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Research Article

Assessment of physicians' and medical majors' knowledge of asthma basics: Current results of the ASSA-II study

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Abstract

Introduction: Bronchial asthma is a disease characterized by chronic inflammation of the airways. At present, about 235-300 million people suffer from asthma, and this number continues to grow. This pathology is also common in children. It causes significant social and economic damage worldwide. Severe forms of asthma are difficult to treat. Thus, a continuous improvement of doctors' knowledge in this field is of great importance.

Methods: The analysis of an anonymous survey of physicians and senior medical students was used in the research.

Results: The study revealed both an average level of basic knowledge in asthma etiology and pathogenesis among the physicians and senior medical students and the significant differences in their knowledge regarding clinical picture and treatment of asthma. Only 49.2% of students and 56.0% of doctors were able to choose the correct definition of asthma from the suggested answers; 65.7% of students and 69.9% of doctors correctly indicated the main clinical and laboratory markers of asthma; 60.2% of students and 91.0% of doctors determined the correct combination of drugs in one delivery device; and 75.9% of students and 91.2% of doctors selected the correct basic asthma therapy depending on the severity.

Conclusion: Basing on the results obtained it was recommended to introduce additional educational activities on the diagnosis and therapy of asthma among medical majors and physicians.

Keywords

bronchial asthma, survey, education, physicians' knowledge, medical majors' knowledge, pharmacoepidemiology.

Introduction

Bronchial asthma is a challenging issue of a modern health care system. According to the World Health Organization (WHO), it is spread worldwide regardless of the development level of countries (GINA 2014, GINA 2017).

Bronchial asthma (BA) is a heterogeneous disease, characterized by chronic inflammation of the airways. The main symptoms of asthma are wheezing, shortness of breath, chest tightness and cough. Symptoms vary in duration and intensity, depending on temporary bronchial obstruction (GINA 2014-2018, Namazova-Baranova et al. 2009, Pearce et al. 2007).

The information on asthma prevalence is different, which is due to the following aspects: different approaches used for disease recognition, late diagnosis, differences in the degree of incidence among countries. WHO's major epidemiological studies report that asthma incidence is from 1% to 18%. Such a wide range of results is due to the assessment of an epidemiological situation in countries with different levels of social and economic development. Countries with poor social development and environmental pollution have both high rates of asthma and an increased risk of severe asthma development with complications and mortality. To date, it is estimated that 235-300 million people suffer from asthma. Scientists say that this figure grows by 50% every 10 years (Chuchalin et al. 2014, GINA 2014, Partridge et al. 1998).

According to the statistics, there were 383.000 deaths due to asthma in 2015. On average, about 250.000 people die from asthma every year. Fifteen million DALYs are detected yearly due to this pathology (DALY is Disability Adjusted Life Year) (Federal clinical guidelines 2018, GINA 2017, Stewart et al. 2001).

It is important to note that asthma causes significant social and economic damage. There was a study to assess the impact of asthma in many countries of Asia, Latin America, Europe, as well as in the USA. Asthma causes direct and indirect costs such as: cost of drugs, cost of hospitalization, days of disability, and premature deaths. Costs depend on the level of control over the disease, prophylaxis and how efficient is prevention of exacerbations (GINA 2014, GINA 2017, Pertseva and Gashinova 2007, Sergeeva et al. 2015).

Asthma is one of the common pathologies in children, with presumably 5% to 10% of world's children suffering from it. Diagnosing asthma in children is challenging since it often cannot be recognized either because of an unclear etiology or because children are diagnosed with asthmatic bronchitis. Due to the late diagnosis, disease progresses, and the therapy starts with administering higher initial doses of drugs (Avdeev et al. 2018, Federal clinical guidelines 2018, Namazova-Baranova et al. 2007, Papadopoulos et al. 2012, Partridge et al. 1998).

Of special consideration is so-called severe asthma. According to statistics, about 5-20% of patients suffer from severe BA. This form is characterized by a more severe course compared to its "ordinary" forms, when the traditional approach to its therapy is of little assistance. Individual disease phenotypes should be singled out in order to develop a personalized approach to treatment of such patients (Avdeev et al. 2018, Nenasheva 2012, Sergeeva et al. 2015).

Considering the above-mentioned, it is recommended to assess physicians' and medical majors' knowledge in asthma therapy, to find gaps in their knowledge and to bridge them.

