Original Article

Nurses knowledge about multidrug resistant bacteria in a teaching hospital

Conhecimento de enfermeiros de hospital universitário sobre bactérias multirresistentes

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Objective: to identify the knowledge of nurses of a teaching hospital about multidrug resistant bacteria. **Methods:** cross-sectional and prospective study with the participation of 109 nurses. Data collection used a questionnaire with open and objective questions. Statistical analysis used the Statistical Package for the Social Sciences software. **Results**: 67.0% of the participants considered the knowledge acquired in the graduation regarding multi-resistant bacteria insufficient to deal with them, with a predominance of professionals graduated before the year 2005; in the transmission process, younger professionals predominated. **Conclusion: k**nowledge about multidrug-resistant bacteria was higher among younger, more recently graduated professionals, with proactive enough to expand knowledge about the subject and to participate in in-service training. The Hospital Infection Control Service was the main source of knowledge for nurses participating in the study.
Descriptors: Infection Control; Bacterial Infections; Knowledge; Drug Resistance, Multiple, Bacterial; Nurses.

Objetivo: identificar o conhecimento de enfermeiros de hospital de ensino universitário sobre bactérias multirresistentes. **Métodos:** estudo transversal e prospectivo, com participação de 109 enfermeiros. Coleta de dados por meio de questionário com questões abertas e fechadas. A análise estatística, seu deu por meio do programa *Statistical Package for the Social Sciences.* **Resultados**: 67,0% dos participantes consideraram o conhecimento adquirido na graduação relativo a bactérias multirresistentes insuficiente para o enfrentamento destas, com predomínio dos formados anterior ao ano de 2005; do processo de transmissão, predominaram os profissionais mais jovens. **Conclusão:** o conhecimento sobre bactérias multirresistentes foi maior entre profissionais mais jovens, de formação mais recente, com iniciativa individual para expandir o conhecimento sobre o tema e participação em treinamentos em serviço. O Serviço de Controle de Infecção Hospitalar foi a principal fonte provedora de conhecimentos para os enfermeiros participantes do estudo.
Descritores: Controle de Infecções; Infecções Bacterianas; Conhecimento; Farmacorresistência Bacteriana Múltipla; Enfermeiras e Enfermeiros.

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Introduction

One of the major problems facing the public health sector worldwide is infections caused by multi-resistant bacteria, which account for about 10.0% of all healthcare-related infections. There is a global consensus that there is a need for urgent action to contain the dissemination[1]. Although there are worldwide recommendations related to actions to prevent the spread of multidrug-resistant bacteria, infectious events by gram-negative pathogens have been increasing and constant[2-3].

In developing countries, there is still a lack of understanding of the impact and relevance of the problem due to insufficient researches related to the theme[4]. Thus, the World Health Organization recommends that institutions with available resources investigate the impact of the problem and the minimum composition of multidrug resistant bacteria control programs[5].

At the same time, professional knowledge is important to understand the infectious chain, especially the four components for infection transmission: microorganism, source, route of transmission and susceptibility[4]. Previous studies indicate that professional knowledge about multi-resistant bacteria may be directly related to the infection rates caused by these pathogens. However, graduation courses have found it difficult to adapt their syllabuses according to existing legislation in order to introduce new subjects. These studies also show that in professional practice, there are knowledge gaps that make it difficult to put into effect measures to prevent infections with multidrug-resistant bacteria[5-6]. In the care of critically ill patients, assisted in a hospital environment, it is believed that this knowledge is crucial for nursing care planning.

Thus, considering that nurses can occupy an important role in controlling the spread of multi drug-resistant bacteria, the objective was to identify nurses' knowledge about multi drug-resistant bacteria in a teaching hospital.

Methods

Prospective and cross-sectional study, from August 2016 to March 2017, at a teaching hospital in Curitiba, Paraná, Brazil, specifically at the Pediatrics, Adult Urgency and Emergency, and Hematology units. From the 123 nurses working in the units investigated, seven refused to participate and seven others were excluded: one due to a change of unit, two due to being on sick leave, two due to maternity leave, one due to vacation, and one for adherence to a strike in the institution. Thus, 109 (88.6%) nurses working in the mentioned units during the data collection period participated in the study.

To select the study settings, the research considered the characteristics of assisted patients susceptible to infections by multi-resistant pathogens, immunosuppression, the need for invasive procedures, or extreme age[1]. Consequently, nursing professionals were chosen as participants, due to the importance of knowledge related to multidrug resistant bacteria for the elaboration of care planning.

