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ORIGINAL ARTICLE

Determination of Knowledge Levels of Student Nurses Regarding Prevention of Healthcare Associated Infections

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Abstract

Objective: Healthcare associated infections are any infections that do not occur during the incubation period and which develop within 48–72 hours after the patient has stayed in the hospital, or within 10 days after discharge from the hospital. In this study, we aimed to determine the level of knowledge of nursing students regarding prevention of healthcare associated infections.

Method: The population of the study consisted of 667 student nurses who studied in the nursing department of a university. The data were obtained from 506 students who accepted to participate in the study between May 13 and 17, 2016. In the study, a questionnaire form titled "Determination of Knowledge Levels of Nurses about Prevention of Hospital Infections" developed by the researcher was used.

Results: The mean score of knowledge that the nursing students had regarding prevention of healthcare-associated infections was 54.28 ± 11.16, the hand hygiene knowledge score was 16.05 ± 4.48, and the mean score of surgical site infections was 5.53 ± 2.42. As seen in the factors affecting the mean scores for the students' knowledge on the prevention of nosocomial infections, it was determined that the mean score of the third-grade students (56.29) was higher than the other averages ($p < .05$).

Conclusion: It was determined that the mean knowledge scores of the student nurses about preventing healthcare associated infections were moderate and that their mean knowledge scores on surgical site infections were low.

Keywords: Healthcare associated infections, students, nursing, knowledge

Introduction

Healthcare associated infections (HAIs) are any infections that do not occur during the incubation period and which develop within 48–72 hours after the patient has stayed in the hospital, or within 10 days after discharge from the hospital (Artan et al., 2015; Brosio et al., 2017; Colosi et al., 2011; Mankan & Kaşıkçı, 2015; Özer & Aktaş, 2017; Yıldırım & Özpulat, 2015). Nosocomial infections are defined as "healthcare associated infections" or "hospital associated infections" that threaten the health of patients, healthcare personnel, and patient accompanists at the hospital (Artan et al., 2015; Brosio et al., 2017; Colosi et al., 2011; Ersoy et al., 2014; Yıldırım & Özpulat, 2015). HAIs prolong the hospitalization period, affect the patient economically, and prolong the duration of the treatment (Abukan et al., 2016; Tolgan et al., 2015). Healthcare associated infections, also referred to as cross infections, are important causes of death as infections developing in the hospital (D'Alessandro et al., 2014; Karim et al., 2012; Tüfek et al., 2012). HAIs that threaten patient safety worldwide are a major problem in developed and developing countries (Abukan et al., 2016).

The most common infections among HAIs have been found to be urinary tract infections, surgical site infections, pneumonia, bacteremia, cardiovascular system infections, central nervous system infections, and other infections (bone-joints, ear-nose-throat, gastrointestinal system, etc.) (Mankan & Kaşıkçı, 2015; Yıldırım & Özpulat, 2015; Oğuz & Kurutkan, 2013). The protective role as one of their roles of nurses is important both in preventing the patient from getting infected and preventing themselves from getting infected (Cebeci et al., 2012; Helder & Latour, 2010). Efforts to prevent HAIs are carried out by an infection control team. The most active and key member of this team is the infection control nurse, the only member of the infection control committee

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serving full time (Gürkan et al., 2011; Yıldırım & Özpulat 2015). HAIs affect primarily patients and less often, the hospital staff, students, and trainees (Brosio et al., 2017; D'Alessandro et al., 2014). As nursing education is based on theory and practice, students should have theoretical knowledge about HAIs during the training process, and they should use their knowledge and skills in the best way during practical applications (Karaçay & Sevinç, 2010).

A variety of factors influence compliance with HAI prevention procedures, the most important being the quality of the basic nursing education (Bello et al., 2011; Kelcikova et al., 2012). Increasing knowledge and awareness of nursing students to prevent HAIs and improving their training will play an important role in preventing HAIs.

This study was carried out because there was no similar work done in the Turkish Republic of North Cyprus (TRNC).

In this study, we aimed to determine the level of knowledge of nursing students regarding the preventing HAIs, and the study asks the following questions:

- What is the knowledge level of student nurses regarding HAI prevention?
- Are there significant differences between descriptive characteristics and knowledge of student nurses on the prevention of HAIs?

Material and Methods

Type
This was a descriptive study.

Place and Time
The study was conducted between May 13 and May 17, 2016, at the Faculty of Health Sciences, Nursing Department, TRNC.

