-19 and are contraindicated when the hands are visually dirty.¹⁵

There was a low percentage of correct answers (<25%) for the questions related to the adequate packaging of an N95 multimode fiber (MMF) filtration facial respiratory mask (MMF N95) or equivalent in conditions of reuse and the required gowning indicated in situations that generate aerosols. Similar results were also observed in a study

carried out in Spain with medical and nursing students, which also found low knowledge related to biosafety measures to prevent the transmission of SARS-CoV-2 in the hospital environment.¹⁰ The emergence of the COVID-19 pandemic emphasized the importance of transmission-based precautions and adequate PPE use, particularly of MMF N95 because of the transmission of SARS despite the use of droplet, contact, and airborne precautions.¹

Thus, activities such as clinical simulation to prepare undergraduate students are essential not only for coping with COVID-19 but also for the prevention and control of other infectious diseases. Therefore, the development and validation of scenarios that allow students to practice methods for the detection, prevention, response, and control of disease with adequate training on the appropriate use of PPE in accordance with the latest guidelines and scientific evidence is recommended.

Providing robust education on the use of PPE remains a challenge.¹⁶ There are difficulties among health care professionals in following guidelines on the correct use of PPE. Therefore, it is necessary that nursing students have training on the correct and proper use of these tools. There is a risk of infection associated with incorrect handling during removal and disposal, with self-contamination by the health care professional who removes the PPE. Some types of PPE make placement and removal difficult, increasing the risk of self-contamination (20%).¹⁷ There are different teaching strategies that can be adopted in undergraduate nursing education. A systematic review study showed that training using educational videos, computer simulations, and face-to-face training for teaching about the use of PPE reduces noncompliance with the guidance for correct handling better than passive training.¹⁷

In this study, it was found that a small percentage of undergraduates (18.8%) had classes and formal content about COVID-19, but 76.3% did not feel safe to act in future clinical practice with the teaching they received on the protection measures of COVID-19. This was also observed in a study carried out in Spain.¹⁰

The study showed that students who had previously had clinical experience, were enrolled in a public education institution, and had a class on safety measures for the care of patients with suspected or diagnosed COVID-19 had greater knowledge about COVID-19. Higher scores for knowledge related to COVID-19 among students in public universities were observed in another study.⁸ Compared with private schools, public universities have been highlighted in evaluations that reflect a better quality of students and teachers.

The discussion about curriculum and essential content for the training of nurses has challenged academic faculty for years; however, with the crisis arising from the pandemic, there is no better time to rethink what constitutes central content and which strategies are most effective for better student learning.¹⁸ The nursing profession worldwide is facing unprecedented challenges because of the COVID-19 pandemic. Schools of nursing must prepare for unique challenges related to their role in training the next

generations of nurses. We recommend that educational institutions provide education for nursing students on infectious diseases, including the proper use of PPE, appropriate personal hygiene practices, and related environmental prevention measures.

Regarding the preventive behaviors that undergraduate students are using to protect themselves from COVID-19, most adopted measures appropriate to those recommended, as also observed in another study.¹⁰ In addition, they perceived a greater risk of being infected when carrying out clinical activities in health care settings. Students who had a better perception of risk showed greater knowledge about COVID-19. This information is relevant, because clinical activities in different areas of nursing practice are mandatory in undergraduate nursing curricula. It is also worth mentioning the relevance of nursing students and professionals to value and adhere to the vaccine against COVID-19.

This is the first study in Brazil conducted nationwide with nursing students on their knowledge about COVID-19. The results contribute to education in confronting the current crisis as well as preparing future nurses in the face of new challenges imposed by the pandemic.

Implications for Nursing Education

The COVID-19 pandemic has presented enormous challenges to health systems and educational institutions and, particularly, health care education. Institutions can use this opportunity to improve the education of future nursing professionals. Undergraduate nursing programs must offer a range of effective theoretical-practical teaching strategies on the prevention and control of infections and infectious diseases, including the most appropriate measures to prevent new epidemics and biosafety protocols in health services. Therefore, it is suggested that educational institutions and teachers review and/or revise curricula to ensure the training of nurses for the future given the number of new and lethal viruses that have emerged since the beginning of the 21st century.¹⁸

To improve knowledge about the importance of hand hygiene, one of the strategies can be the inclusion of practical teaching strategies for nursing students, reinforcing and promoting the guidelines of the WHO regarding the 5 opportunities for hand hygiene (before touching a patient, before performing clean or aseptic procedures, after exposure to body fluids or risk, after touching a patient, and after touching the patient's care environment),¹³ and implementing the SAVE LIVES: Clean Your Hands campaign¹⁵ in all disciplines and in all health care contexts.

This research has as a limitation the inclusion of only students who had access to the internet. However, this study attempted to recruit students from all regions of the country and enrolled in different educational institutions.

Conclusions

The present findings point to the need for educational institutions to plan and implement theoretical and practical

teaching activities on measures for the prevention and control of infectious diseases. This instruction should include an emphasis on PPE and additional precautions, such as those involving aerosols and training in the use and proper disposal of face coverings.

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TEACHING TIP

Gaming Applications to Increase Classroom Interaction

Game-based learning platforms increase student participation when asking the class questions. Multiple benefits of gaming software for test review include reinforcing content, promoting critical thinking, gaining confidence, and answering questions in a nonthreatening environment.¹ Students are digitally connected and with gaming platforms can use their own electronic devices. The teacher adds questions to gaming platforms such as Quizizz (<https://quizizz.com/>) and Kahoot (<https://kahoot.com/>). Questions may include multiple choice, multiple select, word clouds, open ended, and checkbox. There is no character limit for Quizizz, which is beneficial for asking students longer NCLEX-type questions. Students participate using their electronic devices. When students sign into a game, they create a name in which they would like to be identified. Quizizz assigns an emoji. In a study in my course, when asking students questions without one of these applications, student participation may be 10%; when using Quizizz and Kahoot, participation is 85% to 100%. Gaming applications provide active engagement for students. The instructor can see if more time is needed for test review and can alter the response time. Gaming applications also enable the faculty to determine the strengths and weaknesses of the class as a whole, which can lead to more focused review of content.

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