

# Knowledge as a factor in vulnerability to tuberculosis among nursing students and professionals

O CONHECIMENTO COMO FATOR DE VULNERABILIDADE À TUBERCULOSE ENTRE ALUNOS DE GRADUAÇÃO E PROFISSIONAIS DE ENFERMAGEM

EL CONOCIMIENTO COMO FACTOR DE VULNERABILIDAD A LA TUBERCULOSIS ENTRE ESTUDIANTES Y PROFESIONALES DE ENFERMERÍA

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## ABSTRACT

The objective of this study was to identify vulnerability to tuberculosis (TB) related to knowledge about the disease among 76 nursing students and professionals. A quantitative descriptive study was conducted using a closed questionnaire for the collection of data regarding transmission, preventive and biosafety measures, diagnosis, and prejudice regarding the disease. The SAS software version 9.1.3 was used for data analysis, with the level of significance set at 5% ( $p < 0.05$ ). Nursing students and professionals showed a vulnerability to TB related to knowledge about transmission, preventive and biosafety measures, and diagnosis of the disease. With respect to transmission, vulnerability was higher among nursing professionals. The results indicate the need for investment by health-care institutions surrounding this topic in view of the important role of nursing in the establishment of strategies for prevention and control of the disease.

## DESCRIPTORS

Tuberculosis  
Vulnerability  
Nursing  
Communicable disease prevention

## RESUMO

Este estudo intencionou identificar a vulnerabilidade à tuberculose (TB) relacionada à detenção de conhecimento sobre a doença, entre 76 alunos de graduação e profissionais de enfermagem. Trata-se de um estudo quantitativo-descritivo cujos dados foram coletados por meio de um questionário fechado acerca da transmissibilidade, formas de prevenção e medidas de biossegurança, diagnóstico e preconceitos sobre a doença. Os dados foram analisados por meio do software SAS versão 9.1.3, com nível de significância de 5% ( $p < 0.05$ ). Foi evidenciada a vulnerabilidade à TB entre alunos e profissionais relacionada ao conhecimento atinente à transmissibilidade, formas de prevenção e medidas de biossegurança e diagnóstico. No tocante à transmissibilidade, observou-se maior vulnerabilidade entre os profissionais. Os resultados revelam necessidade de investimento em tal questão por parte de instituições médico-assistenciais, considerando o papel desempenhado pela enfermagem nas estratégias de prevenção e controle da doença.

## DESCRIPTORES

Tuberculose  
Vulnerabilidade  
Enfermagem  
Prevenção de doenças transmissíveis

## RESUMEN

Este estudio buscó identificar la vulnerabilidad a la tuberculosis (TB) relacionada al conocimiento poseído sobre la enfermedad entre 76 alumnos y profesionales de enfermería. Estudio cuantitativo descriptivo, con datos recolectados mediante cuestionario cerrado acerca de la transmisión, formas de prevención y medidas de bioseguridad, diagnóstico y preconceitos sobre la enfermedad. Datos analizados con software SAS versión 9.1.3 con nivel de significatividad de 5% ( $p < 0.05$ ). Se evidenció la vulnerabilidad a TB entre alumnos y profesionales relacionada al conocimiento sobre transmisión, formas de prevención, medidas de bioseguridad y diagnóstico. En lo referente a transmisión, se observó mayor vulnerabilidad entre los profesionales. Los resultados determinan necesidad de inversión en tal asunto por parte de instituciones médico-asistenciales, considerando el papel desempeñado por la enfermería en estrategias de prevención y control de la enfermedad.

## DESCRIPTORES

Tuberculosis  
Vulnerabilidad  
Enfermería  
Prevención de enfermedades transmisibles

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## INTRODUÇÃO

Tuberculosis (TB) is an infectious-contagious disease that is more frequent among people living in poverty and under conditions of social exclusion<sup>(1)</sup>, such as unemployment, unhealthy housing conditions, spread of aids and others<sup>(2)</sup>. Although strongly associated with unfavorable socioeconomic conditions, knowledge about TB and the propagation of misinformation, myths and stereotypes have been indicated as possible factors associated with vulnerability to the disease<sup>(3)</sup>. Within this scenario, recent evidence suggests that nursing professionals are vulnerable to TB not only because of elevated exposure, but also because of misinformation and lack of updated knowledge about the disease<sup>(4)</sup>.

