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Original article

Knowledge and judgments about standard precautions for nosocomial infection: comparative analysis of medical vs. non-medical students

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Abstract: *Background* — Nosocomial infection (NI) is among the most common and serious challenges in a healthcare system. Health workers and medical students play an important role in prevention of NI. Despite advances in the field of medicine in Kazakhstan, low detection rate of NIs remains unchanged, which could be due to a lack of awareness of the standard precautions for infection control among medical students and health workers. This study is aimed at examining knowledge and judgments on NIs among medical and non-medical students.

Material and Methods — We conducted a cross-sectional paper-based survey to examine the knowledge and judgments about the standard precautions for NI among medical and non-medical students. Data collection took place between September 21 and December 20, 2017.

Results — The study enrolled 2,817 students. The mean overall score (±SD) was 2.045±1.29. Medical students had a better mean overall score (2.113) than non-medical students (1.785; p<0.001). Awareness of the standard preventive measures was increasing with a year of study, but still just one-third of year 5 medical students were aware of standard prevention (36.3% vs. 17.4% for non-medical students; p<0.001).

Conclusion — The overall score of our survey indicated inadequate knowledge and awareness of the guidelines on infection prevention and control among both medical and non-medical students. In order to improve patient safety and welfare, the courses on infection control should be introduced into the curricular of medical universities in Kazakhstan.

Keywords: nosocomial infection, standard precautions, knowledge, students.

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Introduction

Nosocomial infections (NI) are among the most relevant public health problems worldwide, contributing to the increase in morbidity, mortality, and cost of diagnosing and treatment. They lead to reduction in quality of life in the population [1-3]. The incidence rates of NI are the best indicator of the quality of medical services: high incidence of NI morbidity indicates low quality of medical services. Prevalence of NI in developing countries is 2-3 times higher than in Europe or United States. According to the World Health Organization, 5-10% of all hospitalizations results in NI in North America and Europe, while Latin America, sub-Saharan Africa and Asia show over 40% of hospitalizations with NI [4]. Annually, 5 million NI cases were registered in Europe leading to 50,000-135,000 of additional deaths and the damage to the healthcare system in the amount of 12-24 billion euros [5].

Compliance with standard precautions would prevent global outbreaks and damage from NI. According to standard methods' precautions, blood, body fluids, secretions, excretions (except sweat), non-intact skin, and mucous membranes may contain transmissible infectious agents [6, 7]. Adequate hand hygiene, along with the use of appropriate personal protective equipment and aseptic agents are key remedies in the prevention of NI [6].

Healthcare workers are the basic party for preventing NI when applying infection control practices. In fact, healthcare workers, including nurses and medical students, can directly reduce NI rate by means of recognizing and following the standard precaution procedures [8, 9]. Numerous studies highlighted a significant role of education and judgments of medical students in preventing NI [10-18]. Knowledge of infection control and compliance of medical students with NI prevention procedures varied across countries and training programs. Several studies, involving nursing students, indicated lack of knowledge of, and compliance with, infection control procedures. For instance, nursing students in Jordan exhibited poor knowledge of standard precautions (7.82 of 18) and compliance with them (49.36 of 85) [19]. Adequate monitoring of students' performance in terms of following the standard precautions did not reveal sufficient knowledge among medical students [20]. Furthermore, medical students at universities of

Karachi (Pakistan) have also demonstrated weak knowledge and practices of infection control, e.g., regarding the method of surgical scrubbing [21]. Medical students of Saudi Arabia exhibited acceptable knowledge, which could depend on the primary information source. Despite that, Abdullah Khubrani et al. pointed out that a curriculum should be amended to increase an emphasis on the infection control [22]. Undergraduate nursing students demonstrated decent level of knowledge. Despite this, most of them had poor attitude and incompetent practice concerning infection control procedures. Although students demonstrated a good attitude towards basic hand hygiene rules, less than a half of the students uses personal protective equipment. However, it is important to point out the necessity to improve knowledge concerning the standard precautions of NIs [23].

