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ASSESSMENT OF SENIOR DENTAL STUDENTS AND DENTAL RESIDENTS IN MATTERS OF ANTIMICROBIAL CHEMOTHERAPY

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Abstract. Antimicrobial therapy (AMT) is one of the principal problems in practice of the modern dentist. Mass visits to doctors for dental care, the prevalence of dental diseases among people from all walks of life, a unique quantitative and qualitative composition of the oral microflora, uncontrolled use of antimicrobials by patients results in increased resistance of microorganisms to antimicrobial medicines and increased number of cross-infection among dental office visitors.

This article highlights the results of the study designed to assess knowledge of senior dental students of medical schools and dental residents on the main issues of antibiotic therapy and the empirical use of antimicrobials for treatment of respiratory disorders. Dental students of Belgorod have come into the study.

According to the inquiry, 21.2% of dental students and 12.8% of dental residents were able to correctly choose the pharmacological group of antibiotics. 47.5% of students and 43.8% of residents decided to change the antibiotic due to the absence of clinical response within two to three days. 35% of dental students and 37.5% of the dental residents re-inquired believe that antibiotics should be replaced even in case of the positive result from their use. 16.7% of dental students managed to correctly choose all pharmacologically irrational combinations of antimicrobials, 17.2% of dental residents answered correctly after having been re-inquired. 25.6% of students and 31.2% of residents managed to completely make the empirical assignment of the AMT in case of respiratory infection. Only 50% of students and 62.5% of residents decided that their knowledge of the AMT is insufficient for the future work in the field of health care, and they need to make additional educational efforts related to the topic.

Keywords: antimicrobial chemotherapy, effective use of antibiotics, survey, inquiry.

Introduction

According to statistical projections, by 2050, a number of fatalities affected by the diseases induced by drug resistant bacteria may keep increasing 10 million people annually [1]. To compare, in 2012, mortality from an infectious pathology was about 13 million people worldwide [2], about 700,000 of them, at the lowest estimate, died from resistant

microorganisms [3]. The mass antibiotics intake has resulted in a heavy drop of microorganism sensitivity to these medications. The chemical industry which grew rapidly in discovering antibiotics since 1940s has significantly cut its development rates as soon as a new millennium began [4]. Today the doctor has no more than three to four active antibiotics to prescribe,

though the most aggressive microorganisms may also develop resistance to them.

In 2014, the World Health Organization (WHO) prepared the Global Strategy for Containment of Antimicrobial Resistance which considered the following reasons for increase of microorganism insensitivity to antibiotics [1]:

- uncontrolled over-the-counter sale of antibiotics;
- no uniform treatment standards for infectious diseases;
- no prevention and monitoring programs for infections causing human diseases;
- use of antibiotics to stimulate animal growth;
- low awareness of people and medical staff regarding efficient antimicrobial therapy (AMT).

It is possible and required to fight very hard any identified reasons of microorganism resistance, especially the identified evidence of low awareness of medical staff regarding this problem. It should be noted that perfect professional training of future doctors is very important for today's diagnostics, reasonable therapy, and good recovery prognosis in social and labor areas of life. In this regard, a program of studying units of pharmacology and clinical pharmacology has been implemented in medical universities in this country. Taking into consideration that chemical entities with an antimicrobial mechanism of action are the most numerous group of drugs, the training is more focused on consideration of fundamental principles of these medications – their compound, group identity, and mechanism of action on the bacterial cell. Antibiotics pharmacokinetics and pharmacodynamics, administration frequency, optimal dosage, reasonable bedside treatment as well as possible on-treatment complications are studied in detail in the course of clinical pharmacology. By fifth to sixth year of study, medical students must have had a clear idea of antibiotics classification, effective combinations, and containment of microorganism resistance to drugs.

Research Objective is to assess basic knowledge of antibiotics among fifth-year students (dentistry major) and survival rate of knowledge among medical students of Belgorod Medical University.

Materials and Methods

This study is based on a method of anonymous survey. For this purpose, an original survey for the public opinion poll has been prepared (the questions can be found below in Chapter *Discussion of Results*). In the survey, students should put down their year of study and major, choose whether they are questioned for the first or second time, and answer the following six principal questions regarding antimicrobial therapy:

- 1) define the pharmacological group of some drugs;
- 2) choose pharmacologically unreasonable combination(s) of drugs;
- 3) define the terms of antibiotics change in case of positive clinical treatment effect;
- 4) define the terms of antibiotics change in case of negative clinical treatment effect;
- 5) choose unreasonable antibiotics for empiric treatment of typical respiratory infections;
- 6) assess the necessity of additional educational events of antimicrobial therapy.