Research Population and Sample
The population of the study consisted of 667 student nurses who attended a nursing department at the Faculty of Health Sciences in TRNC. There was no selection of sample. Four hundred and eighty nine undergraduate students from the faculty of health sciences and 17 graduate students from the health sciences institute who accepted to participate in the study were included in the study. One hundred and sixty one students were excluded from the evaluation because they were not present in the class, or they did not completely fill the questionnaire form. The study was completed with 506 student nurses.

Main Points

- Healthcare associated infections (HAI) are any infections that do not occur during the incubation period and which develop within 48–72 hours after the patient has stayed in the hospital, or within 10 days after discharge from the hospital.
- HAIs, also referred to as cross infections, are important causes of death as infections developing in the hospital.
- A variety of factors influence the compliance with HAI prevention procedures, the most important being the quality of the basic nursing education.
- Increasing knowledge and awareness of nursing students to prevent healthcare associated infections and improving their training will play an important role in preventing nosocomial infections.

Data Collection Instruments
The questionnaire form titled "Determination of Knowledge Levels of Nurses regarding Prevention of HAI" developed by the researcher was used (Mankan & Kaşıkçı, 2015). In the first part of the questionnaire, six questions including the descriptive characteristics of the student nurses were given. In the second part, there were 42 knowledge questions on prevention of nosocomial infections. Among these questions, three were multiple-choice, and 39 included "true" and "false" expressions. The questionnaire consisted of five subsections to determine the knowledge level about nosocomial infections. These were 11 questions about preventing intravenous catheter infections 26.18 points, six questions about preventing urinary system infections 14.28 points, nine questions about preventing pneumonia 21.42 points, 12 questions about hand hygiene and glove use 16.05 points, four questions about surgical site infections and medical waste 9.52 points (Mankan & Kaşıkçı, 2015). The responses were "knows" and "does not know," and the 42 knowledge questions in the questionnaire form had a total score of 100 points, calculated by giving each question 2.38 points.

Data Collection
After verbal consents of the participants were received, the questionnaire was distributed in the classroom environment, and the participants were asked to fill out the questionnaires. The response time for the questionnaire form was approximately 10–15 minutes.

Pilot Study
A pilot study was performed with 50 student nurses for clarity on May 13 to May 17, 2016. After the pilot study, no revision was necessary, and the nurses who took part in the pilot study were included in the main sample.

Evaluation of Data
The data were analyzed using the Statistical Package for Social Sciences version 18.0. (SPSS Inc.; Chicago, IL, USA). Each subsection was assessed separately within itself. Numbers, percentage distributions, mean scores, *t*-test, and one-way analysis of variance were used in the evaluation of data.

Ethics
Permission was received from the scientific research assessment ethics committee with the project number (YDU/2016/40-332) as well as from the Near East University at North Cyprus. To use the questionnaire form, necessary permissions were obtained from Mankan and Kaşıkçı (2015). The data were collected by paying attention to the voluntary participation of the student nurses considered in the scope of the study and taking their verbal approvals.

Results

The mean age of the student nurses was determined to be 21.95 ± 2.16 (max = 35, min = 18), and 71.5% (362) were wom-

Table 1
Student Nurses Descriptive Characteristics (n = 506)

Descriptive Characteristics		*n*	%
Sex	Male	144	28.5
	Female	362	71.5
Grade	Undergraduate 1	132	26.1
	Undergraduate 2	132	26.1
	Undergraduate 3	95	18.8
	Undergraduate 4	130	25.7
	Graduate	17	3.4
Employment status	Employed	45	8.9
	Unemployed	461	91.1
Previous education	Received	208	41.5
	Not received	298	58.9

en. Of the student nurses, 26.1% (132) were first-grade undergraduates, 26.1% (132) were second-grade undergraduates, 18.8% (95) were third-grade undergraduates, 25.7% (130) fourth-grade undergraduates, and 3.4% (17) were graduate students. Of the student nurses, 8.9% (45) were working at a health institution, and 41.1% (208) stated that they were educated about nosocomial infections (Table 1).