Most studies were dedicated to evaluating knowledge and attitude towards NI among medical students. Their poor knowledge could be associated with a lack of awareness of standard precautions for infection control at medical universities and inadequate programs of medical education. However, no one attempted to conduct a comparative assessment of students' knowledge, regardless of their training program. The content and quality of medical training programs should promote better knowledge and awareness. Each correct answer was assigned 1 point, while each incorrect answer was scored as 0 points. Each medical student in presumed to accomplish high academic results in infection control, whereas non-medical students are not required to adhere to the guidelines since they cannot play any role in the emergence of NI. Accordingly, the goal of our study was to examine and compare knowledge and judgments on NIs among medical versus non-medical students.

Material and Methods

Subjects and sampling

We conducted a cross-sectional paper-based survey among undergraduate students based on the so-called two-gate design [24]. The study involved two different population (gates): medical students (School of Medicine, Karaganda Medical University) and non-medical students (School of Economics, Karaganda State University). Economics students were selected to represent non-medical students. Their curriculum did not include any medical courses, specifically those related to infection control.

Considering a power of 0.95 and effect size of 20% and significance level of 0.05 we would need 582 students from each school. We decided that the participation rate could be roughly 70%. Consequently, we needed to include all economics students 70% of the School of Medicine students. Data collection took place between September 21 – December 20, 2017.

Questionnaire design

The questionnaire (*Appendix* 1) was adapted from H. Sax et al., 2005 [13] and Tavolacci et al., 2008 [14]. The 16-item questionnaire had three sections: respondents' characteristics (four questions), knowledge of transmission precautions (six questions), and judgments about the precautions (six questions). The respondents' characteristics included age, gender, field of study, and year of study. The section related to knowledge about transmission precautions included six multiple choice questions related to the knowledge on the prevention concept sensu CDC guidelines [19-20]. In the third section, the questions were aimed at determining respondents' judgements on prevention standards, risks of NI, the epidemiological situation with NI in Kazakhstan (prevalence, mortality, extended hospitalization), and the most common reasons for non-compliance with the guidelines. A group of professors from Karaganda Medical University independently evaluated the correctness of the answers.

Statistical analysis

Each correct and incorrect answer was assigned 1 point and 0 points, respectively (the maximum score was 6 points). Two models were applied to the data to evaluate the its dimensionality. The first model represented one-factor latent trait analysis (LTA) and the second model was two-factor LTA [21]. LTA assumes that the probability of correctly answering an item by an individual is explained by one (one-factor model) or more (two-factor model) continuous variables, commonly called *latent variables*. LTA is form of factor analysis for dichotomous variables, that considers an existence of one or more underlying factors.

The standardized factor loadings of the model are usually used to interpret the results. Each of these expresses the correlation coefficient between the latent variable and an underlying continuous variable obtained from each item. An association is classified as weak if the corresponding standardized loading is under 0.30, moderate if it is between 0.30 and 0.70, and strong if it exceeds 0.70.

The Bayesian information criterion (BIC) was used to compare the goodness of fit between the two models. Pairwise two-way margins' residuals and the item fit statistics were used to confirm the goodness of fit.

Cronbach's alpha was used to assess the internal consistency of items, and indirectly evaluated the reliability of the scale.

The Spearman-Brown prediction formula was employed to estimate the hypothetical number of items needed to obtain Cronbach's alpha of 0.7.

Analysis of variance (ANOVA) was used to compare the means of knowledge score among genders, fields of study and years of study. The analysis of covariance (ANCOVA) was used to estimate the knowledge score means adjusted by gender, field of study and year of study.

