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# Future nurses and doctors' knowledge of dengue, zika and chikungunya

*Conhecimento de futuros enfermeiros e médicos sobre dengue, zika e chikungunya*

*Conocimiento de futuros enfermeros y médicos sobre dengue, zika y chikungunya*

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**ABSTRACT**

**Objective:** to compare medical and nursing graduates' self-reported knowledge of dengue, zika and chikungunya. **Method**: this quantitative, exploratory, cross-sectional study was conducted at a public university with 41 nursing and medical graduates. Data were collected using a self-answered questionnaire and analyzed using a generalized linear model with binomial distribution and identity link function. The protocol was approved by the research ethics committee. **Results:** on average, medical students returned more correct answers; however, statistically significant differences were found between the courses only on variables relating to clinical examination and evolution and complications. **Conclusion**: this study underlines the importance of training nurses and doctors, so that they are able and prepared to provide care ranging from preventive actions through to rehabilitation of users affected by an arbovirus.

**Descriptors:** Arbovirus Infection; Education, Higher; Medicine; Nursing; Knowledge.

**RESUMO**

**Objetivo:** comparar o conhecimento autorreferido de formandos de medicina e enfermagem em relação à dengue, zika e chikungunya. **Método:** estudo transversal, exploratório e de abordagem quantitativa, realizado em uma universidade pública com 41 formandos dos cursos de enfermagem e medicina. Os dados foram coletados por meio de um questionário autorrespondido e analisados por meio de um modelo linear generalizado com distribuição binomial com função de ligação identidade. Protocolo aprovado pelo Comitê de Ética em Pesquisa. **Resultados:** os graduandos de medicina apresentaram as maiores médias de acertos; porém, somente as variáveis referentes ao exame clínico e à evolução e complicações apresentaram diferença estatisticamente significativa entre os cursos. **Conclusão:** esse estudo reforça a importância da formação de enfermeiros e médicos, para que estejam capacitados e preparados para assistir à população, desde o desenvolvimento de ações preventivas até a reabilitação de usuários acometidos por uma arbovirose.

**Descritores:** Infecções por Arbovírus; Educação Superior; Medicina; Enfermagem; Conhecimento.

**RESUMEN**

**Objetivo**: comparar los conocimientos autoinformados de egresados de medicina y enfermería en relación con el dengue, el zika y el chikungunya. **Método**: estudio transversal, exploratorio con enfoque cuantitativo, realizado en una universidad pública con 41 egresados de los cursos de enfermería y medicina. Los datos se recolectaron mediante un cuestionario autoadministrado y se analizaron a través de un modelo lineal generalizado con distribución binomial con función de vínculo de identidad. Protocolo aprobado por el Comité de Ética en Investigación. **Resultados**: los estudiantes de medicina tuvieron el promedio más alto de respuestas correctas; sin embargo, solo las variables relacionadas con el examen clínico y la evolución y las complicaciones mostraron una diferencia estadísticamente significativa entre los cursos. **Conclusión**: este estudio refuerza la importancia de formar enfermeros y médicos, para que estén capacitados y preparados para atender a la población, desde el desarrollo de acciones preventivas hasta la rehabilitación de usuarios afectados por un arbovirus.

**Descriptores:** Infecciones por Arbovirus; Educación Superior; Medicina; Enfermería; Conocimiento.

## INTRODUCTION

Dengue, zika and chikungunya are infectious diseases transmitted by *Aedes aegypti (A. aegypti).* These diseases are included in the National List of Compulsory Notification of Diseases, Pathologies and Public Health Events, having great relevance for studies, especially dengue, as it is endemic in some Brazilian regions, in addition to presenting high morbidity rates[1].

Brazil witnessed the emergence of arboviruses with the Zika Virus (ZIKV) in 2015 and Chikungunya Virus (CHKV) in 2014, in addition to frequent epidemics of dengue[2]. Over time, spread of the arboviruses has been facilitated by factors such as population growth in large urban centers, transportation between distant regions, climate change and difficulty in effectively controlling the occurrence of outbreaks[3].

