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Knowledge about healthcare-associated infections in medical, bioanalysis and nursing students from a Venezuelan university

Conocimiento sobre infecciones asociadas a la atención de la salud en estudiantes de Medicina, Licenciatura en Bioanálisis y Licenciatura en Enfermería de una universidad venezolana

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Abstract

Introduction: Knowledge about healthcare-associated infections (HAIs) among health professionals is fundamental to reduce morbidity and mortality rates attributable to these infections.
Objective: To assess the level of knowledge on HAIs in final-year students enrolled in the School of Health Sciences of Universidad de Oriente, Venezuela.
Materials and methods: A descriptive study was conducted in a stratified random sample (n=98). A survey was administered to all participants in order to determine their knowledge about 3 specific areas: basics of HAIs, universal precautions and hand hygiene. Students who obtained an average score of 17.5 were considered as having an adequate level of knowledge about HAIs.
Results: Participants' average age was 24.9 years, and 74.9% were female. The average scores of nursing, medical and bioanalysis students were 18, 18.04 and 17.25, respectively; the total average score was 17.87. 59.2% of the respondents obtained a passing score. In terms of the 3 areas of knowledge assessed in the survey, most of the students obtained a failing score in basics of HAIs (n=78) and the Hand hygiene (n=76) components, while the majority (n=91) had a passing score in the Universal precautions area.
Conclusions: In general, all respondents have adequate knowledge about HAIs and their prevention. However, regardless of the academic program they were enrolled in, students showed a lack of knowledge regarding specific aspects of HAIs, such as the source of the microorganisms that cause these infections or the proper use of gloves, thus it is necessary that more attention is paid to these issues in their curricula.
Keywords: Cross Infections; Infection Control; Health Knowledge, Attitudes, Practice; Universal Precautions; Hand Hygiene (MeSH).

Resumen

Introducción. El conocimiento acerca de las infecciones asociadas a la atención de la salud (IAAS) en profesionales en salud es fundamental para disminuir las tasas de morbimortalidad causadas por estas infecciones.
Objetivo. Evaluar el nivel de conocimiento sobre las IAAS en estudiantes del último año de la Escuela de Ciencias de la Salud de la Universidad de Oriente, Venezuela.
Materiales y métodos. Estudio descriptivo realizado en una muestra aleatoria estratificada (n=98). Se aplicó una encuesta para determinar los conocimientos de los participantes sobre 3 áreas específicas: generalidades sobre IAAS, precauciones universales e higiene de las manos. Se consideró que los estudiantes tenían un conocimiento adecuado si obtenían un puntaje promedio de 17.5.
Resultados. La edad promedio de los encuestados fue 24.9 años y el 74.9% fueron mujeres. En promedio, los estudiantes de Licenciatura en Enfermería, los de Medicina y los de Licenciatura en Bioanálisis obtuvieron 18, 18.04 y 17.25 puntos, respectivamente; el 59.2% de los respondientes aprobó la encuesta y el puntaje promedio total fue 17.87 puntos. En cuanto a las tres áreas de conocimiento evaluadas, la mayoría de estudiantes reprobó Generalidades sobre IAAS (n=78) e Higiene de las manos (n=76), mientras que la mayoría (n=91) aprobó Precauciones universales.
Conclusiones. En general, los estudiantes encuestados tienen un conocimiento adecuado de las IAAS y su prevención; sin embargo, independiente del programa académico, se evidenciaron deficiencias en aspectos puntuales del tema, tales como la fuente de los microorganismos causantes de las IAAS y el uso adecuado de guantes, por lo que es necesario que los currículos de estos programas profundicen más al respecto.
Palabras clave: Infección hospitalaria; Control de infecciones; Conocimiento; Precauciones universales; Higiene de las manos (DeCS).

Introduction

Healthcare-associated infections (HAIs) are the most common adverse event in health care delivery and are of concern worldwide. The burden of HAIs is much higher in low- and middle-income countries than in high-income countries. These infections can occur while patients are being treated in any healthcare facility or even after discharge. They also include occupational infections contracted by healthcare personnel. [1]

The acquisition of HAIs may be associated with the lack of knowledge about certain infections among health care personnel or to practices that do not take into account preventive measures against them. [2,3] Institutions and governments in different countries have identified education as an important factor for prevention and control since poor knowledge in this regard is the main reason why professionals do not adhere to prevention measures in the future. [4,5] However, education is not the only aspect involved, because even though it increases knowledge, it does not necessarily increase the implementation of preventive and control measures. This also depends on factors such as the influence of co-workers or students, the workload and the availability of equipment, implements and sanitary facilities such as sinks with drinking water, paper towels, soap, among others. [3,5,6]