Table 1. Percentage of correct answers on the knowledge of nosocomial infections vs. field of study

	Incorrect answers N (%)	*Correct answers N (%)*	*p*
The most important vehicle of transmitting infectious agents in the hospital			
Medical students	1870 (84.6)	340(15.4)	0.212
Non-medical students	526 (86.7)	81 (13.3)	
The most effective means to reduce transmission of infectious agents			
Medical students	1395 (63.1)	815 (36.9)	<0.001
Non-medical students	440 (72.5)	167 (27.5)	
The main purpose for using non-sterile gloves			
Medical students	1507(68.2)	703 (31.8)	0.391
Non-medical students	425 (70.0)	182 (30.0)	
The main benefit of hand hygiene			
Medical students	1422 (64.3)	788 (35.7)	0.065
Non-medical students	415 (68.4)	192 (31.6)	
The goal of preventing the transmission of infectious agents			
Medical students	738 (33.4)	1472 (66.6)	<0.001
Non-medical students	338 (55.7)	269 (43.3)	
Recognition of the ubiquitous risk of the body fluids			
Medical students	1616 (73.1)	594 (26.9)	0.617
Non-medical students	450 (74.1)	157 (25.9)	

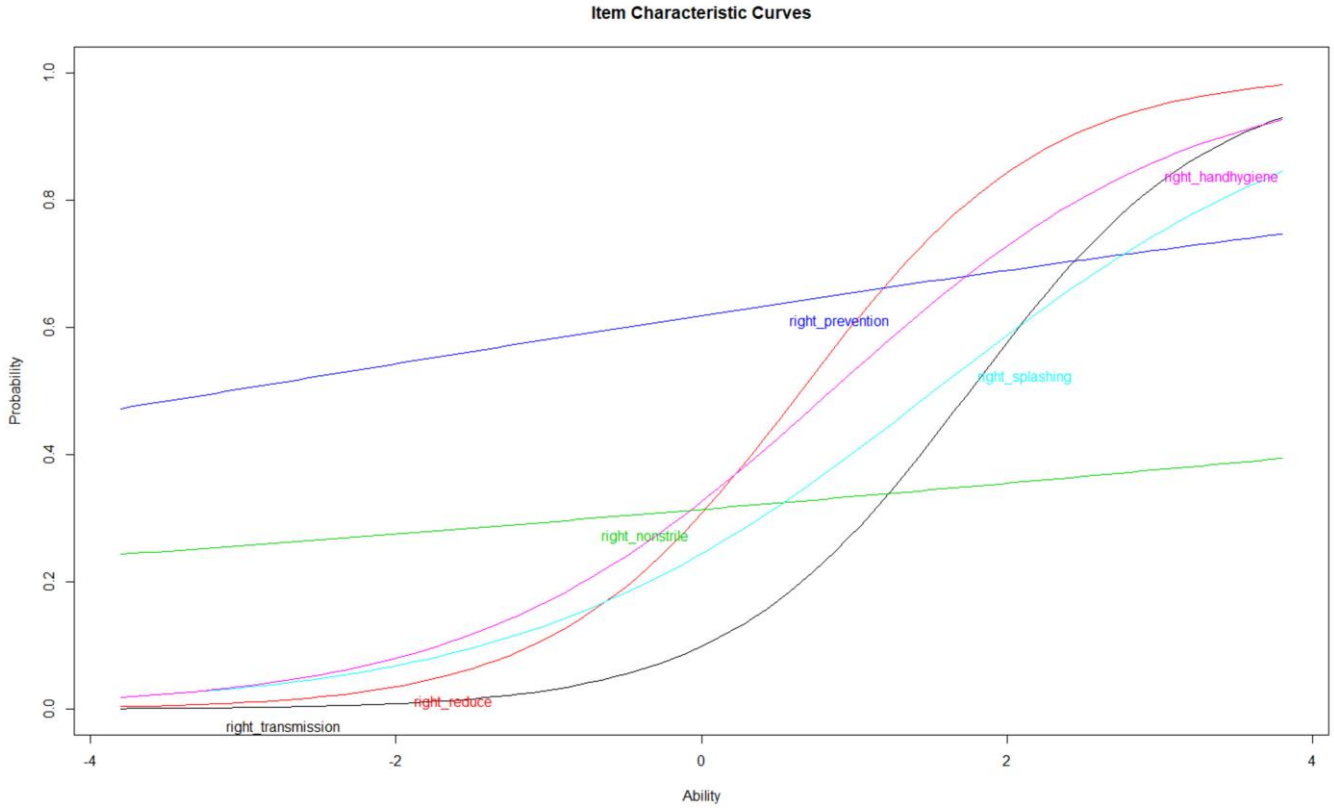

Figure 1. Item-characteristic curves for the single-parameter logistic model of the item response theory.