The survey was held in 2014 to 2015 in the medical school of Belgorod National Research University (Belgorod).

40 fifth-year dental students studying dentistry major (code 31.05.03) took part in the survey for the first time, and 32 resident dentists studying dentistry major (code 04.04.01) took part in the survey for the second time. All the students/residents had had the training in educational programs *Pharmacology* and *Clinical Pharmacology*.

The data in the survey and the poll results have been entered in an electronic database and processed using Microsoft Excel applications.

It should be noted that the knowledge assessment methods are relative and prepared specifically for this research, and cannot show the general level of education quality in the university.

Research Results

The first question in the survey was caused to identify the following basic knowledge in the antibacterial therapy – to which pharmacological group various antibiotics belong. 21.2% dental students and 12.8% resident dentists gave a fully correct answer to this question (Figure 1).

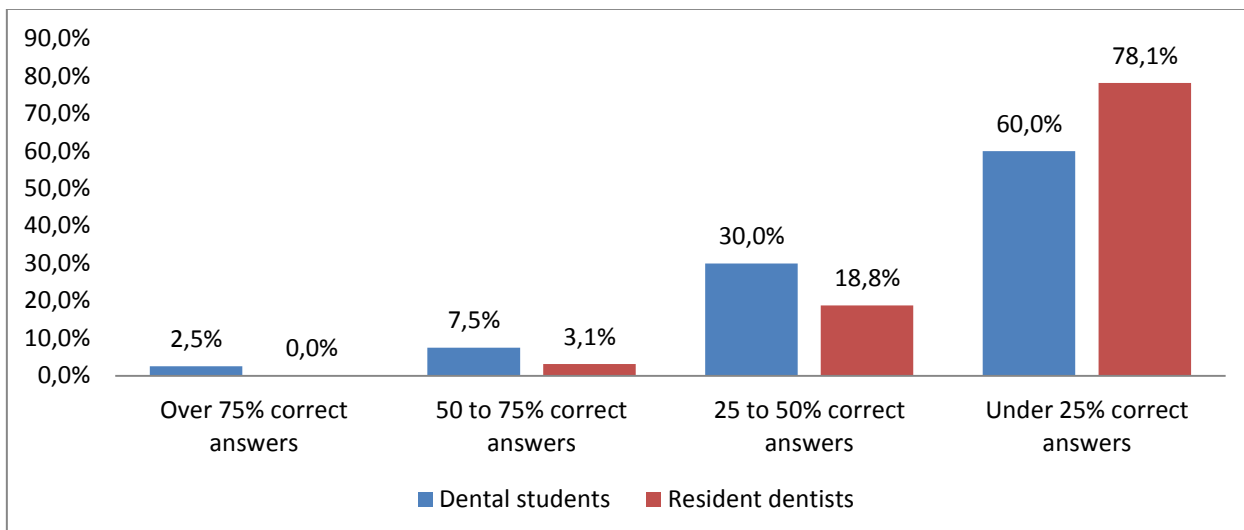


Figure 1. Distribution of correct answers to the question of pharmacological groups of antibiotics

When using antibiotics, like any other drugs, it is required to perform a careful follow-up control of the patient's state, to evaluate positive or negative effect of the therapy provided. It is natural that it is pointless to change the antimicrobial therapy if the patient's body

responds properly to the antimicrobial therapy and his/her general condition improves. Unfortunately, only 65% responding dental students and 62.5% resident dentists re-asked knew that (Figure 2).