Studies conducted in different countries suggest that students of health science programs have insufficient knowledge of HAIs and their prevention; [7-13] this is mainly due to inadequate contents and training on these infections in the curricula of some universities. [5,11,12] In this sense, multiple authors have suggested that theoretical and practical contents on this matter should be strengthened [7,11,12,14-16] and that specific courses addressing HAIs and their prevention should be created. [13,17]

Two important aspects that should also be considered are the role of teachers in HAIs prevention training and their preparation for that. Teachers should not only act as educators, formally speaking, but should also act as role models and promoters of good clinical practices and serve as an example to their learners through the correct application (during teaching and daily clinical practice) of the measures and protocols established. Some research has found that teachers of different health science careers are not well prepared in HAIs and their prevention [18,19] and, therefore, they pass on wrong knowledge to their students and act as negative role models regarding their prevention by transmitting misconceptions or engaging in inappropriate practices. [18,20]

Students' knowledge about HAIs and their prevention is essential to reduce morbidity and mortality rates caused by these infections in professional practice. Given the above, universities must emphasize on raising awareness in future professionals about the spread of the infections to which they will be exposed in clinical practice. [7,16,21] Moreover, this knowledge must be strengthened once they start their working life, as it will allow them to improve their attitudes and practices regarding the prevention and control of HAIs. [22]

Due to the importance of this topic, this research aimed to evaluate the knowledge that medical, bioanalysis, and nursing students from a Venezuelan university have regarding HAIs and their prevention.

Materials and methods

Descriptive and cross-sectional study with field design carried out on a stratified random sample that included final year students of the medical, bioanalysis and nursing programs offered at the School of Health Sciences "Dr. Francisco Battistini Casalta" at the Universidad de Oriente, Bolívar Campus, in Venezuela.

Population and sample

The population consisted of 536 students: 284 from the medical program, 131 for the bioanalysis program, and 121 from the nursing program. Random stratified sampling was conducted, and each of the programs was considered as a stratum. The sample size and its distribution in the strata were estimated using the program for epidemiological data analysis EpiDat 4.1 (Xunta de Galicia/Pan American Health Organization). The estimation took into account the expected standard deviation (σ) according to previous studies that used the same methodology, [7,16] the correction of the sampling error by design effect, and absolute precision of 1.

The selected sample was proportionally distributed according to the size of each stratum. It was comprised of 98 students: 52 from Medicine, 24 from Bioanalysis and 22 from Nursing. Participants were randomly selected by the EpiDat program from the list of students in the population. All students selected agreed to participate in the study.

Data collection

To collect the data, a previously designed and validated survey was administered [7] to establish age, sex, and how information on HAIs and their prevention was acquired. Knowledge was investigated in 3 specific areas: basics of HAIs, universal precautions, and hand hygiene. The survey included 25 closed-ended questions with true/false responses, and each item answered correctly had a score of 1 point. The area basics of HAIs had 5 items, universal precautions had 12, and hand hygiene had 8.

Students who scored an average of ≥17.5 on the survey were considered as having adequate knowledge of HAIs and their prevention. [7,16] This same form of rating was applied to the different aspects evaluated; therefore, the minimum acceptable averages of correct answers by categories were: 3.5/5 for basics of HAIs, 8.4/12 for universal precautions, and 5.6/8 for hand hygiene. [16] Also, 4 questions inquired about the current definition of the HAIs, but the answers were not taken into account for the final rating of the survey.

Statistical processing

A bivariate analysis was performed. Statistical significance (p-value) was calculated using the chi-square test (X^2) for categorical variables and the analysis of variance (ANOVA) for continuous variables, with a 95% confidence interval. A logistic regression was done to identify independent factors associated with

acceptable knowledge about HAIs and their prevention. The considered variables were age, sex, and program, and the calculations were made with the program SPSS version 20; a value of p≤0.05 was considered statistically significant.

Ethical considerations

The research protocol was approved by the Bioethics and Health Biosafety Committee of the Complejo Hospitalario Universitario "Ruiz y Páez" in Ciudad Bolívar, State of Bolivar, Venezuela, through minutes number CHURP-CBBS-001-2017 of January 15, 2017. This research was developed in compliance with the ethical principles for the conduct of medical studies in human beings of the Declaration of Helsinki.[23] Respondents were informed of the purpose of the research and expressed their verbal and voluntary consent to participate in the study.

Results

In total, 98 students were interviewed, 74.5% female and 25.5% male, with an average age of 24.9 years (σ±2.3; range: 22-35). The average score obtained in the survey was 17.8 (σ±1.9; range: 11-23). When evaluating the knowledge about the areas studied, it was found that the average score in universal precautions was the only category above the passing score (Table 1).