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In 2019, in Brazil, 1,668,680 probable cases of dengue, zika and chikungunya were recorded, of which 852 resulted in death[4]. Despite the fact that they share epidemiological similarities, with a transmission cycle basically in urban areas, the evolution and complications resulting from infection by these arboviruses follow different courses[4]. Thus, clinical and laboratory diagnosis is difficult, especially in the presence of cocirculation of more than one type of arbovirus in the same location[5].

The health agents' understanding about the particularities of arboviruses influences early detection of the infection and premature diagnosis of a severe clinical presentation of the disease[6]. However, a number of studies have pointed out deficiencies in the knowledge of health professionals, especially physicians[7], nurses[8]and students attending Nursing[9] and Medicine[10] courses about epidemiological and pathophysiological aspects of dengue, zika and chikungunya, in addition to difficulties recognizing and differentiating signs and symptoms caused by these arboviruses, even in endemic areas.

Such studies present a gap in knowledge, as they did not jointly assess all aspects inherent to dengue, zika and chikungunya, such as etiology, transmission cycle, pathophysiology, epidemiology, signs and symptoms, diagnosis, treatment and prevention means, in addition to not carrying out a comparison between the knowledge presented by undergraduates attending Medicine and Nursing courses; thus, this research aims at minimizing this knowledge gap.

Effective control, prevention, diagnosis and treatment of these arboviruses are closely related to the technical training of health professionals, especially nurses and physicians working in Primary Health Care (PHC) and emergency care services. In this context, the knowledge acquired by nurses and physicians during academic training can be considered one of the main support pillars of the health services, in addition to being a decision-making factor for quality care to the community. Thus, this study asks “Which is the knowledge level of undergraduates in Nursing and Medicine in relation to dengue, zika and chikungunya?"

The knowledge of Nursing and Medicine undergraduates about arboviruses constitutes one of the tasks to be fulfilled by those involved in the referral of the public health policies, particularly with regard to undergraduate education in Nursing and Medicine. The need to carry out a comparative analysis between the subgroups is highlighted, as they are different professions that perform an interdependent work; thus, possible deficiencies in the knowledge of a professional class may influence the assistance provided by another category.

In this context, this study aimed at comparing the self-reported knowledge of medical and nursing students in relation to dengue, zika and chikungunya.

## METHOD

A cross-sectional and exploratory study with a quantitative approach, developed at a public university in the inland of São Paulo, with data collected from February to May 2019.

The population initially defined was 30 and 40 Nursing and Medicine undergraduate students, respectively, which corresponds to the number of students annually enrolled in these courses.

However, the numbers of undergraduate students attending the Nursing and Medicine courses vary and usually do not correspond to the number of freshmen; in 2019, 20 and 25 students completed the Nursing and Medicine courses, respectively, comprising the study population. However, two Nursing students refused to participate and one was excluded from the study for being a member of the research.

Regarding the Medicine course, there were four refusals and seven were excluded after five attempts to perform data collection. Finally, the sample consisted of 17 students in their final year of Nursing and 24 Medicine undergraduate students from a Public Higher Education Institution (PHEI).

For inclusion of the participants, the following criterion was considered: being a student attending the last year of the Nursing or Medicine undergraduate course at a PHEI in the inland of São Paulo. Some students were excluded after five unsuccessful attempts to perform data collection and participate in the research. The data were collected through a self-answered questionnaire, which was elaborated based on the Ministry of Health Protocols on dengue, zika and chikungunya[5,11,12].

The questionnaire consisted of questions grouped in blocks referring to the clinical examination, evolution and complications, containing questions about the signs and symptoms of the diseases; the blocks on clinical and laboratory examination addressed issues related to disease diagnoses; in addition, the blocks that included clinical examination and evolution and complications also dealt with issues related to the treatment of arboviruses.

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The data collected were entered into a database prepared in Microsoft Excel®. The variables were coded according to the alternatives of each item in order to enable statistical analysis. A generalized linear model with binomial distribution with an identity link function was proposed to compare the mean rate of correct answers between the courses. This model was chosen due to the nature of the outcome variables, number of events (correct answers) in a total of attempts (questions).