Table 2. Proportion of correct answers and standardized factor loading for each statement

	Correct answers N (%)	*Factor Loadings*	*Cronbach's alpha if the item is removed*
The most important vehicle of transmitting infectious agents in the hospital	421(14.9)	0.8	0.3
The most effective means to reduce transmission of infectious agents	982(34.5)	0.8	0.2
The main purpose for using non-sterile gloves	885(31.4)	0.1	0.4
The main benefit of hand hygiene	981(34.8)	0.7	0.2
The goal of preventing the transmission of infectious agents	1761(61.8)	0.2	0.3
Recognition of the ubiquitous risk of the body fluids	751(26.7)	0.6	0.2
Cronbach's alpha			0.3

Chi-square tests were used to compare proportions of categorical variables. P-value<0.05 was considered a significance level.

Data analysis was performed using R Project for Statistical Computing and IBM SPSS Statistics version 25 (the citations: R Core Team (2017); R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/).

Results

A total of 2,817 questionnaires were included in this study, and 402 (12.5%) students refused to participate in the survey and the questionnaires returned unfilled.

Age of participants ranged from 16-34 years old with a mean (SD) of 20.04 (1.82); 78.5% were medical students. The distribution of respondents at the training course was the following: year 1 students – 23.9%, year 2 – 17.0%, year 3 – 16.9%, year 4 – 25.2%, and year 5 – 16.9%. Male/female ratio was 0.51 (the sex ratio was 0.46 for medical students and 0.55 for non-medical students).

Table 1 presents a percentage of correct answers to the questions on the knowledge of NI vs. the field of study. Medical students scored a higher number of correct answers only for two questions (on the effective means to reduce the risk of transmission of infectious agents and on prevention of infectious agent transmission) with a statistically significant difference between the fields of study of <0.001 in both questions. The remaining questions did not exhibit statistically significant differences among medical and non-medical students.

A one-factor LTA was fit to six items. Four items showed a moderate-to strong positive association, whereas two presented just a weak positive association (*Table* 2). *Figure* 1 demonstrates that the probability of correct answers for four items increases sharply (high factor loading), while it increases slowly for two other items (low factor loading).

In our study, Cronbach's alpha for two items was higher than the current alpha for the entire scale: 0.31 (*Table* 2). Spearman-Brown prediction formula suggested the necessity to increase to 30 items to have Cronbach's alpha of 0.7.

Table 3. Unadjusted and adjusted means by gender, field of study and year of study

	Unadjusted mean (95% CI)	*p*	*Adjusted mean (95% CI)**	*p*
Gender				
Male	1.969 (1.886, 2.053)	0.031	1.898 (1.810, 1.987)	0.048
Female	2.081 (2.024, 2.139)		1.999 (1.932, 2.066)	
Field of study				
School of Medicine	2.133 (2.079, 2.186)	<0.001	2.113 (2.056, 2.169)	<0.001
School of Economics	1.727 (1.625, 1.828)		1.785 (1.679, 1.890)	
Year of study				
Year 1	1.829 (1.733, 1.925)		1.741 (1.641, 1.842)	
Year 2	1.839 (1.725, 1.953)		1.745 (1.627, 1,863)	
Year 3	2.164 (2.049, 2.278)	<0.001	2.088 (1.971, 2.205)	<0.001
Year 4	2.070 (1.977, 2.164)		1.951 (1.850, 2.052)	
Year 5	2.400 (2.286, 2.515)		2.218 (2.088, 2.347)	

* Adjusted for all variables in the table.