The average score obtained according to the program was compared, finding that medical and nursing students have adequate knowledge about HAIs and their prevention, contrary to bioanalysis students; however, there were no statistically significant differences (ANOVA: F=1.4704; p=0.2350). Medical students obtained the highest average score in basics of HAIs and universal precautions. In contrast, nursing students had the highest average in hand hygiene (Table 1). Regarding universal precautions, statistically significant differences were found between the three groups (ANOVA: F=3.4486; p=0.0358). A Tukey HSD (honestly significant difference) post-hoc test also showed significant differences between medical students and bioanalysis students (p=0.0272).

59.2% of the respondents demonstrated adequate knowledge of HAIs and their prevention. However, when evaluating knowledge about the areas studied, it was found that most know the basic concepts of universal precautions (92.9%), but not of the basics of this type of infection (20.4%) or hand hygiene (22.4%) (Table 1).

Most nursing and medical students passed the survey, as opposed to the bioanalysis students; however, no statistically significant differences were found between the three groups (X^2=4.1798; p=0.1236). When considering each of the three areas evaluated separately, it was found that the majority of respondents failed in the basics of HAIs and hand hygiene (Table 1).

Table 1. Average score and percentage of passing students according to areas of knowledge studied and program.

	Overall	Program			p-value
		Medicine	Bioanalysis	Nursing	
Average score (±σ; Range)	17.8 (±1.9;11-23)	18.1 (±1.62;14-23)	17.3 (±2.35;11-21)	18 (±2.12;11-21)	0.235
Basics of HAIs (±σ; Range)	2.9 (±0.8; 1-5)	3.0 (±0.8;1-5)	2.9 (±0.8;2-5)	2.7 (±0.6;2-4)	0.265
Universal precautions (±σ; Range)	10.4 (±1.1;5-12)	10.6 (±0.9;7-12)	9.9 (±1.5;5-11)	10.5 (±1.1;7-12)	0.035
Hand hygiene (±σ; Range)	4.5 (±1.3;1-8)	4.4 (±1.1;3-7)	4.5 (±1.4;1-8)	4.8 (±1.5;2-7)	0.404
Number and percentage of passing students	58 (59.2%)	33 (63.5%)	10 (41.7%)	15 (68.2%)	0.123
Basics of HAIs	20 (20.4%)	15 (28.8%)	4 (16.7%)	1 (4.6%)	0.524
Universal precautions	91 (92.9%)	49 (94.2%)	21(87.5%)	21(95.5%)	0.494
Hand hygiene	22 (22.4%)	10 (19.2%)	5 (20.8%)	7 (31.8%)	0.483

σ: standard deviation; HAIs: Healthcare-associated infections.
Source: Own elaboration.

Most of the students stated that they had answered the survey based on the knowledge they acquired during their undergraduate studies. However, it is important to note that many participants also reported having obtained information from other sources (Figure 1).
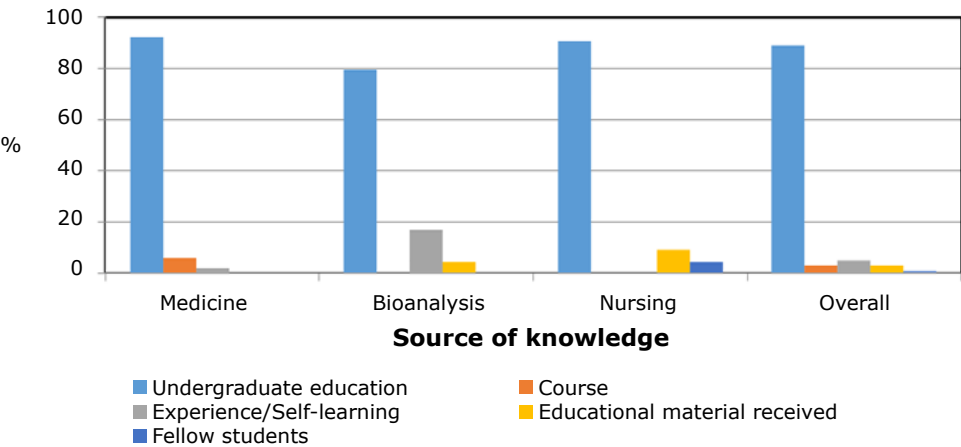
Figure 1. Source of knowledge about healthcare-associated infections and their prevention.
Source: Own elaboration.