Aim: to determine the level of basic knowledge of the treatment of bronchial asthma among physicians and medical majors in their fifth-sixth years of studies.

Materials and methods

The survey was conducted within the first phase of the "ASSA-II" project started in 2017 – a study aimed to assess the knowledge of specialists in the field of bronchial asthma (the full name of the project is "Assessment of Senior Medical Students in the Field of Bronchial Asthma"). So far, the results of the survey conducted in eight centers of Russia and the Ukraine have been obtained and analyzed. The survey was conducted among both Medical Care majors in their fifth-sixth years from four cities (Belgorod, Voronezh, Dnipro and Chelyabinsk) and physicians from eight cities (Belgorod, Voronezh, Krasnodar, Chelyabinsk, Smolensk, Saratov, Lipetsk and Dnipro).

The study has been also started in Moscow, Ufa, Kazan, Krasnoyarsk and Bishkek, and currently the data for the further analysis is being accumulated.

The study was conducted in compliance with the principles of the Helsinki Declaration.

All the students were enrolled in standard educational programs. It is necessary to emphasize that this method of knowledge assessment is relative, and was specially developed for this study, thus, cannot fully reflect the general level of education quality at university.

The students were questioned with a help of an original questionnaire, which had been developed in accordance with the GINA-2014-2017 provisions (GINA 2014, GINA 2017), and consisted of 12 questions. The respondents could give only one correct answer, the option "not sure" was also available. Approbation (validation) of the

preliminary and final versions of the questionnaire was completed with a help of cross-testing within the group of co-authors and on pilot groups of doctors and students in the regions under study. During this period, the options for one question of the questionnaire were adjusted.

The respondents were asked to specify their year of studies and/or major, indicating whether it was the first or second time when s/he had taken the questionnaire, after which, s/he was supposed to proceed with the questionnaire. The respondents did not indicate their names, which helped to obtain more independent results without the factor of possible evaluation influencing the respondents.

The respondent was awarded 1 point for each correct answer, 0.5 point – for an incomplete answer (when choosing both correct and incorrect answers) and 0 point for the incorrect answer. Thus, with all the correct answers, the maximum average score was 1.0.

For each respondent, the average score was calculated, the average score for individual questions, the average score for the centers (cities) and the average score for the entire questionnaire. The average level of response completeness (ARC) was calculated as the average of all the correct, partially correct and incorrect answers, an equivalent being the average level of correct answers. Also, separately were analyzed the patterns of answers to individual questions. All the information entered into the questionnaires was then entered to an electronic database and processed using MICROSOFT EXCEL applications. Statistical data were processed through the analysis of fourfold and arbitrary contingency tables using the Pearson's chi-square (x2) test and, if necessary, with the Yates' correction or the calculation of Fisher's exact test.

The overall results of the first part of the project (ASSA-I, 2014-2016) were published in *Farmateka*, Journal No.5, 2019 (Bontsevich et al. 2019), and the partial results for 2014-2015 were published in the *European Respiratory Journal* (Bontsevich et al. 2014, Bontsevich et al. 2015). The brief results of the project ASSA-II were also submitted and accepted as abstracts for the European Respiratory Congress 2019.

Results

The survey involved 249 students (45.0% – from Belgorod, 31.7% – from Voronezh, 16.9% – from Chelyabinsk, and 6.4% – from Dnepr) and 219 doctors (34.2% – from Belgorod, 18.7% – from Voronezh, 4.6% – from Krasnodar, 9.6% – from Chelyabinsk, 7.3% – from Smolensk, 8.2% – from Saratov, 7.3% – from Lipetsk and 10% – from Dnepr).

The average level of correct answers to all questions was 72.6% among students and 83.8% among doctors. Differences between the centers ranged from 49.2% to 90.0% for students and from 56.0% to 95.6% for doctors.

The lowest level of correct answers – only 49.2% of students and 56.0% of doctors – was obtained to the question concerning choosing the correct definition of asthma from the suggested answers, $p_{doct\text{-}stud}>0.05$; 65.7% of students and 69.9% of doctors correctly indicated the main clinical and laboratory markers of asthma, $p_{doct\text{-}stud}>0.05$. The maximum average level of correct answers was registered for the following questions: the correct combination of drugs in one delivery device (60.2% of students and 91.0% of doctors, $p_{doct\text{-}stud}<0.001$) and the correct basic asthma therapy depending on the severity (75.9% of students and 91.2% of doctors, $p_{doct\text{-}stud}<0.001$).