The lack of knowledge or mistaken knowledge about TB transmission among current and future nursing professionals directly involved in TB prevention and treatment may compromise disease control and lead to risk behaviors due to inadequate individual exposure, thus increasing the vulnerability of this group to the disease<sup>(4)</sup>. In this respect, a study carried out in a teaching hospital in Rio de Janeiro evaluated the knowledge, attitudes and practices among health professionals, such as nurses, nutritionists, physicians, psychologists and social workers, regarding TB transmission as incoherent with literature data, indicating the need for strategies to overcome ignorance and prejudice regarding the disease<sup>(5)</sup>.

Another study designed to identify aspects that could enhance the vulnerability of nursing professionals to TB showed that, although most participants presented a certain level of knowledge about the disease, misconceptions and equivocal concepts about its transmission persisted<sup>(4)</sup>. Furthermore, misconceptions regarding the transmission of TB among final-year nursing students have been reported in a study conducted at a public university in Rio de Janeiro, with instructions regarding the separation of patients' personal-use items as one of the most marked items of wrong information. The results of that study emphasize the need for further discussions about general measures for the prevention of TB and knowledge consolidation for professional healthcare work<sup>(6)</sup>.

Although there is evidence indicating the lack of knowledge and misinformation about TB among nursing professionals and undergraduate students, it is not clear which aspect of the disease the equivocal knowledge refers to, with most studies investigating specific issues, mainly related to transmission and biosafety<sup>(4,6-7)</sup>.

Stereotypic knowledge about the transmission of TB among students and health professionals has been des-

cribed in the literature<sup>(4-6)</sup>. In addition, the scarcity of studies comparing and characterizing the knowledge of these groups, which play a fundamental role in educational strategies concerning prevention and control of the disease, demands the investigation of this topic as a factor related to these individuals' vulnerability to TB.

Therefore, the main goal of the present study was to evaluate the vulnerability to TB related to knowledge about the disease among undergraduate nursing students and nursing professionals. The hypotheses raised were that students and professionals are more or less vulnerable to TB depending on their knowledge about transmission of the disease and measures of individual protection, and that these groups present different levels of vulnerability to TB depending on how they command their knowledge of the disease, mainly as a function of their experience and practice in its management.

## METHOD

### *Theoretical reference framework*

The concept of vulnerability proposed by Ayres<sup>(8)</sup> was used as a base to analyze TB vulnerability among nursing students and professionals. Conceptually, vulnerability denotes the possibility of a person to be exposed to the disease as a result of individual, collective and contextual factors, which cause a higher degree of susceptibility to the infection and illness and, inseparably, greater or smaller availability of means to protect that person<sup>(8)</sup>. Therefore, not only does it imply the detection of people's weaknesses, but also of their capacity to cope with illnesses<sup>(9)</sup>. Analyses concerning vulnerability are based on the evaluation of individual, programmatic and social aspects<sup>(8)</sup>. In the present study, the TB analysis was only focused on the individual domain, which refers to the amount

and quality of information people possess with regard to health problems<sup>(8)</sup>, including the capacity to acquire knowledge and change the behavior that could expose them to the disease<sup>(9)</sup>.

### *Place of study*

The study involved nursing professionals at a teaching hospital and undergraduate nursing students from a teaching institution located in the State of São Paulo, Brazil.

The teaching hospital attends the maternal-infant population and is a training area for the nursing training program at the teaching institution. At the time of the study, the nursing team consisted of 36 nurses (NN), 44 practical nursing (PN), and 101 nursing assistants (NA), divided among the sectors of adult, pediatric and neonatal inten-

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sive therapy units, neonatal semi-intensive therapy unit, gynecology and obstetric emergency care unit, pediatric emergency care unit, surgical and obstetric center, sterilization center, and maternity, pediatric, internal medicine and surgery units. The teaching institution is a municipal autarchy. Sixty-six students were enrolled and regularly attended the undergraduate nursing course when the study was carried out.

