



Prace oryginalne - Original papers

# PREVALENCE OF BRONCHIAL ASTHMA AND RESPIRATORY SYSTEM SYMPTOMS IN A GROUP OF STUDENTS FROM GRODNO. AN EXAMPLE OF STANDARDIZED EPIDEMIOLOGICAL SURVEY

## Występowanie astmy oskrzelowej i objawów chorób układu oddechowego u studentów z Grodna. Przykład standaryzowanego badania epidemiologicznego

OLEG AHIYEVETS<sup>A,B,C,D,E,F</sup>

Belarusian State Medical University, Minsk, Republic of Belarus

Research supervisor: A.I. Shpakou, Associate Professor, Head of the Department of Sports Medicine and Rehabilitation of the Yanka Kupala State University of Grodno, Republic of Belarus

**A-** przygotowanie projektu badania (study design), **B-** zbieranie danych (data collection), **C-** analiza statystyczna (statistical analysis), **D-** interpretacja danych (data interpretation), **E-** przygotowanie maszynopisu (manuscript preparation), **F-** opracowanie piśmiennictwa (literature search), **G-** pozyskanie funduszy (funds collection)

### Summary

**Introduction:** Due to an insufficient knowledge of the real asthma prevalence rate among children and adults in Belarus, we conducted a population-based respiratory health survey.

**Aim of the study:** The study aimed at estimating the prevalence rate of asthma and major respiratory symptoms among students of the Grodno Region (Western Belarus).

**Material and methods:** The cross-sectional study was conducted in 2014 and included 833 students aged 20-40 (young adults). Physician-diagnosed respiratory diseases and symptoms were ascertained using electronic version of the ISAAC questionnaire (web LimeSurvey).

**Results:** The prevalence of asthma was 2.88% (physician-diagnosed). The obstructive (asthmatic) bronchitis (without established diagnosis of asthma) was found in 5.04% of the respondents. A chronic respiratory symptom occurring in the past 12 months and suggestive of asthma included attacks of dyspnea at rest, cough (5.88%) or in previous periods (8.88%), and wheezing in the chest (one of the most characteristic symptoms of asthma) - 8.04%, which may indicate a higher prevalence of asthma among patients. Wheezing and wheeze without diagnosed asthma, colds or infections were reported in a small number of cases (about 1.0%). 32 respondents (3.84%) can be attributed to the group of risk for asthma due to the presence of specific respiratory symptoms.

**Conclusions:** The findings show a low prevalence of physician-diagnosed asthma among students of Western Belarus. Relatively low prevalence of allergic disorders among respondents of Belarus suggest underdiagnosis of allergic diseases, in particular of asthma. Presumably, cases of asthma might be diagnosed as spastic bronchitis, "obstructive bronchitis", "asthmatic bronchitis", a traditional label for clinical manifestation of asthma in medical practice in the region.

**Keywords:** asthma, epidemiology, students

### Streszczenie

**Wprowadzenie:** Wyniki badań epidemiologicznych przeprowadzonych na Białorusi wskazują na niedoszacowanie rozpoznania astmy wśród dzieci i dorosłych.

**Cel badania:** Ocena częstości występowania astmy i objawów chorób układu oddechowego wśród studentów uczelni wyższej w Grodnie (Białoruś).

**Materiał i metody:** Badanie przekrojowe przeprowadzono w 2014 roku i zawiera ono dane ankietowe uzyskane od 833 studentów w wieku 20-40 lat (młode dorosłe). Choroby i objawy chorób układu oddechowego diagnozowane przez lekarza określone przy użyciu elektronicznej wersji kwestionariusza ISAAC (web LimeSurvey).

**Wyniki:** Częstość występowania astmy, diagnozowanej przez lekarza wyniosła 2,88%. Obstrukcyjne (astmatyczne) zapalenie oskrzeli (bez ustalonego rozpoznania astmy) - 5,04% badanych. Przewlekłe objawy chorób układu oddechowego występujące w ciągu ostatnich 12 miesięcy oraz objawy astmy w postaci ataków duszności w spoczynku, kaszel nocny - 5,88%, świsty w klatce piersiowej (jeden z najbardziej charakterystycznych objawów astmy) - 8,04%. To może wskazywać na wyższą częstość występowania astmy wśród badanych. 32 badanych (3,84%) przypisane do grupy ryzyka dla astmy, spowodowanej obecnością specyficznych objawów oddechowych.