Of the student nurses, 52.4% (265) answered the question about the definition of HAIs correctly, and 85.0% (430) correctly answered the question about the item: "For peripheral venous catheters, hand hygiene must be provided before the catheter is inserted"; 79.1% (400) correctly answered the question about the item: "The infusion of blood and blood products should be completed within four hours.";

Table 2
Percentage Distribution of Student Nurses' Responses to Questions on Healthcare Associated Infections Prevention (n = 506)

		Know		Not know	
		n	%	*n*	%
Prevention of ICI	• Which one of the following definitions of nosocomial infection is true?	265	52.4	241	47.6
	• For peripheral venous catheters, hand hygiene must be provided before the catheter is inserted.	430	85.0	76	15.0
	• The infusion of blood and blood products should be completed within four hours.	400	79.1	106	20.9
	• Solutions remaining in single-dose ampoules or vials should be stored for later use.	108	21.3	398	78.7
	• Catheters inserted for intravenous therapy should be changed at least once in 48–72 hours.	412	81.4	94	18.6
	• There is no need to routinely replace peripheral venous catheters unless complications occur in pediatric patients.	195	38.5	311	61.5
Prevention of USI	• If the catheter and drainage system are separated, the connection point must be disinfected and reattached.	312	61.7	194	38.3
	• Non-sterile gloves should be worn during catheter insertion.	212	41.9	294	58.1
	• The urine bag and the collecting system should all be at bladder level.	188	37.2	318	62.8
	• The urine bag is put on the patient carried on a stretcher.	149	29.4	357	70.6
Prevention of pneumonia	• As the water in the humidifier reduces, it must be added.	275	50.8	249	49.2
	• Normal saline should be used for oxygen therapy moisturizers.	326	64.4	180	35.6
	• Ambu bags should be cleaned and disinfected after each use.	373	73.7	133	26.3
	• Non-sterile gloves are worn in tracheostomy stroma care.	175	34.6	331	65.4
	• A sterile catheter should be used for each aspiration in open aspirated patients.	370	73.1	136	26.9
	• Catheter used in oral aspiration can be used in aspiration of secretory airways.	265	52.4	241	47.6
Hand Hygiene and Using Gloves	• It is enough to use only alcohol-based hand antiseptics when there is visible contamination on the hands.	192	37.9	314	62.1
	• After contact with the surfaces surrounding the patient, hand hygiene must be provided.	386	76.3	120	23.7
	• Hand hygiene must be provided before the preparation of medicines.	414	81.8	92	18.2
	• After removing the gloves, if there is no tear or puncture, hand hygiene is not necessary.	163	32.2	343	67.8
	• As sterile gloves create a barrier, it is not necessary to wash hands before wearing gloves	194	38.3	312	61.7
	• Before dealing with a clean area from a dirty area on the same patient, gloves should be removed, hand hygiene should be ensured, and gloves should be worn afterwards if necessary.	392	77.5	114	22.5
SSI	• Hair is cut with a shaver 24 hours before surgery.	342	67.6	164	32.4
	• Which is not medical waste?	270	53.4	236	46.6

Note. ICI = Intravenous Catheter Infections; USI = Prevention of Urinary System Infections; SSI = Surgical Site Infections

Table 3
Distribution of Student Nurses' Mean Knowledge Scores on Prevention of Healthcare Associated Infections (n = 506)

	Mean	SD	Min	Max
Prevention of intravenous catheter infections	14.15	3.66	10.49	17.81
Prevention of urinary system infections	5.82	3.45	9.27	9.9
Prevention of pneumonia	12.72	4.08	8.64	16.8
Hand hygiene	16.05	4.86	11.19	20.92
Prevention of surgical site infections and medical waste	5.53	2.42	3.11	7.95
Total	54.28	11.64	42.64	65.92

Table 4
Comparison of Mean Knowledge Scores of Student Nurses According to Descriptive Characteristics (n = 506)

Descriptive Characteristics		n	%	Total points	p
Sex	Male	144	28.5	54.85	.488
	Female	362	71.5	54.05	
Grade	Undergraduate 1	132	26.1	53.41	.011
	Undergraduate 2	132	26.1	55.01	
	Undergraduate 3	95	18.8	56.29	
	Undergraduate 4	130	25.7	54.04	
	Graduate	17	3.4	45.90	
Employment status	Employed	45	8.9	52.60	.311
	Unemployed	461	91.1	54.44	
Previous education	Received	208	41.5	55.38	.077
	Not received	298	58.9	53.51	