### Study population

Forty nursing professionals (NN, PN and NA) from the day shift who were directly involved in patient care were included in the study. Professionals from the night shift ( $n = 80$ ) and those on vacation or leave ( $n = 16$ ) were excluded. Fifteen professionals refused to participate and thirty questionnaires (42%) were not returned, even after more than two attempts.

The sample from the teaching institution consisted of 36 students enrolled in the second, third and fourth year who regularly attended the nursing course in 2009 and were present at the time of data collection. Forty-six questionnaires were distributed to students who agreed to participate in the study, but only 36 were returned. First-year students were excluded because of the lack of previous contact with the TB topic. Both students and professionals who did not fill out the questionnaires attributed this to lack of time.

### Data collection

The data were collected through a self-administered questionnaire that consisted of sociodemographic variables and closed questions, regarding knowledge about TB adapted from previous studies<sup>(4,6-7,10)</sup> and classified into four knowledge domains: transmission of the disease, preventive and biosafety measures, diagnosis and prejudices. After informed consent, the participants were asked to answer the questionnaires the researcher handed out, who collected them at the end of the class on the same day for the student group and 48 hours after delivery for the professional group.

### Data analysis

For appropriate statistical analysis, the questions posed in the questionnaire were divided into groups of responses, containing two possible alternatives (correct or incorrect). Multiple-choice questions were grouped as yes or no answers. The results are reported as means, standard deviation and absolute and relative frequencies. SAS software, version 9.1.3, was used for data analysis, with the level of significance set at 5% ( $p < 0.05$ ). The association between each question, respective knowledge domain and place of data collection was evaluated, using the Chi-square test or Fisher's exact test. The sum of the number of correct answers for the domains studied was calculated. The Kolmogorov-Smirnov test and normal plot

graphs were used to determine whether mean (and median) scores showed a normal distribution. Since the test revealed no normal distribution, values were compared by the nonparametric Mann-Whitney test.

### Ethical procedure

The study was approved by the Ethics Committee of the teaching institution (No. 190/10) and was conducted according to the guidelines of National Health Council Resolution 196/96.

## RESULTS

### Socio-demographic characteristics of the nursing students and professionals

The sample consisted of 76 subjects, 36 (47.4%) students and 40 (52.6%) professionals. In these two groups, there were PN and NA who were enrolled in the undergraduate nursing course at the time of the study, and undergraduate students who worked as PN, NA and trainee nurses (TN), corresponding to 26.3% ( $n = 20$ ) of the sample. Most subjects (86.8%;  $n = 66$ ) were females, ranging in age from 19 to 24 years (35.5%;  $n = 27$ ).

Among the students, 41.7% ( $n = 15$ ) were enrolled in the second year, 41.7% ( $n = 15$ ) in the third year and 16.7% ( $n = 6$ ) in the fourth year. Fifteen (41.7%) students were working as a TN, PN or NA. Among the professionals, 40.0% ( $n = 16$ ) had a university degree, 45.0% ( $n = 18$ ) secondary education and 12.5% ( $n = 5$ ) were enrolled in the undergraduate nursing course. One professional (2.5%) did not respond. About 45.5% ( $n = 25$ ) of the professionals and students who worked as PN, NA and TN reported that they had been practicing their profession for 1 to 4 years.

With respect to professional category, 37.5% ( $n = 15$ ) were NN, 30.0% ( $n = 12$ ) PN, 27.5% ( $n = 11$ ) NA and 5.0% ( $n = 2$ ) did not answer this question. Six (15.0%) professionals worked in the internal medicine and surgery units, five (12.5%) in the pediatric emergency care unit, five (12.5%) in the maternity unit, five (12.5%) in the surgical and obstetric center, three (7.5%) in the pediatric intensive therapy unit, six (15.0%) in the pediatric unit, two (5.0%) in the adult intensive therapy unit, one (2.5%) in the neonatal intensive therapy unit, one (2.5%) in the neonatal semi-intensive therapy unit, three (7.5%) in the sterilization center and three (7.5%) did not answer.