The average score for the questions on the current definition of HAIs was 2.9 (σ±1.01; range: 1-4). When evaluating this average according to each of the programs, it was found that bioanalysis students obtained 3.2 points (σ±0.8; range: 1-4); nursing students, 3.1 (σ±0.9; range: 1-4), and medical students, 2.8 (σ±1.1; range: 1-4). 77.6% of respondents correctly answered the question about the groups that are susceptible to contracting a HAI. In particular, nursing students were unaware that HAIs could develop up to 48 hours after hospital discharge or up to 3 months later if a device has been implanted in the patient. Also, a significant percentage of medical students are unaware that anyone in any health care setting is susceptible to acquiring one of these infections (Table 2).

Tables 3, 4, and 5 show the questions asked and the percentage of correct answers according to the areas evaluated and the program studied by the respondents.

Table 2. Percentage of correct answers in relation to the current definition of healthcare-associated infections.

Question	Correct answer	Overall	M	B	N
These are infections that occur only in hospitalized patients and appear 48 hours after admission.	F	64.3	57.7	70.8	72.7
These are infections that appear up to 48 hours after hospital discharge or up to 3 months after discharge if the patient has an implanted medical device or prosthesis.	T	73.5	73.1	83.3	63.6
These are infections that occur in any person, patient, healthcare worker or visitor who is in contact with healthcare facilities.	T	77.6	67.3	79.2	100
These are infections that occur in hospitals, long-term care facilities, community/outpatient facilities, home care settings, or community centers.	T	78.6	76.9	87.5	72.7

M: Medicine; B: Bioanalysis; E: Nursing; T: True; F: False.
Source: Own elaboration.

Table 3. Percentage of correct answers regarding the basics of healthcare-associated infections.

Question	Correct answer	Overall	M	B	N
The environment (air, water, inert surfaces) is the main source of bacteria responsible for HAIs	F	11.2	13.5	12.5	4.5
Older or very young age increases the risk of HAIs.	T	95.9	96.2	100	90.9
Invasive procedures increase the risk of HAI.	T	93.9	98.1	91.7	86.4
The prevalence of HAIs in Venezuela is unknown.	T	48	53.8	41.7	40.9
HAIs are responsible for approximately 10 000 deaths every year in Venezuela.	F	43.9	42.3	41.7	50

M: Medicine; B: Bioanalysis; E: Nursing; V: True; F: False; HAIs: Healthcare-associated infections.
Source: Own elaboration.

Table 4. Percentage of correct answers in relation to universal precautions.

	Question	Correct answer	Overall	M	B	N
Universal precautions:	include recommendations to protect only the patients.	F	89.8	85.5	91.7	95.5
	include recommendations to protect patients and health workers.	T	96.9	96.2	95.8	100
	are applicable to all patients.	T	90.8	90.4	87.5	95.5
	are applicable only to health care workers who come into contact with body fluids.	F	81.6	86.5	75	77.3
Universal precautions recommend wearing gloves:	during all procedures.	F	11.2	15.4	4.2	9.1
	when there is a risk of contact with blood or body fluids	T	95.9	100	87.5	95.5
	when there is a risk of getting a cut.	T	92.9	98.1	87.5	86.4
	when health care workers have a skin injury.	T	95.9	98.1	91.7	95.5
When there is a risk of blood or body fluid splashes, health care workers should wear	mask only.	F	93.9	92.2	87.5	95.5
	eye protection only.	F	98	100	91.7	100
	gown only.	F	95.9	98.1	91.7	95.5
	mask, protective glasses and gown.	T	99	98.1	100	100

M: Medicine; B: Bioanalysis; E: Nursing; T: True; F: False.
Source: Own elaboration.

Table 5. Percentage of correct answers regarding hand hygiene.

	Question	Correct answer	Overall	M	B	N
When is hand hygiene recommended?	Before or after touching a patient.	F	72.4	77.8	75	54.5
	Before and after touching a patient.	T	99	100	95.8	100
	Before patient contacts (i.e., after touching one patient and treating another).	T	89.8	92.6	83.3	90.9
	After removing the gloves.	T	84.7	79.6	91.7	86.4
What are the indications for using alcohol-based handrub or alcohol-glycerin solutions (on clean hands)?	Instead of traditional hand washing with soap and water (for 30 seconds).	T	31.6	25.9	25	50
	Instead of hand washing with antiseptic (for 30 seconds).	T	27.6	18.5	33.3	40.9
	Instead of surgical hand washing (for 3 minutes).	T	14.3	9.3	20.8	18.2
	Traditional hand washing with soap and water should be done before washing hands with alcohol-based handrub.	F	29.6	27.8	20.8	40.9

M: Medicine; B: Bioanalysis; N: Nursing; T: True; F: False.
Source: Own elaboration.