Table 4. Analysis of responses to perception and attitude questions

	Responses				*p*
	1	2	3	4	
Concept of standard precautions (country specific)					
	Never heard about it	I heard about it	Vague knowledge	I know it well	
Field of study					
Medical students	6.3%	27.5%	40.1%	26.2%	<0.001
Non-medical students	16.1%	25.2%	47.6%	11.0%	
Gender					
Male	10.1%	23.4%	40.8%	25.7%	0.001
Female	7.6%	28.7%	42.1%	21.5%	
Year of study					
Year 1	6.2%	28.0%	48.4%	17.4%	<0.001
Year 2	8.1%	26.9%	45.9%	19.0%	
Year 3	11.6%	27.1%	45.2%	16.2%	
Year 4	11.5%	26.3%	35.9%	26.3%	
Year 5	4.0%	26.4%	33.3%	36.3%	
Senior age or very young age increase the risk of nosocomial infection					
	Strongly agree	Agree	Disagree	Strongly disagree	
Field of study					
Medical students	10.1%	48.1%	33.7%	8.0%	<0.001
Non-medical students	15.3%	50.1%	26.7%	7.9%	
Gender					
Male	10.7%	47.6%	34.1%	7.5%	0.474
Female	11.5%	49.0%	31.3%	8.2%	
Year of study					
Year 1	9.9%	51.5%	28.8%	9.8%	<0.001
Year 2	8.8%	53.7%	30.1%	7.5%	
Year 3	14.5%	50.6%	27.7%	7.1%	
Year 4	12.5%	44.9%	33.8%	8.9%	
Year 5	10.5%	42.8%	41.3%	5.5%	
What is the average proportion of patients who suffer from nosocomial infection?					
	0-10%	11-20%	>20%	I do not know	
Field of study					
Medical students	19.7%	34.3%	11.9%	34.1%	<0.001
Non-medical students	15.3%	22.9%	10.7%	51.1%	
What is the average proportion of infected patients likely to die because of this infection?					
	0-2%	3-5%	>5%	I do not know	
Field of study					
Medical students	25.5%	28.8%	8.2%	37.5%	<0.001
Non-medical students	14.0%	21.1%	8.6%	56.3%	
On average, by how many days would a hospital stay be prolonged because of a nosocomial infection?					
	0-10 days	11-20 days	>20 days		
Field of study					
Medical students	51.2%	38.1%	10.8%		0.013
Non-medical students	47.3%	37.7%	15.0%		

The mean overall score (SD) was 2.045 (1.29) points. The average score among medical students (2.113) was significantly higher than in non-medical students (1.785, p<0.001). The overall score did differ between male and female students (1.898 vs. 1.999, p=0.048). The score progressively increased with a year of study, and the maximum score of 2.218 was observed in year 5 medical students (*Table* 3).

Regardless of the students' field, many respondents showed a vague knowledge of the standard precaution concept in Kazakhstan (*Table* 4). Awareness of standard preventive measures increased with a year of study, but only a third of year 5 students were aware of standard prevention (36.3% vs. 17.4% in year 1 students, p<0.001). Most of students of all years of study identified age as a risk factor of NI (*Table* 4). Awareness of both average proportion of patients suffering from NI and mortality from NI was higher among medical vs. non-medical students (p<0.001).

Awareness of the average proportion of patients who suffer and would die from NI among medical students increased with a year of study. This could be related to available courses on infection control in individualized education plans. Most students responded that the patient hospital stay due to NI could be extended to 10 days (*Table* 5).

Among proposed reasons for not following the transmission precautions, lack of knowledge was cited as the most important barrier (45.1%), followed by forgetfulness (35.3%), lack of means (29.4%), and lack of time (29.3%). In non-medical students, compared with medical students, lack of knowledge (38.2% vs. 47.0%, p<0.001) and forgetfulness (29.3% vs. 37.0%, p=0.001) were considered less important (*Table* 6).