Discussion

The first question required the respondents to choose the best definition of asthma from five possible options. Half of students (49.2%, varying from 43.8% to 56.0% in different centers) and 56.0% of doctors (from 24.7% to 80.5% in different centers) answered correctly, $p_{doct\text{-}stud}>0.05$ (Fig. 1).

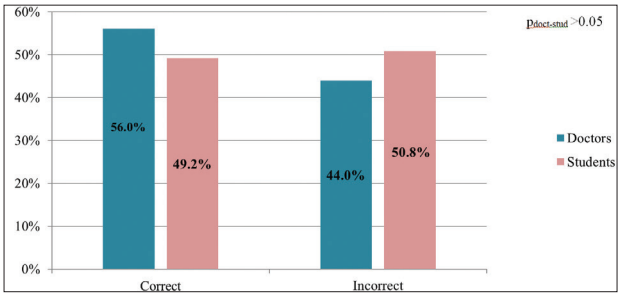

Figure 1. Responses to the question about BA definition

In the next question of the questionnaire, it was necessary to select a possible trigger of an asthma attack from the following list of options: indoor allergens, physical stress, cold, administration of non-steroidal anti-inflammatory drugs, or "all the above" (the correct answer) (Avdeev 2005, Chuchalin 2017, GINA 2014). The correct answers were given by 92.4% of doctors (varying from 86.4% to 100% in different cities) and 78.1% of students (from 73.2% to 100%), $p_{doct\text{-}stud}<0.001$ (Fig. 2).

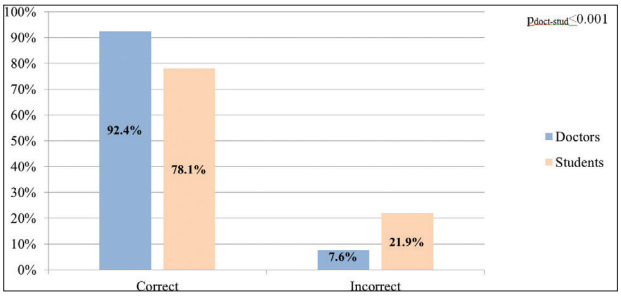

Figure 2. Responses to the question about asthma triggers

According to statistical data, bronchial hyperreactivity triggered by irritants ranks first in asthma pathogenesis. It is accompanied by stimulation of membra-

ne phospholipids metabolism and by the release of the following inflammatory mediators from mast cells: histamine, acetylcholine, serotonin, proteases, eosinophil chemotaxis factor and neutrophils. Primary inflammatory mediators and metabolic products of arachidonic acid –prostaglandins (GD2) and leukotrienes (LTC4) – cause an increase in vascular permeability, an edema of the respiratory tract mucosa, a bronchial smooth muscle spasm, infiltration of tissue with eosinophils and neutrophils and strengthen bronchial secretions (British Guideline 2008, Chuchalin et al. 2014, GINA 2014, Zureik et al. 2002).

The third question of the questionnaire was about asthma pathogenesis. The respondents were to choose a key factor of asthma pathogenesis from the following options:

1. Bronchial hyperreactivity (correct option)
2. Body allergization
3. Hypersensitivity of respiratory tract mucosa
4. Defective bronchial muscles tone
5. Not sure

Two thirds – 66.3% (from 53.6% to 88.1% in different centers) of students and 82.1% of doctors (from 66.9% to 93.8% in different centers) gave the correct answer, $p_{doct-stud}<0.001$ (Fig. 3).