78.7% (398) incorrectly answered the question about the item: "Solutions remaining in single-dose ampoules or vials should be stored for later use." Of the student nurses, 81.4% (412) correctly answered the question about the item: "Catheters inserted for intravenous therapy should be changed at least once in 48–72 hours."; 61.5% (311) incorrectly answered the question about the item: "There is no need to routinely replace peripheral venous catheters unless complications occur in pediatric patients."; 61.7% (312) correctly answered the question about the item: "If the catheter and drainage system are separated, the connection point must be disinfected and reattached."; 58.1% (294) incorrectly answered the question about the item: "Non-sterile gloves should be worn during catheter insertion."; 62.8% (318) incorrectly answered the question about the item: "The urine bag and the collecting system should all be at bladder level."; 50.8% (275) correctly answered the question about the item: "As the water in the humidifier is reduced, it must be added on."; 64.4% (326) correctly answered the question about the item: "Normal saline should be used for oxygen therapy moisturizers."; 73.7% (373) correctly answered the question about the item: "Ambu bags should be cleaned and disinfected after each use."; 65.4% (331) incorrectly answered the question about the item: "Non-sterile gloves are worn in tracheostomy stoma care."; 73.1% (370) correctly answered the question about the item: "A sterile catheter should be used for each aspiration in open aspirated patients."; 52.4% (265) correctly answered the question about the item: "Catheter used in oral aspiration can be used in aspiration of secretory airways." Of the student nurses, 62.1% (314) incorrectly answered the question about the item: "It is enough to use only alcohol-based hand antiseptics when there is visible contamination on the hands."; 76.3% (386) correctly answered the question about the item: "After contact with the surfaces surrounding the patient, hand hygiene must be provided."; 81.8% (414) correctly answered the question about the item: "Hand hygiene must be provided before the preparation of medicines."; 67.8% (343) incorrectly answered the question about the item: "After removing the gloves, if there is no tear or puncture, hand hygiene will not be necessary."; 61.7% (312) incorrectly answered the question about the item: "As sterile gloves create a barrier, it is not necessary to wash hands before wearing gloves."; 68.6% (347) correctly answered the question about the item: "In the hand washing process, the hands should be rubbed for 60 seconds."; 67.6% (342) correctly answered the question about the item: "Hair is cut with a shaver 24 hours before surgery."; 53.4% (270) correctly answered the question about the item: "Which is not medical waste?" (Table 2).

The mean knowledge score the student nurses received was 14.15 ± 3.66 (max = 17.81, min = 10.49) for prevention of intravenous catheter infections, 5.82 ± 3.45 (max = 9.9, min = 9.27) for prevention of urinary system infections, 12.72 ± 4.08 (max = 16.8, min = 8.64) for prevention of pneumonia, 16.05 ± 4.86 (max = 20.92, min = 11.19) for hand hygiene, 5.53 ± 2.42 (max = 7.95, min = 3.11) for surgical site infections and medical waste, and 54.28 ± 11.64 (max = 65.92, min = 42.64) overall (Table 3).

There was no statistically significant difference between the student nurses' knowledge scores on preventing HAI (p > .05) based on their sex, employment status, and status of previous education. When the class levels of the students

were examined, the third-year undergraduate students got 56.29 points. It was found that their knowledge levels regarding the prevention of nosocomial infections compared with those of the students in the other classes were statistically significantly different ($p < .05$) (Table 4).

Discussion

The student nurses' mean knowledge score on prevention of HAIs was found to be 54.28 points, a medium level score (Table 4). The mean knowledge score of nurses has been reported as 64.98 in the study of Mankan and Kaşıkçı (2015), 61.31 in a study by Bello et al. (2011). In our study, the mean knowledge score found 54.28, lower than the other studies. The low level of knowledge scores of student nurses within the scope of this study suggests that they did not have sufficient knowledge about the questions that were asked owing to professional deficiencies and lack of experience.

HAIs are any infections that do not occur during the incubation period and which develop within 48–72 hours after the patient has stayed in the hospital, or within 10 days after discharge from the hospital (Artan et al., 2015). Regarding the definition of HAIs, 81.1% of the nurses responded correctly in a study by Mankan and Kaşıkçı (2015), and 61.9% in a study by Turan et al. (2018). In our study, 47.4% of the student nurses correctly answered the question about the definition of HAIs. On the basis of these data, it was concluded that most of the nursing students did not know what HAIs were and at what time intervals do they occur.