The class of generalized linear models is an extension of the traditional linear model, which allows the population mean to be dependent on a linear predictor through a non-linear linkage function and allows probability distribution of the response variable to be any member of the exponential family (Normal, Binomial, Poisson and Gamma Distribution)[13].

All the graphs presented were prepared with the aid of the R software, version 3.4.1, and the analyses were performed in SAS 9.2. For all comparisons, a 5% significance level and a 95% confidence interval were adopted. The research protocol was approved by the Research Ethics Committee of the University where the study was carried out.

## RESULTS

The data related to the correct answers in the questions about dengue, zika and chikungunya are presented in Table 1.

**TABLE 1:** Mean of correct answers in the questions about dengue, zika and chikungunya, according to the Nursing and Medicine undergraduates. São Carlos, SP, Brazil, 2019.

| Variables | Nursing (n=17) | | Medicine (n=24) | |
|---|---|---|---|---|
| | Mean | Standard Deviation | Mean | Standard Deviation |
| **Pathophysiology** | | | | |
| Dengue | 75.74 | 13.60 | 80.21 | 9.69 |
| Zika | 53.78 | 13.86 | 64.29 | 15.19 |
| Chikungunya | 55.15 | 18.25 | 64.06 | 17.02 |
| **Epidemiology** | | | | |
| Dengue | 74.21 | 11.52 | 74.04 | 10.59 |
| Zika | 79.14 | 18.68 | 74.62 | 11.37 |
| Chikungunya | 77.06 | 16.49 | 72.08 | 14.74 |
| **Clinical exam** | | | | |
| Dengue | 67.16 | 16.26 | 90.63 | 14.18 |
| Zika | 57.52 | 26.71 | 78.70 | 19.36 |
| Chikungunya | 58.24 | 24.04 | 84.17 | 16.92 |
| **Laboratory exam** | | | | |
| Dengue | 55.88 | 25.81 | 69.79 | 16.45 |
| Zika | 49.41 | 22.49 | 56.67 | 21.80 |
| Chikungunya | 42.65 | 19.29 | 51.04 | 21.47 |
| **Evolution and complications** | | | | |
| Dengue | 62.75 | 18.19 | 75.69 | 12.98 |
| Zika | 74.51 | 17.79 | 89.58 | 10.78 |
| Chikungunya | 64.71 | 26.27 | 78.47 | 18.04 |
| **Prevention means** | | | | |
| Dengue | 71.43 | 25.25 | 75.60 | 18.59 |
| Zika | 52.94 | 29.78 | 63.10 | 24.89 |
| Chikungunya | 53.78 | 29.25 | 61.90 | 26.53 |
| **Total** | | | | |
| Dengue | 69.53 | 8.17 | 79.08 | 5.96 |
| Zika | 62.88 | 10.50 | 72.04 | 7.06 |
| Chikungunya | 60.65 | 13.92 | 70.74 | 8.86 |

The total mean values of correct answers for dengue, zika and chikungunya, respectively, were 79, 72 and 70.7 for Medicine and 69.5, 62.8 and 60.6 for Nursing.

The Medicine students presented the highest mean scores when compared to their Nursing counterparts in all variables, with the exception of the variable referring to the epidemiology of arboviruses, in which the mean scores

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among Medicine undergraduates were 74, 74.6 and 72 for dengue, zika and chikungunya, respectively; and, for Nursing students, 74.2 for dengue, 79.1 for zika and 77 for chikungunya.

The mean values of correct answers in relation to the clinical examination stand out, which were 90.6, 78.7 and 84.1 for Medicine, respectively, for dengue, zika and chikungunya, whereas values of 67.1, 57, 5 and 58.2 were found for Nursing. The block of variables referring to the clinical examination presented the highest differences in the mean values of correct answers between the courses, indicating greater discrepancy in the students' knowledge levels.