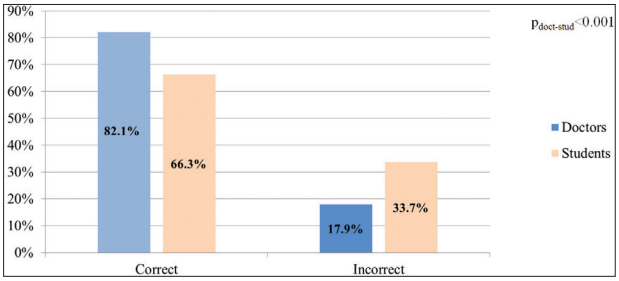

Figure 3. Responses to the question about bronchial asthma pathogenesis

The main laboratory and instrumental markers to diagnose asthma are a decreased forced expiratory volume within the 1st second (FEV1), increased IgE and eosinophilia (Avdeev 2005, Chuchalin et al. 2014, GINA 2014, Nenasheva 2012). In the next question, the respondents were required to specify the most appropriate instrumental and laboratory asthma marker out of the proposed options:

1. decreased lung capacity, normal FEV1, increased IgE, eosinophilia
2. increased FEV1, decreased IgE, specific changes on chest radiographs
3. decreased FEV1 and lung capacity, increased IgM, lymphocytosis
4. increased FEV1, normal lung capacity, decreased IgE, neutrophilia, specific changes on chest radiographs
5. decreased FEV1, increased IgE, eosinophilia (correct answer)
6. Not sure

Almost the same number of respondents – 65.7% (from 60.8% to 77.4% in different cities) of students and 69.9% of doctors (from 50.0% to 95.2%) – gave the correct answer, $p_{doct-stud}>0.05$ (Fig. 4).

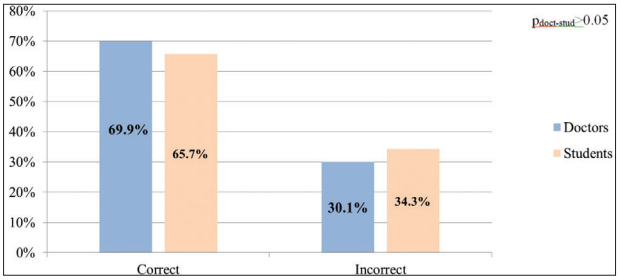

Figure 4. Responses to the question about the main laboratory and instrumental markers of bronchial asthma

The next question was about the asthma diagnostic methods. The respondents had to indicate an appropriate method of examination from the following options: radiography, bronchography, bronchoscopy, and pulmonary function test (correct answer). The majority of the surveyed answered correctly (87.6% of students and 92.0% of doctors, varying from 85.7% to 93.8% in different centers and from 80.6% to 100% in different centers, $p_{doct-stud}>0.05$) (Fig. 5).

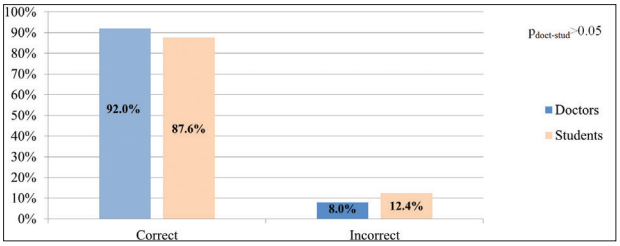

Figure 5. Responses to the question about the main methods of bronchial asthma diagnostics

The sixth question required the respondents to specify the severity of asthma according to GINA classification (Table 1).

The majority of the respondents gave the correct answer: 77.1% of students and 78.8% of doctors (from 64.3% to 93.8% and from 61.1% to 100% in different students' and doctors' centers, respectively, $p_{doct-stud}>0.05$) (Fig. 6).

According to modern clinical guidelines, asthma treatment has to be carried out under continuous monitoring (British Guideline 2008, Federal clinical guidelines 2018, Agarwal et al. 2015, Sears et al. 2003). Asthma monitoring is an assessment of symptoms severity, or to what extent they have been reduced or eliminated by the conducted therapy. It consists of symptoms control and risk factors for the future negative outcomes. Poor symptoms control complicates the patient's life and is a risk factor for exacerbations.

Control is determined by using an asthma control test™ (ACT™). This is a questionnaire (Table 2) consisting of five questions, with the help of which control over

Table 1. Classification of asthma severity by clinical features before treatment according to GINA (British Guideline 2008, GINA 2014, Chuchalin et al. 2014)