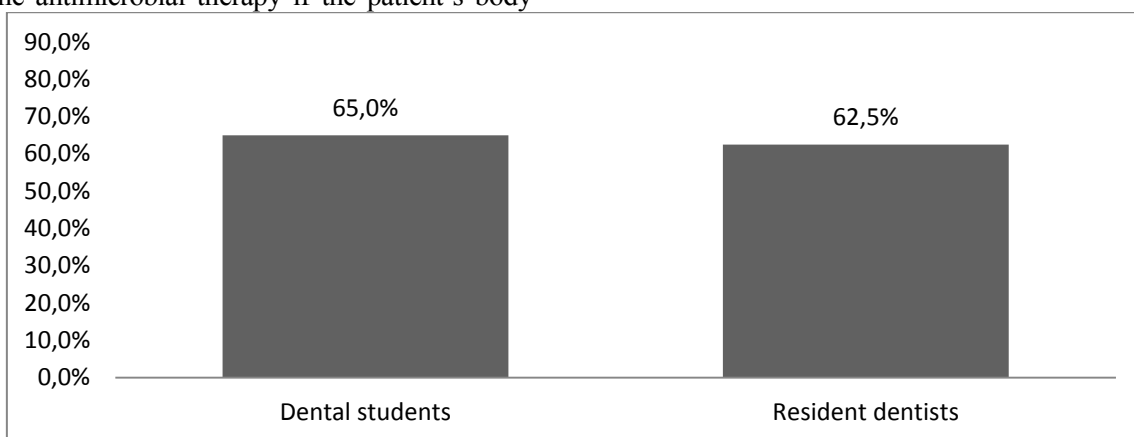


Figure 2. Percentage of correct answers regarding antibiotics change in case of a positive clinical effect

If the patient shows negative dynamics of the general health condition and has no clinical effect of the antibiotic administration, the medication is to be changed

as in a classic «student's» case within two to three days since the medication was taken. 47.5% students and 43.8% residents gave that answer (Figure 3).

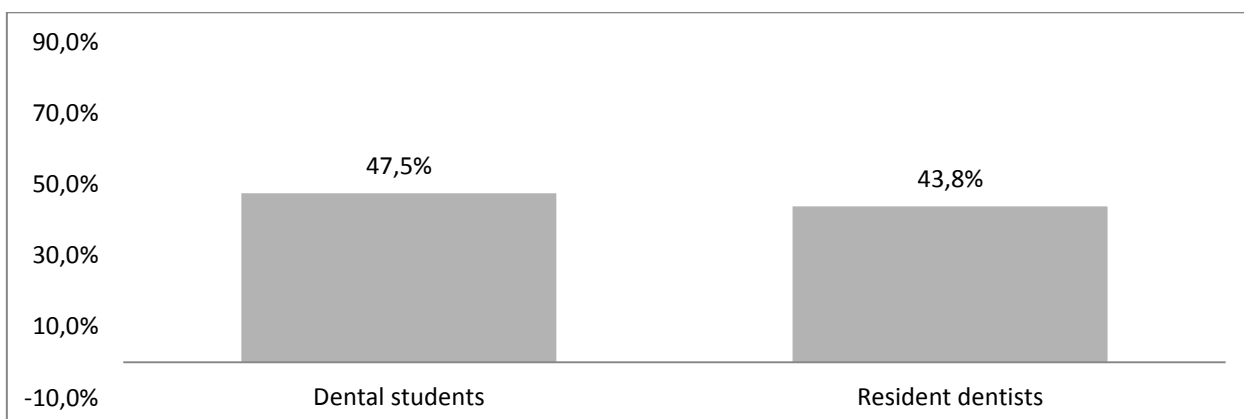


Figure 3. Percentage of correct answers regarding antibiotics change in case of a negative clinical effect

The next question in the survey was about assessment of knowledge in correct combinations of antibiotics with each other: students had to choose pharmacologically inefficient combinations among those proposed. For the first time, 16.7% dental students chose all combinations correctly, for the second time, 17.2% resident dentists answered correctly.

One of the questions in the survey was that about medications which have been reviewed regarding their reasons to administer from the perspective of today's clinical pharmacology. In this regard, students were offered to choose which medications were unreasonable

to prescribe as empiric therapy of respiratory infections. 25.6% students and 31.2% residents gave a fully correct answer.

It is very important for the doctor like for any other expert to assess his/her knowledge properly, wish to constantly improve his/her professional activities. The purpose of the last question in our survey is to find out if students need any extra educational events regarding problems of effective antimicrobial therapy. For the first time, 50% students answered yes to that question, for the second time, 62.5% resident dentists said yes (Figure 4).