The overall result showed a statistically significant difference when comparing the knowledge between Medicine and Nursing undergraduates for dengue, zika and chikungunya (Table 2).

**TABLE 2:** Comparison of the mean values of correct answers between the Nursing and Medicine courses about dengue, zika and chikungunya. São Carlos, SP, Brazil, 2019.

| Variables | Estimate | Confidence Interval (%) | p-value |
|---|---|---|---|
| **Pathophysiology** | | | |
| Dengue | -4.47 | -13.62 – 4.67 | 0.340 |
| Zika | -10.5 | -22.03 – 1.02 | 0.070 |
| Chikungunya | -8.92 | -19.68 – 1.85 | 0.100 |
| **Epidemiology** | | | |
| Dengue | 0.17 | -7.38 – 7.72 | 0.960 |
| Zika | 4.52 | -3.32 – 12.36 | 0.260 |
| Chikungunya | 4.98 | -3.52 – 13.47 | 0.250 |
| **Clinical exam** | | | |
| Dengue | -23.47 | -30.74 – -16.2 | <0.010 |
| Zika | -21.19 | -30.74 – -11.64 | <0.010 |
| Chikungunya | -25.93 | -34.67 – -17.2 | <0.010 |
| **Laboratory exam** | | | |
| Dengue | -13.91 | -28.86 – 1.05 | 0.070 |
| Zika | -7.25 | -21.1 – 6.59 | 0.300 |
| Chikungunya | -8.39 | -23.83 – 7.04 | 0.290 |
| **Evolution and complications** | | | |
| Dengue | -12.95 | -24.66 – -1.24 | 0.030 |
| Zika | -15.07 | -24.89 – -5.25 | <0.010 |
| Chikungunya | -13.77 | -25.22 – -2.32 | 0.020 |
| **Prevention means** | | | |
| Dengue | -4.17 | -14.56 – 6.23 | 0.430 |
| Zika | -10.15 | -21.72 – 1.41 | 0.090 |
| Chikungunya | -8.12 | -19.71 – 3.46 | 0.170 |
| **Total** | | | |
| Dengue | -9.55 | -13.41 – -5.7 | <0.010 |
| Zika | -9.16 | -13.51 – -4.82 | <0.010 |
| Chikungunya | -10.09 | -14.49 – -5.69 | <0.010 |

Despite the fact that the Nursing students obtained the highest mean values of correct answers regarding the epidemiological aspects of arboviruses, this fact does not represent a statistically significant difference.

It is noted that a statistically significant difference ($p<0.05$) was observed between the Medicine and Nursing courses only for the variables related to clinical examination and evolution and complications, in which medical undergraduates obtained the highest mean of correct answers.

Figure 1 shows the comparison between the proportions of correct answers between the groups of Nursing and Medicine students, regarding the clinical examination for the three arboviruses studied.

The Medicine undergraduates obtained a proportion of correct answers that varied from 70% to 100% when asked about the clinical examination of dengue, with 2/3 giving correct answers to more than 90% of the questions. Among the Nursing undergraduates, the variation in the proportion of correct answers regarding the clinical examination of dengue was from 60% to almost 80% and half of the participants gave correct answers to between 60% and 70% of the questions.