### Knowledge about disease transmission as a factor of vulnerability to TB

Twenty-one (60.0%) students and 24 (61.5%) professionals responded that one can contract the *Mycobacterium tuberculosis* (MT) when talking to people in general. About 86.1% of the students and 85.0% of the profession-

als responded that contamination by the tuberculosis bacillus is possible when talking to people with TB who were receiving treatment for more than one month. The possibility of transmission by kissing people under treatment was reported by 86.5% of the participants. In addition, 85.3% of the subjects reported that transmission is possible when sleeping in the same room with people with TB during this phase of treatment (Table 1).

Regarding the possibility of contamination when talking to people with TB who are not being treated, although most of the answers revealed no mistaken knowledge,

5.3% (n = 4) of the subjects reported that transmission of the bacillus is not possible under these conditions.

Also in this respect, 40.5% of the professionals and 19.4% of the students responded that there is no possibility of contamination when living in the same house as TB patients. Sixty-nine (93.2%) of the participants mentioned the possibility of contamination with *Mycobacterium tuberculosis* when sharing personal use items like glasses, cutlery and plates with people with TB. The possibility of transmission through contact with the skin was reported by 52.6% of the subjects (Table 1).

**Table 1** - Distribution of the sample according to knowledge about TB transmission - São Paulo, 2010

Possibility of contamination	Total		Nursing students		Nursing professionals		p value
	N	%	N	%	N	%	
<b>Talking to people in general*</b>							0.89 <sup>a</sup>
Incorrect	45	60.8	21	60.0	24	61.5	
Correct	29	39.2	14	40.0	15	38.5	
<b>Talking to TB patients under treatment</b>							0.89 <sup>a</sup>
Incorrect	65	85.5	31	86.1	34	85.0	
Correct	11	14.5	05	13.9	06	15.0	
<b>Sharing personal use items (glasses, cutlery, plates)*</b>							0.36 <sup>b</sup>
Incorrect	69	93.2	35	97.2	34	89.5	
Correct	05	6.8	01	2.8	04	10.5	
<b>Sleeping in the same room as TB patients under treatment*</b>							0.86 <sup>a</sup>
Incorrect	64	85.3	31	86.1	33	84.6	
Correct	11	14.7	05	13.9	06	15.4	
<b>Contact with the skin of TB patients</b>							0.02 <sup>a,**</sup>
Incorrect	40	52.6	14	38.9	26	65.0	
Correct	36	47.4	22	61.1	14	35.0	
<b>Kissing TB patients under treatment*</b>							0.74 <sup>a</sup>
Incorrect	64	86.5	31	88.6	33	84.6	
Correct	10	13.5	04	11.4	06	15.4	
<b>Living in the same house as TB patients*</b>							0.05 <sup>a</sup>
Incorrect	22	30.1	07	19.4	15	40.5	
Correct	51	69.9	29	80.6	22	59.5	

<sup>a</sup> Chi-square test; <sup>b</sup> Fisher's exact test; \* Questions not answered by some participants (n < 76); \*\* Value < 0.05 indicates significance.

Moreover, when students and professionals were asked which individuals would be more vulnerable to TB, no equivocal knowledge about the transmission of the disease was observed. However, some of the subjects (7.9% ; n = 6) did not mention young and elderly individuals or individuals presenting malnutrition and alcohol and drug dependence as groups of people who were more likely to be contaminated. Although mistaken answers were obtained to the question about how to advise patients about the separation of glasses and personal items of the patient, social isolation and absence from work during treatment, 57.9% (n = 44) of the subjects answered this question adequately.

Comparison of the percentage of correct answers to the questions related to disease transmission showed no significant difference between students and professionals, except for the question regarding the possibility of contamination through contact with the skin of TB patients, with 65.0% of the professionals providing mistaken answers versus 38.9% of students (p < 0.02). Borderline significance was observed for the question regarding the possibility of contamination when living in the same house as TB patients (p < 0.05) (Table 1). On the whole, the results showed a similar percentage of mistaken answers and misconceptions related to this domain among students and professionals, with the two groups being vulnerable to TB when considering knowledge about disease transmission.