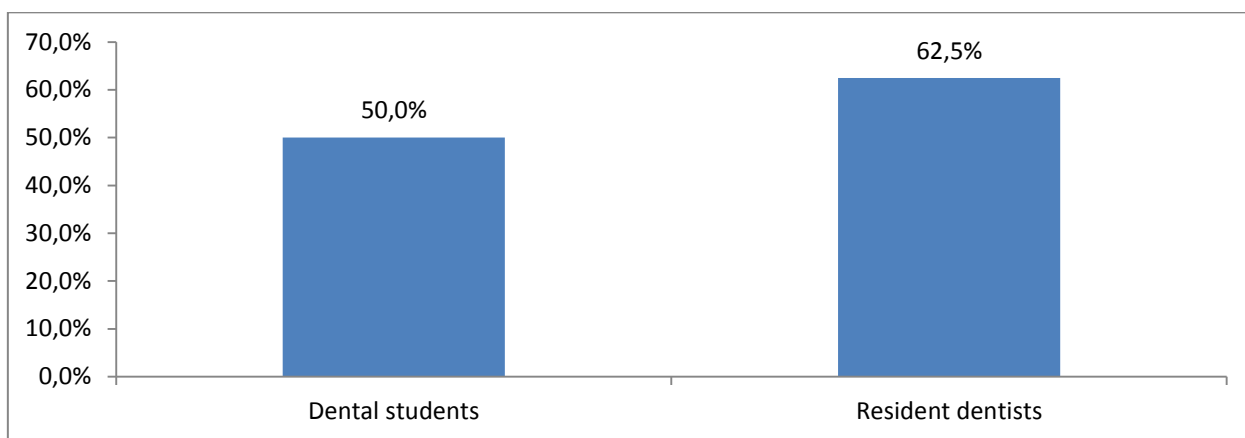


Figure 4. Students and residents' need for extra educational activities on effective antimicrobial therapy, %.

Discussion of Results

Despite completion of courses *Pharmacology* and *Clinical Pharmacology* as well as the first survey with detailed overview and explanation of all questions in the

survey and the second one, most respondents had difficulties when identifying the pharmacological group of the antibiotics [5] – 80% respondents gave the wrong answer to that question (Table 1).

Table 1

Antibiotic	Pharmacological Group	% Correct Answers	
		Students	Residents
cefuroxime	cephalosporins (second generation)	47.5%	34.4%
ciprofloxacin	fluoroquinolones (second generation)	22.5%	6.3%
metronidazole	nitroimidazoles	7.5%	0.0%
co-trimoxazole	sulfanilamides	5.0%	0.0%
levofloxacin	fluoroquinolones (third generation)	11.3%	12.5%
amoxicillin + clavulanate	(amino-)penicillins (protected)	35.0%	25.0%
azithromycin	macrolides	30.0%	21.9%
fluconazole	antifungal, azoles	22.5%	15.6%
meropenem	carbapenems	12.5%	0.0%
clindamycin	lincosamides	2.5%	0.0%
doxycycline	tetracyclines	17.5%	6.3%
ceftriaxone	cephalosporins (third generation)	40.0%	31.3%

The most difficult task was to identify the pharmacological group for clindamycin (2.5% correct answers in the first survey and 0% correct answers in the second one), co-trimoxazole (5.0% correct answers in the first survey and 0% correct answers in the second one), and metronidazole (7.5% correct

answers in the first survey and 0% correct answers in the second one). The best result was shown when identifying the pharmacological group for cefuroxime (47.5% correct answers in the first survey and 34.4% correct answers in the second one), ceftriaxone (40% correct answers in the first survey and 31.3% correct

answers in the second one), amoxicillin/clavulanate (35% correct answers in the first survey of students and 25% correct answers in the survey of residents) (Figure 5).

Generally, a tendency has been noted to deteriorate recognition of the drug pharmacological group – in a year, they totally fail to identify the group for clindamycin, co-trimoxazole, metronidazole, and meropenem.