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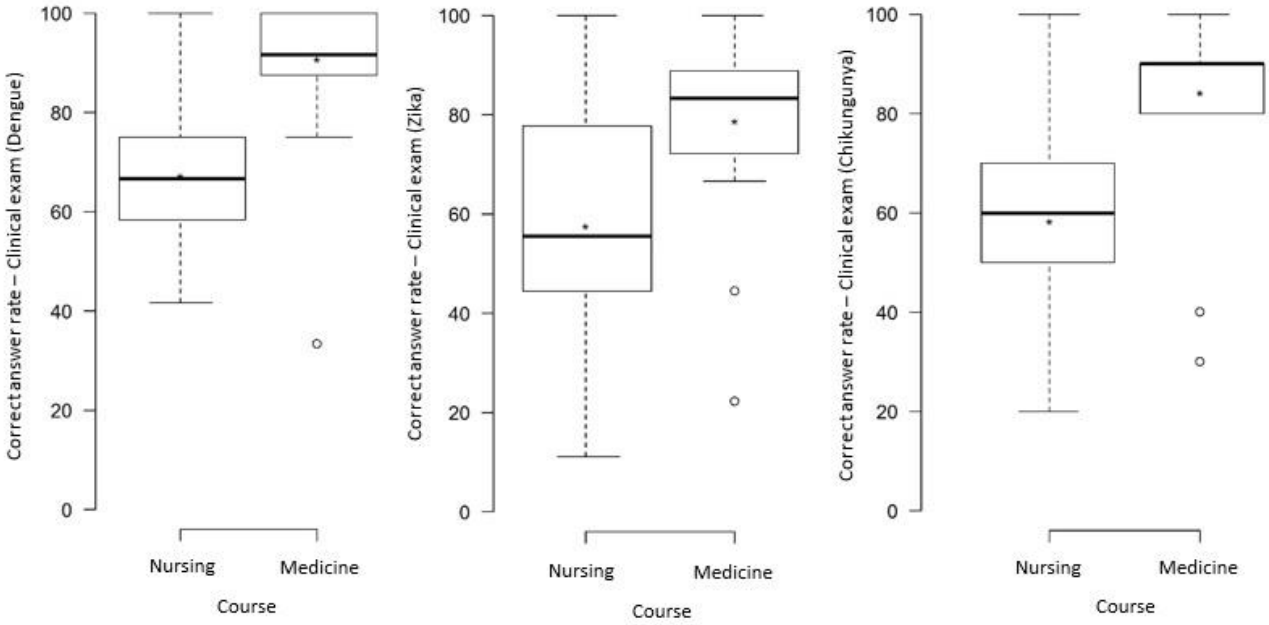


**FIGURE 1:** Comparison between the proportions of correct answers between the Nursing and Medicine undergraduates about the clinical examination of dengue, zika and chikungunya. São Carlos, SP, Brazil, 2019.

In relation to the clinical examination of zika, the proportion of correct answers given by Nursing students varied from 40% to almost 80%, with 2/3 of the participants giving correct answers to more than 50% of the questions; while for Medicine, the correct answer range was almost 80% to 90% and 1/3 gave correct answers to more than 80% of the questions.

The Nursing graduating students obtained a proportion of correct answers varying from 50% to 70% on the clinical examination of chikungunya and half of the participants gave correct answers to 60% of the questions; while the Medicine undergraduates maintained superior performance, with a success rate that varied from 80% to 90%.

As for the evolution of the diseases in question, Figure 2 shows the comparison between the proportions of correct answers among Nursing and Medicine undergraduates.