### Knowledge about prevention and biosafety measures, and diagnosis as a factor of vulnerability to TB

About 95.7% of the participants reported that the BCG-ID vaccine grants protection against pulmonary TB. The use of utility gloves during care to patients with active TB was mentioned by 85.0% of professionals and 94.4% of students as a measure to prevent dissemination of the disease. Although the use of N95 masks was

mentioned as an important measure of individual protection against active TB by 96.1% of the subjects, about 50.0% of the professionals and 36.1% of the students indicated the use of surgical masks by health professionals as an important measure of individual protection. The isolation of active pulmonary TB patients in the hospital was reported by 98.7% of the subjects as an important biosafety measure (Table 2).

**Table 2** - Distribution of the sample according to knowledge about preventive and biosafety measures and diagnosis of TB - São Paulo, 2010

Knowledge about diagnosis preventive and biosafety measures	Total		Nursing students		Nursing professionals		p value
	N	%	N	%	N	%	
<b>Efficacy of the BCG-ID vaccine against pulmonary TB*</b>							<b>0.61<sup>b</sup></b>
Incorrect	67	95.7	32	94.1	35	97.2	
Correct	03	4.3	02	5.9	01	2.8	
<b>Use of a surgical mask</b>							<b>0.22<sup>a</sup></b>
Incorrect	33	43.4	13	36.1	20	50.0	
Correct	43	56.6	23	63.9	20	50.0	
<b>Use of an N95 mask</b>							<b>1.00<sup>b</sup></b>
Incorrect	03	3.9	01	2.8	02	5.0	
Correct	73	96.1	35	97.2	38	95.0	
<b>Use of gloves</b>							<b>0.27<sup>b</sup></b>
Incorrect	68	89.5	34	94.4	34	85.0	
Correct	08	10.5	02	5.6	06	15.0	
<b>Isolation of the patient*</b>							<b>0.48<sup>b</sup></b>
Incorrect	01	1.3	01	2.8	00	0.0	
Correct	74	98.7	35	97.2	39	100.0	
<b>Knowledge about the first diagnostic test for pulmonary TB*</b>							<b>0.24<sup>b</sup></b>
Incorrect	72	96.0	35	100.0	37	92.5	
Correct	03	4.0	00	0.0	03	7.5	

<sup>a</sup> Chi-square test; <sup>b</sup> Fisher's exact test; \* Questions not answered by some participants (n < 76).

With respect to the first test used for the diagnosis of active pulmonary TB, 92.5% of the professionals and 100% of the students did not mention bacilloscopy (Table 2). When asked whether they knew which service offers a diagnostic test for TB, 7.5% (n = 3) of the professionals and 19.4% (n = 7) of the students answered that they did not know.

Comparison of the percentage of incorrect answers showed no significant difference between groups, demonstrating a similar percentage of misconception in the questions related to preventive and biosafety measures among students and professionals.

### Prejudice about the disease as a factor of vulnerability to TB

When asked about their attitudes in case they found out that a colleague/friend/relative had TB, 93.2% of

participants answered that they would not change their jobs and/or leave the places frequented by this person and, only 2.6% of the professionals would like the person with TB to leave. However, 19.2% of subjects would stay in places frequented by persons with TB without saying anything but would be afraid, and 15.1% would not know what action to take when facing this situation. Seventy-two (96.0%) of the subjects reported that they would support the person and four (5.6%) reported that they would try to avoid assisting patients with active pulmonary TB (Table 3). No significant associations were observed between prejudice-related questions and belonging to the group of students or professionals.

Finally, no significant differences regarding the four TB knowledge domains were observed among students who had already worked as nursing professionals ( $0.361 \leq p \leq 0.626$ ).