Discussion

Prior to our study, there were no other studies conducted in Kazakhstan on standard precautions for NIs and related topics. Our study contributes to the knowledge assessment of Karaganda Medical University students, and also evaluates the adequacy of their training. Our findings agree with some studies on the knowledge of medical students regarding precautionary measures [9, 12, 18, 25-35].

Our results show that general knowledge of standard precautions is unsatisfactory among the studied groups. This finding implies poor level of preparation from the very beginning of studying the topic at a university. The average score of knowledge in medical students was not much different from non-medical students who did not have specialized courses on epidemiology and prevention of NIs in their curriculum. Marginally sufficient score was achieved only by students of years of study 3 and 5, who had a course of epidemiology in their curriculum. The result suggests the inefficiency of the infection control curriculum at the medical university, hence appropriate interventions are needed to improve the situation.

The results of our research are similar to previous studies: they highlighted gaps in the training of medical students pointing at their low level of knowledge on NI. A third of medical students admitted lack of awareness of morbidity and mortality from NI. Interestingly, in many cases, students in our research claimed sufficient proficiency in the concepts of standard precautions, although the score of their knowledge on standard precautions was fairly low. Despite their own judgments on NI awareness, our

questionnaires revealed a lack of knowledge on, and attention to, nosocomial infections.

Regarding such results, we suppose that one of their causes is an underestimation of the importance of standard precautions for NIs. As suggested by F. Brosio et al., more efforts should be made to enhance knowledge on NIs [12]. Special training in standard precautions, such as mentoring, good clinical practice modeling and computer-based training package would help improving students' knowledge and developing major attributes of professional behavior, identity, and values [23, 35, 36].

Absence of the specific national plan on preventing NIs in Kazakhstan could be a possible explanation of limited knowledge on NI among the students. Their poor knowledge could be also explained by the lack of policies and/or guidelines for NIs in the field of infection control, both at the national and institutional levels. As this finding implies, policies on NI prevention are not aimed at developing much better knowledge on standard precautions among students.

Table 5. Analysis of responses about the epidemiological situation with nosocomial infection in Kazakhstan

	Responses								
	School of Medicine				School of Economics				p
	1	2	3	4	1	2	3	4	
What is the average proportion of patients who suffer from nosocomial infection?									
Year of study									
Year 1	79	141	36	228	32	35	14	109	
	16.3%	29.1%	7.4%	47.1%	16.8%	18.4%	7.4%	57.4%	
Year 2	71	112	47	118	13	30	11	77	
	20.4%	32.2%	13.5%	33.9%	9.9%	22.9%	8.4%	58.8%	
Year 3	37	119	50	116	26	53	19	56	<0.001
	11.5%	37.0%	15.5%	36.0%	16.9%	34.4%	12.3%	36.4%	
Year 4	140	209	57	173	22	21	21	68	
	24.2%	36.1%	9.8%	29.9%	16.7%	15.9%	15.9%	51.5%	
Year 5	108	177	73	119					
	22.6%	37.1%	15.3%	24.9%					
What is the average proportion of infected patients likely to die because of this infection?									
Year of study									
Year 1	105	121	26	232	28	37	10	115	
	21.7%	25%	5.4%	47.9%	14.7%	19.5%	5.3%	60.5%	
Year 2	77	109	35	127	16	31	13	71	
	22.1%	31.3%	10.1%	36.5%	12.2%	23.7%	9.9%	54.2%	
Year 3	66	99	24	133	24	35	18	77	<0.001
	20.5%	30.7%	7.5%	41.3%	15.6%	22.7%	11.7%	50.0%	
Year 4	155	167	60	197	17	25	11	79	
	26.8%	28.8%	10.4%	34.0%	12.9%	18.9%	8.3%	59.8%	
Year 5	160	140	37	140					
	33.5%	29.4%	7.8%	29.4%					
On average, by how many days would a hospital stay be prolonged because of a nosocomial infection?									
Year of study									
Year 1	274	170	40		105	59	26		
	56.6%	35.1%	8.3%		55.3%	31.1%	13.7%		
Year 2	175	123	50		70	43	18		
	50.3%	35.3%	14.4%		53.4%	32.8%	13.7%		
Year 3	178	115	29		52	71	31		<0.001
	55.3%	35.7%	9.0%		33.8%	46.1%	20.1%		
Year 4	277	232	70		60	56	16		
	47.8%	40.1%	12.1%		45.5%	42.4%	12.1%		
Year 5	227	201	49						
	47.6%	42.1%	10.3%						