Data were obtained through an instrument developed by the researchers, based on recommendations for the prevention of the spread of multidrug-resistant bacteria from the World Health Organization, the Centers for Diseases Control and Prevention (CDC), and the National Health Surveillance Agency. The content of the instrument was evaluated and validated by experts in Infection Control Service. Two pilot tests and three adjustments of the instrument were performed to reach the final version.

The questionnaire includes 42 open and objective questions with affirmative multiple-choice alternatives, referring to: 1) the participant's profile; 2) the acquisition of knowledge about multidrug-resistant bacteria (whether the theme was addressed at graduation, participation in events on the subject, participation in training at the institution on admission and during professional activities, and the origin of information and recommendations); 3) the level of knowledge on the subject, with questions that addres-

sed concepts about multidrug resistant bacteria, risk factors, transmission processes and barriers to prevent dissemination (resources used, difficulty in using the measures).

Data were obtained by one of the researchers, in the units considered, during the participant's working hours and at the time with the lowest number of activities, after the Informed Consent Form was signed.

The results were analyzed using Fisher's Exact Test, Chi-Square, and Odds Ratio-OR with 95% significance limit (p-value less than or equal to 0.05). Analysis of Variance (ANOVA) for comparison of means. For normality tests, the Kolmogorov-Smirnov tests were performed. Participants' responses to patient risk factors for colonization/infection and the application of preventive barriers were grouped by similarity.

The research project was approved by the Institution's Research Ethics Committee of the institution, under protocol 2,039,098/2017. All the prescriptions from Resolution 466/12 of the National Health Council, which deals with researches involving human beings, were followed.

Results

The study included 109 nurses working in direct patient care at the Pediatric, Adult Emergency and Urgency, and Hematology units. Among them, 92.7% were women, 57.8% graduates of public universities, 90.8% with specialist title, 18.3% had master's degree, and 12.8% were PhDs, with an average time of 16.21 years of professional activity.

Regarding whether multi-resistant bacteria were a theme addressed in the undergraduate course, 74 (67.9%) participants reported having discussed it in a discipline and there was statistical significance between those from public and private schools (p=0.007; OR=0.28; Confidence Interval (95% CI)=0.11-0.70). From the 46 professionals graduated from private institutions, 38 (82.6%) had the content addressed during graduation. In contrast, from the 63 professionals from public institutions, 36 (57.1%)

had discussed it. Fifty (67.6%) nurses stated that the knowledge acquired was not enough, impairing their professional practice, especially those who graduated before 2005 (p=0.081; OR=0.37; 95% CI=0.16- 0.89).

Regarding the training on multi-resistant bacteria in the professional practice environment provided by the Hospital Infection Control Service, 30 (27.5%) nurses reported having participated, when admitted to the institution, with greater participation of the group of nurses from the Emergency and Urgency unit (Table 1).

Table 1 – Admission training on multidrug resistant bacteria

Variables	n=109	Yes (27.5%) n=30 (%)	No (72.5%) n=79 (%)	p
Age (years)				0.831
Up to 40	63	18 (28.6)	45 (71.4)	
>40	46	12 (26.1)	34 (73.9)	
Year of Graduation				0.669
Up to 2005	59	15 (25.4)	44 (74.6)	
After 2005	50	15 (30.0)	35 (70.0)	
Length of professional practice in the General Hospital Complex (years)				0.645
Up to 10 years	69	20 (29.0)	49 (71.0)	
>10	40	10 (25.0)	30 (75.0)	
General Hospital Complex Unit				0.006*
Hematology In patient unit	22	1 (4.5)	21 (95.5)	
Bone Marrow Transplant Service and High-Risk Chemotherapy	39	9 (23.1)	30 (76.9)	
Pediatrics	26	9 (34.6)	17 (65.4)	
Adult emergency and urgency unit	22	11 (50.0)	11 (50.0)	
Work period				0.816
Daytime	77	22 (28.6)	55 (71.4)	
Nighttime	32	8 (25.0)	24 (75.0)	

*Statistical significance by Chi-square test

Regarding the training related to multi-resistant bacteria, during the professional activity, the results showed that the participation was more frequent among those who worked during the daytime for all ages (p=0.231) and investigated units (p=0.728) (Table 2).