**Table 3** - Distribution of the sample according to attitudes toward persons with TB - São Paulo, 2010

Attitudes towards persons with TB	Total		Nursing students		Nursing professionals		p value
	N	%	N	%	N	%	
<b>Would like to leave the job and/or place frequented by person with TB*</b>							<b>1.00<sup>b</sup></b>
Yes	01	1.4	00	0.0	01	2.6	
No	69	93.2	33	94.3	36	92.3	
I don't know	04	5.4	02	5.7	02	5.1	
<b>Would like the person with TB to leave the place*</b>							<b>0.10<sup>b</sup></b>
Yes	01	1.4	00	0.0	01	2.6	
No	70	94.6	32	91.4	38	97.4	
I don't know	03	4.1	03	8.6	00	0.0	
<b>Would stay in places frequented by person with TB without saying anything but would be afraid *</b>							<b>0.55<sup>a</sup></b>
Yes	14	19.2	05	14.3	09	23.7	
No	48	65.8	25	71.4	23	60.5	
I don't know	11	15.1	05	14.3	06	15.8	
<b>Would support the person with TB *</b>							<b>0.24<sup>b</sup></b>
Yes	72	96.0	36	100.0	36	92.3	
No	00	0.0	00	0.0	00	0.0	
I don't know	00	0.0	00	0.0	00	0.0	
Other	03	4.0	00	0.0	03	7.7	
<b>Attitude towards assisting patient with active pulmonary TB*</b>							<b>0.61<sup>b</sup></b>
Would try to avoid assisting	04	5.6	01	2.9	03	8.1	
Would not be afraid	68	94.4	34	97.1	34	91.9	

<sup>a</sup> Chi-square test; <sup>b</sup> Fisher's exact test; \* Questions not answered by some participants (n < 76).

## DISCUSSION

This study demonstrated vulnerability to TB related to knowledge about the disease among students and professionals for the knowledge domains of preventive and bio-safety measures, diagnosis and transmission. Regarding knowledge about transmission, professionals were more vulnerable than students, as indicated by the higher percentage of mistaken answers. With respect to prejudice about TB, there was a high percentage of answers demonstrating the lack of prejudice related to the questions the questionnaire raised among students and professionals.

Mistaken knowledge about TB transmission was observed among students and professionals, in line with a study involving medicine students, in which only one-third of the participants correctly responded all questions about disease transmission<sup>(10)</sup>. Misconceptions regarding the transmission of TB were also described among nursing professionals at a teaching hospital<sup>(4)</sup>. Also regarding disease transmission, curiously, a large part of the present sample responded that TB can be transmitted through items like plates, cutlery and glasses used by TB patients, in accordance with other studies<sup>(4,6)</sup>. The need to instruct patients and their family to separate these items was also mentioned, a fact also reported in a previous study<sup>(6)</sup>. However, incoherently, many professionals responded that it is not possible to contract the bacillus when living in the same house as the sick person.

TB is mainly transmitted through the air. Talking, coughing and sneezing of an infectious TB patient release droplets of variable sizes that contain the bacillus into the air. Larger droplets tend to deposit on the ground, whereas lighter ones can remain in suspension for several hours<sup>(11)</sup>. However, only dried droplets ranging in size from 2 to 10 µm (Wells' droplet nuclei) are contagious and can reach the alveoli, where they lodge<sup>(12)</sup> and start multiplying<sup>(11)</sup>. Droplets that are not dried and contain clumps of bacilli are retained by the mucosa of the upper airways. These droplets are removed from the bronchi by the mucociliary system<sup>(12)</sup>, swallowed, inactivated by the gastric juice, and eliminated in feces. Thus, bacilli deposited on glasses, cutlery, plates and other objects will rarely disperse in aerosols<sup>(11)</sup> and are more likely to be ingested than inhaled, so that they will not reach the lungs, where they usually lodge and reproduce<sup>(4)</sup>. Therefore, this route does not play an important role in the transmission of the disease<sup>(11)</sup>. Thus, airborne transmission is the only important route of TB transmission, whereas transmission through the digestive tract is of no epidemiological importance<sup>(13)</sup>.

Misconceptions about the possibility of TB transmission in the presence or absence of treatment are also noteworthy. Transmission of the bacillus is known to be at its highest while the sputum positive TB patient has not yet started treatment<sup>(11)</sup>. An important reduction in bacilliferous populations and in the number of expelled bacilli is observed during chemotherapy, although the patient may continue eli-

minating bacilli<sup>(4)</sup>. However, transmission gradually declines to nonsignificant levels at the end of a few days or weeks of treatment<sup>(11)</sup>. Taken together, the results show that professionals and students might be vulnerable to TB because they do not understand the basic mechanisms of disease transmission and are therefore significantly exposed to infection and are likely to provide mistaken information regarding the transmission route. Comparison showed a higher percentage of misconceptions regarding TB transmission among professionals when compared to the student group, although a larger number of correct answers would be expected from professionals because of their care practice.