Level 1: Intermittent	Level 2: Mild persistent	Level 3: Moderate persistent	Level 4: Severe persistent
◦ Symptoms less than once a week	◦ Symptoms more than once a week but less than once a day	◦ Symptoms daily	◦ Symptoms daily
◦ Brief exacerbations	◦ Exacerbations may affect activity and sleep	◦ Exacerbations may affect activity and sleep	◦ Frequent exacerbations
◦ Nocturnal symptoms not more than twice a month	◦ Nocturnal symptoms more than twice a month	◦ Nocturnal symptoms more than once a week	◦ Frequent nocturnal asthma symptoms
		◦ Daily use of inhaled short-acting β2-agonist	◦ Limitation of physical activities
◦ FEV1 or PEF>80% pred	◦ FEV1 or PEF>80% pred	◦ FEV1 or PEF 60–80% pred	◦ FEV1 or PEF<60% pred
◦ PEF or FEV1 variability<20%	◦ PEF or FEV1 variability 20–30%	◦ PEF or FEV1 variability>30%	◦ PEF or FEV1 variability>30%

Note: FEV1: forced expiratory volume in one second; PEF: peak expiratory flow; % pred: % predicted.

Table 2. Asthma control according to GINA for adults and children (Federal clinical guidelines 2018).

Symptoms in the past 4 weeks	Asthma symptom control		
	Well-controlled	Partly controlled	Uncontrolled
Daytime symptoms more than twice/week (or once/week*) Any night waking due to asthma Reliever needed more than twice/week Any limitation of daily activity due to asthma	No criterion applies	1–2 criteria apply	3–4 criteria apply

Note: * – In children ≤5 years

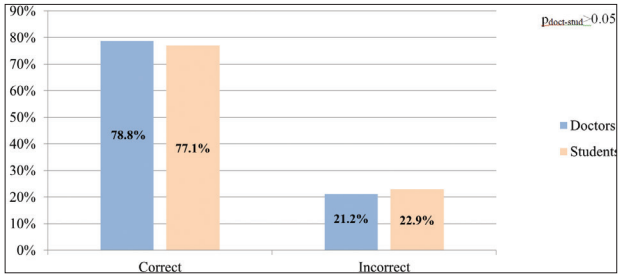

Figure 6. Responses to the question about classification of asthma severity

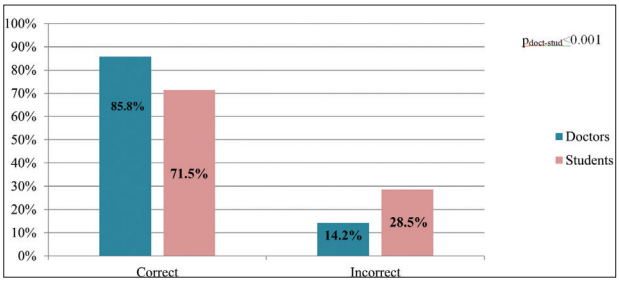

Figure 7. Responses to the question about asthma control

bronchial asthma is measured in patients over 12 years old (Chuchalin 2017, Federal clinical guidelines 2018, Horak et al. 2016, King and Hanania 2010).

In the next question, it was necessary to indicate the existing levels of disease control. The following options were proposed:

1. Level 1, level 2A, level 2B, level 3
2. Satisfactory, unsatisfactory
3. Controlled, partly controlled, uncontrolled (correct answer)
4. Inhalation, tableted, intravenous
5. Not sure

The correct answer was given by 71.5% of students (from 61.6% to 87.5% in different cities) and 85.8% of doctors (from 61.1% to 100%), $p_{doct\text{-}stud}<0.001$) (Fig. 7).

The best way of monitoring asthma at home is peak expiratory flow rate (PEF) measurements made by using a peak flow meter. PEF is the maximum speed at which air can pass through the airways during maximum rapid expiration after the deepest possible breath. It allows to evaluate the response to the therapy and to analyze the inciting agents (Brodskaya and Belevsky 2016, Chuchalin 2017, Federal clinical guidelines 2018). Peak flow meters are relatively inexpensive, portable and easy to operate.

In the next question of the questionnaire, it was required to indicate the correct option of asthma self-control at home:

1. Breathing test
2. Peakflowmetry (correct answer)
3. Pneumometry
4. Spirography
5. Not sure

The correct answer was given by 71.9% of students (from 64.3% to 81.0% in different cities) and 86.5% of doctors (from 75.3% to 100%), $p_{doct\text{-}stud}<0.001$) (Fig. 8).