Hand hygiene is a golden standard to prevent HAIs, and the World Health Organization recommends this preventive method strongly (Brosio et al., 2017; D'Alessandro et al., 2014; Ulutaşdemir et al., 2008). The knowledge score of hand hygiene was found to be 94.4% in a study by Turan et al. (2018). In our study, 85.0% answered correctly. This percentage shows student nurses giving particular attention to hand hygiene practices and the use of standard prophylactic precautions.

Catheter-related bloodstream infections are common infections that are expensive to treat and increase mortality rates. Intravenous catheters inserted for intravenous therapy in adult patients should be replaced at least once in 48–72 hours (Aktaş et al., 2011; Arpa et al., 2013). In a study of the nursing students, 81.4% (350) gave an incorrect answer to the question, catheters inserted for therapy in adult patients should be replaced at least once in 48–72 hours Turan et al. (2018). In our study, student nurses gave correct answer to the same item, and it was determined that the mean knowledge score of nursing students on the prevention of intravenous catheter infections was 14.15 (Table 3). This result shows that student nurses know the importance of the time to replace intravenous catheters.

Urinary catheterization has been reported to be the most important in urinary system infections (Çelik et al., 2011, Oğuz & Kurutkan, 2013). In our study, 37.2% of the student nurses responded correctly to the question, "Non-sterile gloves should be worn during catheter insertion"; 32.6% (165) incorrectly answered the question, "If the catheter and drainage system are separated, the connection point must be disinfected and reattached." (Table 2). The correct answer to this question was, "If the catheter and drainage system are separated, the connection point must be disinfected, and a new drainage system should be installed." The catheter should be aseptically placed in sterile conditions to prevent catheter-based urinary tract infections. The healthcare personnel who places the catheter should wash their hands before and after the application and perform care after the catheter is placed (Turan et al., 2018). Among HAIs, urinary tract infections are the most common and account for 40%–60% of HAIs. Urinary catheterization has been reported to be the most important in urinary system infections (Çelik et al., 2011). Student nurses obtained an average of 5.82 points out of the 14.28 points calculated from the questions asked about the prevention of urinary system infections. This score was found to be low (Table 4). The reason that the correct response was so low suggests that the students lacked adequate professional experience.

Hospital-acquired pneumonia accounts for an average of 15% of HAIs. Hospital-acquired pneumonia is an HAI with the highest mortality and morbidity (Uçgun, 2010). In our study, student nurses obtained an average of 12.72 points of the 21.42 points calculated from the questions asked about the prevention of pneumonia (Table 3). This result shows student nurses may need to be given separate training about the prevention of pneumonia because they are the most frequent contact with the patient and could cause the infection to be easily transported.

It is important to know under which conditions nurses should wash their hands, how to perform hygienic handwash, when and how alcohol-based hand antiseptics are used, and when and how to use and change gloves (Günaydın, 2012; Uçgun, 2010). Mankan and Kaşıkçı (2015) reported 81.44% and Graf et al. (2011) 100% participants responded correctly to the question about hand hygiene in a great proportion in their studies. In our study, 76.3% student nurses answered correctly.

Surgical site infections are the second most common HAIs (Arpa et al., 2013). Among the leading occupational risk factors of health workers are medical wastes and it is known that the most common medical staff of infectious diseases is nurses (Akbolat et al., 2011; Çelik et al., 2011; Uçgun, 2010).

Infectious wastes account for 5%–10% of the hospital waste, and it is necessary to separate the wastes at the place where they are produced. "The needle is thrown into the sharp and penetrating object box before the lid is closed." In a study by Yıldırım and Özpulat (2015), 35.5% of the student nurses stated that used needles should be thrown into the waste box after placing the lid. In our study, student nurses demonstrated poor knowledge regarding disposing used injector needles. This result shows student nurses should improve their knowledge about waste management.

In this study, it was determined the mean knowledge score of the student nurses about preventing HAI was moderate. The highest knowledge score was regarding hand hygiene, and the lowest knowledge score was regarding surgical site infections and medical waste prevention.

It is suggested that training on prevention of HAI should be planned according to the knowledge, attitudes, and skills of the student nurses. HAIs occur as a separate course in the curriculum of the nursing departments.

This study was limited to undergraduate and postgraduate nursing students in the Faculty of Health Sciences and Health Sciences Institute.

Ethics Committee Approval: Ethics Committee approval for the study was obtained from the Ethic Committee of Near East University at North Cyprus (YDU/2016/40-332).

Informed Consent: Verbal informed consent was obtained from all individual participants included in the study.

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