Table 6. Analysis of responses regarding the perceived barriers to compliance with the standard precautions' guidelines

Perceived barriers		*Not important, %*	*Important, %*	*Very important, %*	*p*
Lack of knowledge		8.7	46.2	45.1	
	Field of study				
	Medical students	6.8	46.2	47.0	<0.001
	Non-medical st.	15.8	46.0	38.2	
	Gender				
	Male	10.9	43.1	46.0	0.005
	Female	7.7	47.7	44.7	
	Year of study				
	Year 1	11.9	38.3	49.9	
	Year 2	8.8	43.6	47.6	<0.001
	Year 3	8.8	55.3	35.9	
	Year 4	8.7	44.2	47.1	
	Year 5	4.2	53.9	41.9	
Forgetfulness		9.1	55.6	35.3	
	Field of study				
	Medical students	8.6	54.4	37.0	0.001
	Non-medical st.	10.9	59.8	29.3	
	Gender				
	Male	11.6	54.6	33.8	0.005
	Female	7.9	56.1	36.0	
	Year of study				
	Year 1	9.5	50.1	40.4	
	Year 2	12.3	56.4	31.3	<0.001
	Year 3	8.8	66.2	25.0	
	Year 4	9.1	51.6	39.2	
	Year 5	5.5	57.9	36.7	
Lack of means		19.8	50.8	29.4	
	Field of study				
	Medical students	20.6	50.2	29.2	0.162
	Non-medical st.	17.1	52.9	30.0	
	Gender				
	Male	21.6	48.5	30.0	0.169
	Female	19.0	51.9	29.1	
	Year of study				
	Year 1	26.1	48.7	25.2	
	Year 2	23.2	52.4	24.4	<0.001
	Year 3	13.9	57.1	29.0	
	Year 4	18.0	46.4	35.6	
	Year 5	16.4	52.2	31.4	
Lack of time		15.4	55.3	29.3	
	Field of study				
	Medical students	15.8	55.8	28.3	0.083
	Non-medical st.	13.8	53.4	32.8	
	Gender				
	Male	15.9	54.4	29.8	0.779
	Female	15.2	55.8	29.1	
	Year of study				
	Year 1	15.1	53.3	31.6	
	Year 2	22.1	53.0	24.8	<0.001
	Year 3	13.2	64.7	22.1	
	Year 4	15.6	51.8	32.6	
	Year 5	10.9	56.4	32.7	

Non-medical students in our study served a background to NI knowledge of medical students. However, regardless of the field of study, both groups displayed unsatisfactory awareness of NI. This result points out that current professional training of medical students does not succeed in augmenting their awareness of NIs. Moreover, training of medical students on NIs does not

significantly differ from non-medical students. This result is quite alarming finding for the national education and healthcare systems. Educational programs on infection control should be revised for patient safety as well as for improvement of student knowledge. According to A.A. Ibrahim et al., a medical education program should be started at the college level before clinical practice starts, emphasizing the importance of infection control guidelines [9].

One of the limitations was low reliability of the knowledge scale that could have weakened the expected associations.

Conclusion

Our study revealed the inadequate knowledge and awareness of the infection prevention and control guidelines among medical students. Their responses did not suggest high level of knowledge in the field of preventing NIs, compared with non-medical students.