The logistic regression analysis showed that the probability of having adequate knowledge about HAIs and their prevention is statistically associated with studying Medicine, being this probability approximately 3 times higher than if studying Bioanalysis or Nursing (OR: 3.312; 95% CI:1.199-9.150; p=0.021). However, when considering each of the areas studied individually, no statistically significant relationship was found between age, sex, or program studied and having adequate knowledge.

Discussion

Throughout history, multiple investigations have been carried out in students and health workers to determine the degree of knowledge that they have about HAIs,

as well as their attitude regarding the implementation of measures to prevent them, and the proper implementation of those measures when they have direct contact with patients. The results of those studies are divergent: some have reported insufficient knowledge of HAIs and their prevention,[8,9,11-13] while others report adequate knowledge with specific deficiencies,[7,10,14,16,17] which coincides with the findings of the present study.

Medical and nursing students had very similar average scores (higher in the latter group). This is consistent with some studies[7,10,16] but differs from others conducted in Namibia[17] and Albania,[15] where medical students had the highest passing scores.

In the present research, most of the respondents stated that they acquired knowledge about HAIs while they were studying in the university, which coincides

with the reports of other researchers.[4,7,11,14,15] However, self-learning was also reported as an important source of knowledge.[4,11,13] This is a relevant finding, as some authors argue that undergraduate education in developing countries does not often emphasize the potential risk of the spread of communicable infections from either the environment or from other patients or staff, and the corresponding preventive measures.[20,21,24] It should be noted that there is not a single course in the health sciences programs of the Universidad de Oriente that imparts the necessary knowledge about this type of infections. Many aspects of this topic are fragmented and dispersed across several courses, which make it challenging to integrate this knowledge and put it into practice during daily activities.

In general, the participants in the study know the definition of HAI; however, medical students had the lowest average score in this part of the survey, a finding that is consistent with other studies.[8,11] There is also a lack of knowledge, mainly among medical and nursing students, regarding the time from infection to onset of symptoms and the fact that HAIs may not only occur in patients. This information is relevant for making an accurate diagnosis of a HAI.[7]

The students surveyed showed insufficient knowledge about the general characteristics of HAIs, which differs from the reports of other authors.[10,15,16] It is noteworthy that many students believe that the primary source of HAI-producing microorganisms is the environment and do not conceive the hands as the main vehicle for the spread of pathogens, concepts that are fundamental to prevent these infections.[7,10,13,17] The lack of knowledge about the transmission mechanisms of microorganisms that produce HAIs indicates that there are significant gaps in the teaching given to the students.

Furthermore, the teachers of this same institution were also unaware of the role played by the hands of the staff in the onset of HAIs, as well as the impact of their hygiene on prevention.[19] Both students and teachers are unaware that in Venezuela, there are no statistical records on HAIs,[19] findings similar to those obtained in Italy[10] and France.[7]

The universal precautions category had the highest scores; however, the students of the three programs think that they should wear gloves when performing any procedure. This is consistent with what has been described in other works.[4,7,10,13,16,17] In this regard, the World Health Organization has recommended the use of gloves only in cases of possible contact with body fluids or secretions, either by direct contact with the patient or with contaminated surfaces.[1] The routine use of gloves as a preventative measure to avoid the spread of HAIs was introduced in the 1980s and early 1990s. However, it resulted in the misconception that gloves should be used for all activities and procedures involving contact with the patient.[25] Perhaps this belief rooted in the students is the product of their training, since this same flaw was observed in their teachers.[19]

Most respondents know when to perform hand hygiene, but few know when to use alcohol-based handrubs. This is a problem for the prevention of HAIs since adequate hand hygiene is considered a necessary measure to avoid the dissemination of pathogenic microorganisms that produce infectious diseases.[1,4,7,10,12,16,17] It is noteworthy that students are unaware that alcohol-based handrubs can be used for hand hygiene instead of washing with an antiseptic solution or that it is a substitute for surgical handwashing.[7,10]

This is the first research carried out in Venezuela that seeks to establish the knowledge that students from different health sciences programs have about HAIs and their prevention. Although this study is the first approximation to this issue, future research should assess the attitude, implementation and compliance with prevention measures, since these three aspects do not always go together.

Conclusion

Respondents have adequate knowledge of HAIs and their prevention, but the level of knowledge of bioanalysis students must be improved. In general, the students of the three programs have insufficient knowledge of specific aspects such as the source of the microorganisms that cause HAIs and the proper use of gloves and alcohol-based handrubs.

Conflicts of interest

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