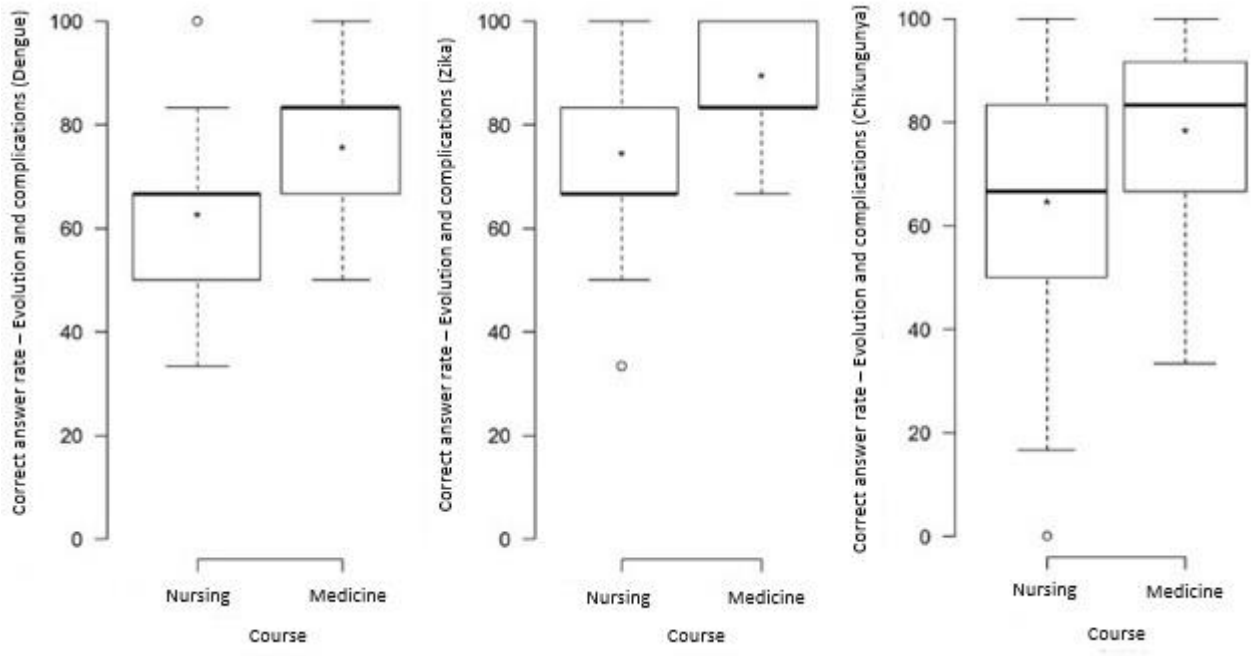


**FIGURE 2:** Comparison between the proportions of correct answers between the Nursing and Medicine undergraduates about the evolution and complications of dengue, zika and chikungunya. São Carlos, SP, Brazil, 2019.

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The Medicine undergraduates had a 75.69% success rate with regard to the evolution and complications of dengue. Among the Nursing undergraduates, the proportion of correct answers about the evolution and complications of dengue was 62.75%.

As for zika, the proportion of correct answers for evolution and complications was 74.51% for Nursing and 89.58% for Medicine.

The Nursing undergraduates had a 64.71% success rate for the evolution and complications of chikungunya and their Medicine counterparts, 78.47%.

## DISCUSSION

The in-depth knowledge of Medicine and Nursing students about vector reproduction, virus transmission and pathophysiological mechanisms of arboviruses, in addition to diagnosis, treatment and prevention means is fundamental in the current context, as Brazil is considered an endemic country for these diseases.

Lack of knowledge about arboviruses and their specificities, together with the difficulty preventing their occurrence or treating the complications, represents a challenge for the control of these diseases. The implementation of preventive actions against exposure to the vectors stands out, especially through educational practices developed in the PHC services; in addition to emphasizing the role of nurses as the main health education agents[14].

The level of knowledge presented by the Nursing students about the prevention means for arboviruses indicates the need for better qualification, especially with regard to zika and chikungunya. Supervised teaching activities in the practical field are important tools that contribute to training, helping students to become able to assemble and lead multidisciplinary teams, as well as to foster interprofessional and collaborative practice.

A study carried out on the perception of risk and the level of knowledge about diseases transmitted by *A. aegypti* showed that physicians performed better when compared to nurses[15]. Such fact can be partially explained by the greater workload required for the training of physicians, between undergraduation and residency; therefore, the greater possibility of dedication to specific themes of the curriculum.

The fact that nurses are responsible for care and management functions at different health care levels may compromise care quality since, throughout undergraduation, the approach to certain themes can be considered neglected, as well as insufficient for learning and practical application.

A research study showed that 87.5% (70) of the Nursing students had unsatisfactory knowledge about dengue[13]. Similarly, a study revealed that, of the 313 Health Sciences students, only 21% had sound knowledge about dengue[16]. The fact that dengue is considered a recurrent disease and that it often presents itself in a benign form can contribute to future nurses directing the focus of studies to more serious pathologies.

A study assessed the knowledge of 500 university students from four courses, including Nursing and Medicine, about zika and revealed that 62.8% (314) of the participants had little knowledge about the disease. The Medicine students had the best overall performance and the Nursing students, the worst[10]. The difficulty differentiating the signs and symptoms, which can also manifest in other febrile diseases, combined with the fact that only recently has zika received greater attention from the media in Brazil and from health professionals, are also possible explanations for this knowledge gap.