Asthma exacerbations (synonyms: BA attacks, or acute BA) are episodes of increasing shortness of breath, cough, wheezing, or chest congestion, requiring changes in the usual regimen of therapy. An exacerbation of BA is characterized by a decreased PEF and FEV1. They can develop in patients with an already established diagnosis of asthma or can be observed for the first time. The deve-

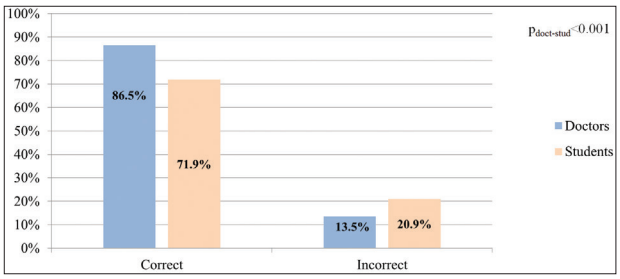

Figure 8. Responses to the question about the methods of asthma self-control

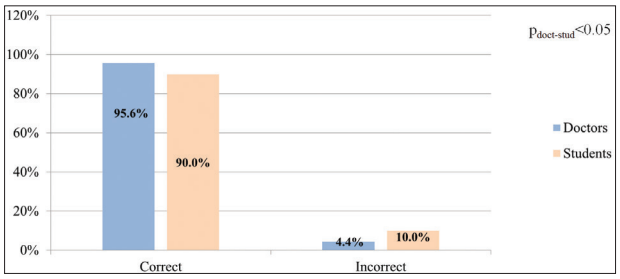

Figure 9. Responses to the question about definition of a severe asthma attack

lopment rate of asthma exacerbations may vary significantly in different patients — from a few minutes or hours to 10–14 days. Exacerbations relief time also varies from 5 to 14 days (Belevsky 2013, Chuchalin 2017, GINA 2017). With an adverse course of asthma exacerbation, the status asthmaticus – an episode of an acute respiratory failure (life-threatening asthma; nearly fatal asthma) – is highly likely to develop (Table 3).

In the ninth question, the respondents were required to select the correct option for a severe asthma attack:

1. Silent chest
2. Status asthmaticus (correct version)
3. Angina pectoris
4. Paroxysm
5. Not sure

Almost all the students and doctors chose the correct answer – 90.0% of students and 95.6% of doctors (from 87.5% to 95.2% and from 92.7% to 100% in different cities, respectively, $p_{doct\text{-}stud}<0.05$) (Fig. 9).

The last questions were aimed at determining the level of knowledge in the following aspects: basic therapy prescription, drugs of choice in the treatment of asphyxiation, combination drugs in management of patients with asthma.

The modern view on the treatment of asthma is aimed at achieving control over the symptoms of the disease and the prevention of complications and adverse outcomes. To date, a stepwise therapy of asthma is prescribed, depending on the symptoms and condition of the patient. For mild to moderate exacerbations, the best way to quickly eliminate bronchial obstruction is to repeatedly use fast-acting inhaled β2-agonists (2 to 4 inhalations every 20 minutes for the first hour). After the first hour, the required dose of β2-agonists will depend on the severity of the exacerbation (Avdeev et al. 2016, Aysanov and Kalmanova 2009, Belevsky 2013, Ichinose et al. 2017).

The tenth question was about choosing a drug to use first of all in asthma attack treatment:

1. Mechanical lung ventilation

Table 3. Classification of BA exacerbations **(**Chuchalin A.G.2017)

Moderate asthma exacerbation	One of the following criteria: ◦ Strengthening the symptoms ◦ PEF 50-75% of the best or calculated result ◦ Increased frequency of using ambulance drugs ≥50% or their additional use through a nebulizer ◦ Night awakenings due to the onset of symptoms of asthma and requiring the use of first-aid drugs
Severe exacerbation of asthma	One of the following criteria: ◦ PEF 30-50% of the best values ◦ Respiratory rate ≥25/ min ◦ Pulse ≥110/min ◦ Inability to pronounce a phrase on one breath
Life threatening asthma	One of the following criteria: ◦ PEF<33% of the best values ◦ SpO2<92% ◦ PaO2<60mm Hg ◦ Normocapnia (PaCO2 – 35-45mmHg) ◦ "Silent Chest" ◦ Cyanosis ◦ Weak breathing effort ◦ Bradycardia ◦ Hypotension ◦ Fatigue ◦ Stupor ◦ Coma
Nearly fatal asthma	◦ Hypercapnia (PaCO2>45 mm Hg) and/or ◦ Need for mechanical lung ventilation

2. β2 short-acting agonists (correct version)
3. Inhaled glucocorticoids
4. Systemic hormones
5. Aminophylline
6. Not sure

The correct answer was chosen by 77.7% of students (from 70.2% to 93.8% in different cities) and 84.6% of doctors (from 77.0 % to 100%), $p_{doct-stud}>0.05$).