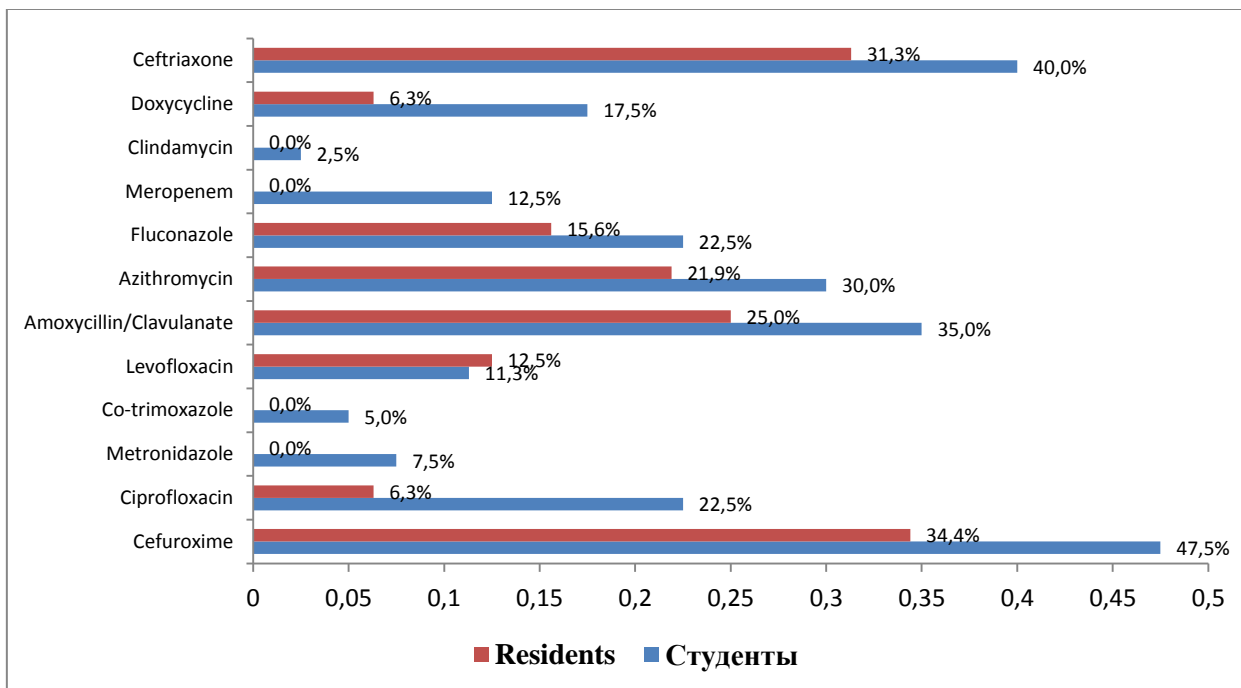


Figure 5. Correct identification of pharmacological groups for antibiotics by dental students and residents, %.

When treating a patient, a dynamic quality assessment of the prescribed antimicrobial therapy, positive response of the body – improvement of the patient’s general health condition and laboratory parameters – has a particular importance for a clinician. Unfortunately, 35% dental students and 37.5% resident dentists gave the wrong answer to question: «If it is a positive clinical effect during the antimicrobial therapy the antibiotic should be changed (1 answer):

- in 5 days
- in 7 to 10 days
- in 11 to 14 days
- no change is required»

Due to increase in microorganism resistance to anti-infective medications, increase in cross resistance and increase in «mixed infections», the doctor today faces the necessity to use no mono-preparation of the antibacterial range but to combine reasonably the drugs he/she has at his/her disposal. This is one of the most difficult and complicated problems in the antimicrobial therapy as medications should not duplicate each other in the mechanism of action and spectrum of antimicrobial activity, increase toxic effects of each other, and they should be combined with other drugs the patient takes.

25.6% dental students for the first time and 31.2% resident dentists for the second time gave the correct answer (first three choices) to question: «Choose pharmacologically ineffective combinations of the medications (several answers are possible):

- Ceftriaxone + Amoxicillin;
- Ofloxacin + Doxycycline;
- Levofloxacin + Clarithromycin;
- Ampicillin + Gentamicin;
- Azithromycin + Ampicillin + Amikacin»,

which shows low awareness of the respondents regarding effective antibiotics combination. Distribution of the correct answers for each combination is shown in Table 2.

Table 2

Assessment of pharmacologically ineffective combinations of antibiotics (% students)

Ineffective Antibiotics Combinations	Students with Dentistry Major (n=40)	Resident Dentists (n=32)
Ceftriaxone + Amoxicillin	7.5%	12.9%
Ofloxacin + Doxycycline	22.5%	25.8%
Levofloxacin + Clarithromycin	20.0%	12.9%

As is known, the respiratory disease is one of the leading one among adults and kids. Great attention is paid to reasonable pharmacotherapy of respiratory infections due to a social importance of these diseases resulted in large economical expenses for the state.