Regarding chikungunya, a research study carried out in 2017, involving 563 professionals and students in the health, area found that 43.3% (244) of the participants were unaware of the existence of the virus and, of those who were, only 31% revealed adequate knowledge about the disease[9]. These findings show the urgency of offering qualification and training, both for professionals directly involved in patient care and for professors of undergraduate courses in the health area at higher education institutions. It is noted that chikungunya, dengue and zika alike are diseases with a high potential to cause epidemics, compromising the population's well-being and burdening the health services.

Nurses are the health agents who maintain greater proximity with the users of health services, and are considered the main responsible for care and health education actions. These professionals are the main actors in PHC who, in conjunction with the health surveillance services, develop activities to prevent arboviruses, aiming to minimize the risk of outbreaks and epidemics[17].

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The educational activities on the prevention of arboviruses aimed at users and the community are generally developed and organized by nurses. These professionals also provide direct assistance to people diagnosed with one of these diseases, requiring consolidated theoretical knowledge about all aspects inherent to arboviruses.

The relevance of the clinical examination of dengue becomes even more accentuated when considering that the clinical-epidemiological criterion is the most indicated to confirm suspected cases of dengue in an epidemic period, while the laboratory criterion plays an ancillary role[5].

Professionals with insufficient knowledge about the clinical characteristics of the disease may delay decision-making related to measures to contain spread of the virus and impair proper clinical management. In addition to the technical knowledge related to the diagnosis, drug therapy, test ordering and interpretation, health professionals should be familiar with the epidemiology of these diseases.

Lack of adequate knowledge about epidemiology can lead these professionals to inadequately guide the patients, compromising success of the virus transmission control strategies. A study assessed the knowledge, attitudes and practices of 79 health professionals about the dengue infection, 82.0% of which were physicians, and significant gaps were identified with regard to epidemiology and prevention[7].

These findings reflect the traditional biologicist health care model, which has been prevalent for a long time in public health, focusing only on physicians and diseases, without considering the relevance of the context and social determinants of the health-disease process[18].

The epidemiological characteristics of arboviruses indicate the need to intensify actions to fight against the vector and direct prevention actions[19]. Comprehensive health care requires that physicians, in addition to specific practices in their area of expertise, also develop health education actions during the consultation. Likewise, nurses must have adequate technical knowledge to recognize the signs and symptoms of the diseases, as they in charge of welcoming and risk classification.

The need to train health professionals already working to deal with the new reality of emerging diseases such as zika and chikungunya is highlighted, reflecting on the training of nurses and physicians since, in many health services, these professionals provide tutoring to students, in addition to monitoring the internships.

A number of research studies carried out with Nursing students and professionals revealed deficiencies in knowledge regarding various aspects of zika and chikungunya[10,13,16]. The deficiency in the theoretical and practical teaching regarding arboviruses makes physicians and nurses feel little confident when they start their professional activities and face difficulties in identifying and treating these diseases. The need to improve knowledge even before insertion of the professionals in the labor market is emphasized[20].

Given the above, the need to rethink teaching strategies is evident, prioritizing the training of professionals with robust theoretical knowledge and practical experience. These professionals must be able to articulate the different knowledge areas, especially with regard to the prevention, diagnosis and treatment of diseases transmitted by *A. aegypti*.

### Study limitations

This study was limited by the resistance of undergraduates, especially from the Medicine course, to participate in the study, which hindered data collection. Another limitation is the lack of studies which would enable a comparison with the results obtained in this survey, especially in the national scope.

## CONCLUSION

It is concluded that, among Medicine and Nursing undergraduates, the mean values related to the clinical examination were the only ones with a statistically significant difference. However, the results of the other variables showed the need to develop strategies that favor multidisciplinary professional training that includes aspects of health promotion, protection, prevention, recovery and rehabilitation.

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