In the next question, the respondents were asked to choose a drug therapy for asthma depending on the symptoms and the risk of exacerbations (GINA 2017). It was necessary to specify the right option for the basic treatment of moderate asthma (Avdeev et al. 2016, Chuchalin 2017, Federal clinical guidelines 2018, Fitzpatrick and Moore 2017, Ichinose et al. 2017):

1. Inhaled glucocorticoid + aminophylline
2. Inhaled glucocorticoid + long-acting β2-agonist (the correct option)
3. Aminophylline + long-acting β2-agonist
4. M-anticholinergic + long-acting β2-agonist
5. Not sure

The correct answer was chosen by 75.9% of students (from 52.4% to 87.5% in different cities) and 91.2% of doctors (from 77.8% to 100%), $p_{doct-stud}<0.001$).

An efficient asthma treatment achieved by administering the combination of inhaled glucocorticoids and a long-acting β2-agonist led to an introduction into clinical practice of medications which combine fixed doses of inhaled corticoids and a long-acting β2-agonist in one inhaler (Avdeev et al. 2016, Belevsky 2013, Fitzpatrick and Moore 2017, GINA 2014, GINA 2017, Ichinose et al. 2017). In the twelfth question, it was required to choose the correct combination of drugs in one delivery device from the following options:

1. Inhaled glucocorticoid + aminophylline
2. Inhaled glucocorticoid + long-acting β2-agonist of (the correct option)
3. Aminophylline + long-acting β2-agonist
4. M-anticholinergic + β-blocker
5. Not sure

Only 60.2% of the surveyed students and 91.0% of the doctors (from 33.3% to 75.0% and from 70.0% to 100% in different cities, respectively) were able to give the correct answer, $p_{doct-stud}<0.001$.

Conclusion

The survey among the senior students of medical universities and physicians within the multicenter study (ASSA-II project) revealed an average level of medical majors' and physicians' knowledge in asthma basics (definition, etiology, pathogenesis, clinical picture, treatment and prevention). The most difficult questions for both groups of the respondents were the following questions: asthma recognition, instrumental and laboratory markers of asthma and asthma control levels. The students also struggled with the questions about asthma pathogenesis, the choice of drugs for exacerbation relief, the main drugs for basic therapy and combination of drugs for asthma treatment. In general, it should be emphasized that doctors did better with most of the questions (Fig. 10), which can indicate lack of practical experience among students.

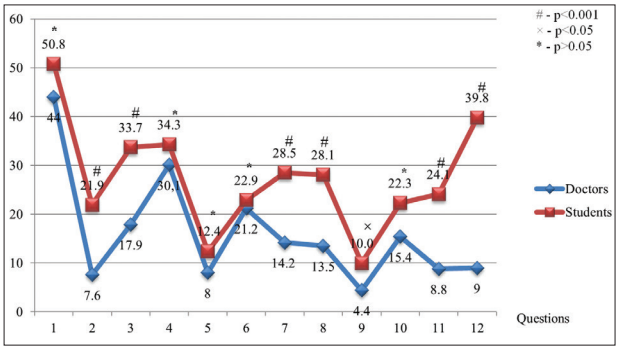

Figure 10. Distribution of incorrect answers to all questions in groups of students and doctors, %

Thus, both students and doctors would make quite a big number of mistakes in diagnostics and decision-making about treatment of asthma, which leads to late diagnosis and late therapy administration, poor asthma control, exacerbations and adverse outcomes, reducing the quality of patients' life and, consequently, decreasing the compliance.

In the authors' view, the number of academic hours and practical lessons at universities is still insufficient for taking a closer look at the topics related to respiratory system, in particular, obstructive diseases, which is needed for an adequate preparation of a future practitioner. The obtained results prove the need to conduct additional educational activities on diagnostics and therapy of asthma and, hence, the delivery of timely and effective care.

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