With respect to the domain related to preventive measures, surprisingly, a high percentage of students and professionals reported that the BCG-ID vaccine grants protection against pulmonary TB, in agreement with a study involving nursing students from a public university<sup>(6)</sup>. This vaccine is a key measure of protection against severe manifestations of primary infection, such as hematogenic dissemination and meningoencephalitis<sup>(11)</sup>. There is no indication in the National Immunization Program of the Ministry of Health that the vaccine protects against the pulmonary form of TB<sup>(14)</sup>.

The two groups also presented equivocal knowledge about biosafety measures, especially when reporting on the use of surgical masks by health professionals as an individual protection measure, a fact also observed in another study<sup>(7)</sup>. Surgical masks do not offer adequate protection and should only be used by patients with a suspicion or confirmation of TB, in order to contain particles generated by coughing, sneezing or speaking<sup>(15)</sup>. Students and professionals might be vulnerable to infection with *Mycobacterium tuberculosis* (MT) by believing that the use of a surgical mask offers true protection and by not taking adequate precaution against aerosols. In addition, the use of utility gloves was mentioned as a biosafety measure for active pulmonary TB, indicating lack of knowledge about the epidemiological importance of the respiratory route in the transmission of the disease<sup>(13)</sup>.

No significant difference in knowledge about the diagnosis of TB was observed among students and professionals, with the two groups being vulnerable to the disease in terms of this aspect, as demonstrated by the high percentage of incorrect answers in this domain. One important finding is that only a very small portion of the sample reported the use of bacilloscopy for the diagnosis of active pulmonary TB, although this test is widely recommended in control programs designed for health professionals, especially nurses who play an important role in the control of the disease and in the training of the nursing team. Direct bacilloscopy by Ziehl-Neelsen staining is the gold standard for detection of the bacillus and is indicated for the screening of all patients with respiratory symptoms and for monthly bacterial monitoring during treatment<sup>(11)</sup>.

Although the present study was not conducted at a general hospital that attends a large number of TB cases, the

professionals were expected to possess basic knowledge about the disease transmission, irrespective of professional category. In this respect, permanent education activities play an essential role at hospital institutions, in order to update the knowledge of nursing professionals about TB, at least those related to individual protection and disease control measures. Similarly, the concepts and factors of vulnerabilities to the most prevalent diseases, including TB, should be strongly incorporated into undergraduate nursing programs, integrating theoretical knowledge into students' practical primary and secondary care activities, as recommended by the National Curricular Guidelines for Undergraduate Nursing Programs<sup>(16)</sup>.

Given the epidemiological relevance of TB, the current findings indicate the urgent need for medical and teaching institutions' greater efforts to spread knowledge, in line with other authors<sup>(3)</sup>. Those efforts may benefit both students and professionals, contributing to broaden nurses' awareness about their vulnerability to the disease<sup>(17-19)</sup>. Moreover, adequate knowledge of TB may also directly impact nursing practice, as the individual and collective aspects of appropriate biosafety measures could be addressed. Given that acquired knowledge may change behavior<sup>(9)</sup>, correct information about TB could contribute to prevent infection and illness.

The study permitted inferences and interpretations, but the results should be analyzed with caution because of some methodological limitations. First, although the questions of the questionnaire have been used in previous studies, the difficulty to clearly understand them may have produced mistaken answers and may not necessarily indicate a lack of knowledge. In addition, since the study investigated vulnerability related to knowledge, due to the perception that the study may represent an evaluation, professionals refrained from participating, a fact that limited the sample size. Finally, the results obtained are based on a sample from only one teaching institution and one hospital. Thus, generalizations should be made with caution, since this sample may not represent the true behavior of all professionals and students.

## CONCLUSION

Professionals and students showed vulnerability to TB related to knowledge about the disease. With respect to knowledge domains, higher vulnerability was observed among professionals for disease transmission. As for diagnostic, preventive and biosafety measures, the two groups were found to be susceptible to contamination because of misconceptions or equivocal knowledge about TB. The results indicate the need for healthcare institutions to invest in this topic, aiming to improve students and professionals' knowledge about TB, in view of the important role of nursing in the establishment of strategies to prevent and control the disease.

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