Table 2 – Training on multi-resistant bacteria during professional activity

Variables	n=109	Yes (62.4%)	No (37.6%)	p
		n=68(%)	n=41(%)	
Age (years)				
Up to 40	63	36 (57.1)	27 (42.9)	0.231
>40	46	32 (69.6)	14 (30.4)	
Year of Graduation				1.000
Up to 2005	59	37 (62.7)	22 (37.3)	
After 2005	50	31 (62.0)	19 (38.0)	
Time of professional practice in the General Hospital Complex (years)				
Up to 10 years	69	42 (60.9)	27 (39.1)	0.688
>10	40	26 (65.0)	14 (35.0)	
General Hospital Complex Unit				
Hematology Inpatient unit	22	13 (59.1)	9 (40.9)	
Bone Marrow Transplant Service and High-Risk Chemotherapy	39	23 (59.0)	16 (41.0)	0.728
Pediatrics	26	16 (61.5)	10 (38.5)	
Adult emergency and urgency unit	22	16 (72.7)	6 (27.3)	
Work period				
Daytime	77	53 (68.8)	24 (31.2)	0.050*
Nighttime	32	15 (46.9)	17 (53.1)	

*Statistical significance by Chi-square test

Regarding the sources of institutional information, most participants 77 (70.6%) reported that the Hospital Infection Control Service was the largest source, followed by colleagues, 22 (20.2%), and management, 17 (15.6%), and less often through personal research.

The occurrence of multi-resistant pathogens in the units investigated was recognized by 108 (99.1%), especially with regards to Gram-negative bacteria: *Klebsiella pneumoniae carbapenase* (KPC), mentioned by 89 (81.7%) participants; *Acinetobacter spp*, by 74 (67.9%); and beta-lactamase-producing enterobacteria, by 67 (61.5%). As for the main risk factor for colonization / infection with multidrug-resistant bacteria, immunosuppression was mentioned by 81 (74.3%) participants, followed by prolonged hospitalization and antibiotic use.

Regarding the process of transmission of multi-resistant bacteria, 38 (34.9%) participants answered affirmatively, especially participants under 40 years old (p=0.045; OR=2.39; 95% CI=1.03-5, 53). Regarding the year of graduation (p=0.687), length of institutional activity (p=0.681), work unit (p=0.733) and working period (p=0.385) there was no statistical significance. Among the resources used to prevent the spread of these bacteria, the following stand out: isolation, 48 (44.0%); proper use of personal protective equipment, 42 (38.5%); and hand hygiene, 33 (30.3%).

Among the participants, 80 (73.4%) reported difficulties in applying prevention measures related to multi-resistant bacteria such as: lack or insufficiency of materials (46 - 57.5%), such as adequate personal protective equipment and antisepsis products; lack of adherence of the multi-professional team to the recommendations related to multi-resistant bacteria (23 - 28.8%); problems related to the physical structure, such as the lack of adequate sites for isolation, the excessive number of beds in a room, and the sharing of toilets (19 - 23.8%). Additionally, 14 (17.5%) nurses reported the workload of nursing professionals and the hygiene as difficulties to the practice of prevention measures.

Regarding hand hygiene, 78 (71.6%) participants did not change the frequency after identification of multi-resistant bacteria in a patient. They indicated that the main reason for this were the universal recommendations, regardless of the patient's diagnosis.

The results also showed that participants who were pro-active and sought to improve their knowledge about multidrug resistant bacteria, and those with adherence to education and personal research activities (p=0.001; OR=6.42; 95% CI=2.06-20.11) stated appropriate knowledge to guide the nursing staff, as well as those who received training during professional activity (p=0.004; OR=3.41; 95% CI=1.49-7.82). However, in the association of adequate knowledge with participation in admission training, there was no statistical significance (p=0.179).

Discussion

As limitations of this study, the impossibility of presenting the association of the knowledge of the participating nurses with the index of infection by multi-resistant bacteria in the units surveyed stands out, considering the number of variables, such as different lengths of stay, comorbidities and immunological conditions. Also, the lack of studies that address the knowledge of nurses about multidrug-resistant bacteria required that, to compare the results found, similar studies had to be used, such as those about standard precautionary knowledge.

The results of this research fill a gap of studies that address nurse's knowledge about multidrug-resistant bacteria, as well as the importance of health institutions to invest in the best practices of in-service education. Creating education strategies that encourage the participation of health workers enables professional training[7].