Only through a proper training of medical students, there is a possibility of changing the situation with the prevalence of NIs in Kazakhstan for better. As a recommendation for improvement of the hospital patient safety, this study proposes an introduction of infection control educational programs at medical universities of Kazakhstan. Additionally, there is a need to come up with novel policies targeting major issues of infection prevention at the national and local levels. Hence, the Ministry of Healthcare, hospitals, medical universities and other interested parties should enhance the knowledge and practices of the standard precautions for nosocomial infections.

Ethical approval

Permission for this study was obtained from the Ethics Committee of Karaganda Medical University. A cover letter explaining the purpose of the study and requesting participation was attached to each questionnaire. Signed written informed consent form was received from each participant. Confidentiality and anonymity of the respondents were maintained ensured by encrypting names with codes. The study was carried out according to the guidelines of the Declaration of Helsinki.

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Conflict of interest

The authors declare that they have no conflicts of interest.

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Appendix 1. Fulltext of questionnaire

Dear Respondent!

We would appreciate your participation in our study on knowledge of infection control by filling out this questionnaire. It would only take 10 minutes of your time.

Please, reply honestly and independently. The answers will be used in the cumulative form.

1. **Your gender** □ Female □ Male
2. **Date of birth: ____/____/____**
3. **Your field of study _____**
4. **Your year of study:**

□ Year 1
□ Year 2
□ Year 3
□ Year 4
□ Year 5

5. **What is the most important vehicle of transmitting infectious agents in the hospital?**

□ Healthcare instruments
□ Air
□ Hands
□ Food

6. **What would be your first choice to reduce transmission of infectious agents most effectively?**

□ Mask
□ Latex gloves
□ Hand hygiene
□ Apron

7. **Do you know your country-specific concept of standard precautions (CDC, WHO)?**

□ Never heard about it
□ I heard about it
□ Vague knowledge
□ I know it well

8. **Does senior age or very young age increase the risk of a nosocomial infection?**

□ Strongly agree
□ Agree
□ Disagree
□ Strongly disagree

9. **What is the average proportion of patients who suffer from nosocomial infection?**

□ 0%-10%
□ 11%-20%
□ >20%
□ I do not know

10. **What is the average proportion of infected patients likely to die because of this infection?**

□ 0%-2%
□ 3%-5%
□ >5%
□ I do not know

11. **On average, by how many days would a hospital stay be prolonged because of a nosocomial infection?**

□ 0-10 days
□ 11-20 days
□ >20 days

12. **What are non-sterile gloves used for?**

□ To protect healthcare workers when having contact with intact skin of a patient
□ To protect a patient against transmission of an infectious agent by hands
□ To protect healthcare workers when having contact with blood or another body fluid
□ To protect healthcare workers when a patient has symptomatic infection

13. **Hand hygiene immediately before caring for a patient**

□ Helps protecting healthcare workers
□ Is useful to protect a patient
□ Helps protecting the environment
□ Is useful only for infected patients

14. **Transmission prevention of infectious agents involves mainly:**

□ Isolating all infected patients
□ Hospitalization of all patients in individual wards
□ Following preventive measures in accordance with the risk degree of transmission
□ Proper treatment of infections

15. **Does accidental splashing of a patient's body fluid in a healthcare worker's eye represent a risk of systemic infection?**

□ Yes, but only if the patient has an identified infection
□ No, healthcare workers have sufficient innate immune defense
□ Yes, regardless of the type of splashing
□ Not if the healthcare worker is vaccinated against hepatitis B

16. **In everyday work, prevention guidelines are not always followed. What are your judgements about the following options? (Please reply regarding each option)**

Lack of knowledge:	□ not important	□ important	□ very important
Forgetfulness:	□ not important	□ important	□ very important
Lack of means:	□ not important	□ important	□ very important
Lack of time:	□ not important	□ important	□ very important

Thank you very much for your time!