The correctly chosen empiric therapy of the diseases affecting a respiratory tract provides the patient's quick recovery and rehabilitation. Numerous international and national recommendations which have been issued in recent years are a significant phase to improve quality of pharmacotherapy of respiratory infections. At the same time, the most up-to-date recommendations give no guarantee of their actual studying by students in the course of educational process and their further use in practical health care.

Streptococci (*S. pneumoniae*), Haemophilus influenzae, moraxella (*M. catarrhalis*), mycoplasma (*M. pneumoniae*), etc. are the most frequent agents of respiratory infections [5]. The students should considered the medications proposed in the survey – Ampicillin + Oxacillin («Ampiox»), Gentamicin, Co-trimoxazole («Biseptol») and Nistatine (as a medication used to prevent fungal infection affected by antibiotics administration) – as empirically ineffective because they have no spectrum of activity towards these agents. The correct choice for this question was «Ceftriaxone». As the research has shown, that question was a problem for 74% students and 69% residents (Figure 6).

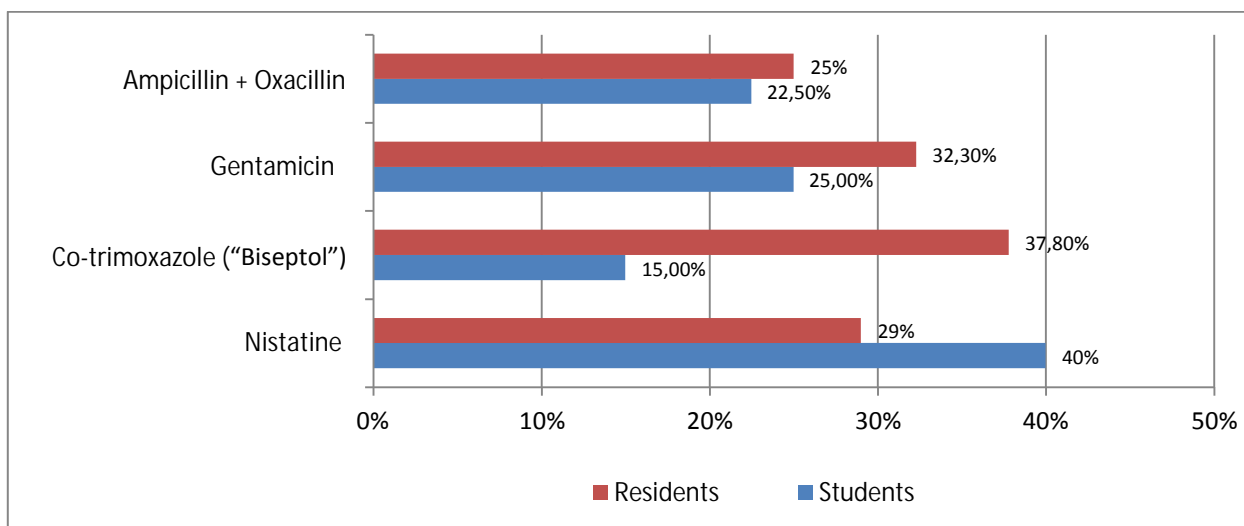


Figure 6. Proper identification of ineffective drugs for empiric treatment of respiratory infections by students and resident dentists, %

Conclusions

The survey which has been held for the first time among fifth-year dental students and a further survey of resident dentists from medical universities show a low level of training and poor survival rate of knowledge within one year regarding antimicrobial chemotherapy. More than half of graduate students and residents gave the wrong (or insufficiently correct) answers to the basic questions of the topic. The most difficult tasks have been as follows: choice of antibiotics for empiric treatment in case of infectious respiratory diseases, choice of

pharmacologically effective/ineffective drug combinations.

In the authors' opinion, the current number of academic hours is still insufficient to consider topics in antimicrobial therapy thoroughly and in detail and to train effectively future dental practitioners.

The obtained results show the necessity to increase duration of courses in antibiotics and antimicrobial therapy in the educational program within pharmacology and clinical pharmacology, as well as to hold extra educational events regarding effective antimicrobial therapy which will increase students' knowledge in this area.

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