For most participants the theme was addressed in the graduation course as a part of isolated subjects, especially for the professionals with training in private schools, which have been investing invested in adaptations for this need earlier. Despite the establishment of the Patient Safety Plan in Brazil[8] and the Global Action Plan on Microbial Resistance[9], which influenced universities and institutions, the age and year of graduation of the participants did not show statistical differences.

The nurse's statement that the acquisition of knowledge during graduation related to the theme was insufficient to cope with multi-resistant bacteria, corroborates the findings in the national[10] and international[11] literature, suggesting a shortcoming of academic institutions.

The participation of nurses in the area of urgency and emergency in training activities about the theme, in admission, and during professional activity may be related to the institutional focus on professionals working in areas where patients are more vulnerable to colonization/infection[12].

In this context, despite the worldwide evidence on the subject, the institution has not invested in training or education strategies in admission processes which would be sufficient to meet the nurse's expectations.

Participation in training offered during professional activities seems to be more effective when compared to training at admission. These results are higher than those of a similar study, referring to standard precautions training, which reported a percentage of 27.9%[13], and lower than another study that found 87.0%[14]. These studies show that participation in training influences the degree of knowledge about the recommended measures.

The most important source of institutional information mentioned was the Hospital Infection Control Service, similar to the results of another study on the subject[13]. However, a greater participation of professionals working in daytime training during professional activity, suggests that the institution should direct more attention to nurses working at night.

Educational interventions certainly improve workers knowledge and behavior, especially when they are uninterrupted and combined with other strategies. Training sessions by the Hospital Infection Control Service staff on health care-related infection control and multidrug-resistant bacteria can reduce the existing educational gap.

The predominance of professionals graduated after 2005 and nurses in the areas of Hematology and Adult Emergency and Urgency as participants in educational activities on the subject suggests the effectiveness of recent approaches on the subject in graduation and worldwide attention to areas with patients more susceptible to multidrug resistant bacteria.

The highlighting of gram-negative bacteria from the group of enterobacteria indicates the need for strategies to prevent dissemination, such as proper hygiene of toilet areas and the destination of contaminated waste, sources of dissemination in the hospital environment and community[15]. Investing in educational interventions is crucial for reducing the

transmission of gram-negative pathogens[3].

The main risk factor for colonization / infection was immunosuppression. Regarding transmission, one of the processes was cited, corroborating another study, that considered this knowledge insufficient[16]. Hand hygiene has been mentioned as an action to control and prevent the spread of multidrug-resistant bacteria, but not as the main resource in this control, according to broad dissemination and recommendations[4].

There was a positive association between the knowledge of the need for hand hygiene and its adherence[4]. The fact that in this study hand hygiene appears as something of less importance confirms the need for the institution to invest to develop a greater adherence among health professionals and the implementation of measures that change the attitudes related to facing this challenge.

The World Health Organization warns that, on average, the adherence of health workers to the recommendations of adequate hand hygiene practices is only 61.0%[4]. Adherence to good hospital practice guidelines is directly related to the availability or adequacy of inputs[17]. In the same context, the non--compliance with the institutional policy related to the theme favors the increase in the incidence of multi-resistant bacteria infections.

Professionals from the multi-professional team with more experience and institutional time, who do not adhere to preventive recommendations for multidrug-resistant bacteria, can be a negative example for younger professionals. High rates of healthcare--related infections are associated with noncompliance with these recommendations[11].

Given these results, institutions are recommended to commit to the theme and offer greater attention to outpatient units and to patients vulnerable to multi-resistant bacteria. The Education Services and Hospital Infection Control Service sectors should be integrated with institutional planning, valuing the worker and promoting the creation or maintenance of institutional culture to face multidrug resistance. The importance of hand hygiene should be effectively disseminated and be one of the health care-related infection control strategies.

The results of this research may support the managers of the institution to improve the qualification of professionals. Therefore, this study suggests that workers from the night shift and those who graduated on a more distant date. Also, the need for educational institutions to articulate theory and practice about the theme in the training of nurses should be emphasized.

Conclusion

The findings of the research indicated that knowledge about multidrug-resistant bacteria was higher among younger, more recently educated professionals, who presented an individual initiative to broaden their knowledge, with adherence to training during professional activities. The Hospital Infection Control Service was the main source of knowledge for nurses participating in the study.

Collaborations

Rocha MYYO, Pontes L and Pasquini R took part in project design, analysis, data interpretation, article writing, and in the relevant critical review of intellectual content. Lima JFS contributed to the writing of the article. Kuzma S assisted in the statistical analysis of the data. All authors contributed to the final approval of the version to be published.

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