**Wnioski:** Wyniki badań wskazują na niską częstość występowania astmy wśród studentów i stosunkowo wysoką częstość zaburzeń oddechowych. Dostyc niska częstość występowania chorób alergicznych wśród respondentów sugeruje niedodiagnozowanie chorób alergicznych, zwłaszcza astmy. Przypuszczalnie, przypadki astmy mogą być zdiagnozowane jako spastyczne zapalenie oskrzeli, obturacyjne zapalenie oskrzeli lub astmatyczne zapalenie oskrzeli czyli tradycyjnych etykiet dla objawów klinicznych astmy.

**Słowa kluczowe:** astma, epidemiologia, studenci

## Introduction

In modern clinical practice of a doctor, patients with diagnosed bronchial asthma constitute a significant part. The latest epidemiological studies reveal that 4 to 8% of the population suffer from bronchial asthma. Currently, this human pathology is considered as global and affects all the continents [1]. The disease started in childhood and adolescence, often continues becoming a cause of disability, and sometimes dramatic outcomes. The percentage of cases among pediatric population increases up to 5-10%, among adults - ranges within 5% [2]. Bronchial asthma is a chronic disease caused by allergic inflammation of bronchi, accompanied by their increased reactivity [3]. Bronchoconstriction periodically causes difficulties in breathing or asthma attacks. The diagnosis of asthma is often possible to assume on the basis of presence of such respiratory symptoms as episodes of intense dyspnea, wheezing in the chest, night cough interrupting sleep (apart from acute infectious respiratory diseases) [4]. The disease causes significant damage associated not only with the cost of treatment, but it also limits active participation of patients in everyday life, greatly reducing its quality.

Recent years epidemiological studies in the neighboring countries reveal that 5 to 10% of child and adolescent population suffer from asthma. In Northern and Eastern Europe, asthma is diagnosed among 6.0% of children aged 13-14 years and among 4.0% of adults. Official statistics data on the prevalence of asthma in Belarus are mainly based on observations obtained from the patents applying to hospitals. It is not uncommon that patients are being diagnosed and treated with other diseases. This indicates a large gap between the factual data and reports of cases of the disease (the incidence of asthma according to the Ministry of Health does not exceed 0.5-1%, depending on the region) [5].

In clinical practice, the diagnosis of asthma is often replaced by such terms as "obstructive syndrome", "obstructive bronchitis", "asthmatic component in

respiratory viral infections", "recurrent obstructive bronchitis" [6]. This situation occurs due to the unwillingness of practicing physicians to use established criteria for the diagnosis of asthma, the unwillingness to register the illness because of the fear of worsening the reporting data, negative attitude of parents and patients themselves to this diagnosis, etc. According to the international consensus papers on the diagnosis of asthma, it is fairly stated that such uncertain terms should be avoided and common diagnosis of "asthma" should be used [7]. Consequently, the problem of underdiagnosis and late diagnosis remains an urgent problem of modern pulmonology and epidemiology in Belarus [8,9].

For the purpose of the most efficient planning of the health care service prevention measures, there is a need to study the epidemiology of the disease using standardized methods.

The main aim of this study was to estimate the prevalence rate of asthma and major respiratory symptoms among students of Grodno (aged 20-40 - young adults).

The primary and prerequisite information for studying this problem was low prevalence of asthma, allergies and respiratory symptoms among people living in Western Belarus.

## Methods

The study was conducted in 2014 taking into account the experience of the authors participating in the international research project "Diagnosis and prevention of allergic diseases of the respiratory system and skin through the use of population-based screening (BUPAS-PoIBUCan)", implemented in collaboration with the staff of the Department of Epidemiology of the Medical University of Silesia in Katowice (Poland) and the Department of Pediatrics at the Ternopil State Medical University (Ukraine).

The cross-sectional study was conducted among 833 students, using electronic version of the ISAAC questionnaire web LimeSurvey – a virtual tool for surveys of large population groups (<http://edukacijainauka.pl/limesurvey/index.php/669294>). LimeSurvey allows you to create electronic questionnaires with different question types, to place them on a Web server on the Internet or local network, to send notification to the respondents by e-mail, to carry out the calculation of basic statistics on the answers, to export data with the answers into statistical processing programmers, such as Excel, Statistica, etc. One of the important features of LimeSurvey is that this programme is distributed under a public contract General Public License, which guarantees its free implication by the researcher. The Pearson's chi-squared test ( $\chi^2$ ) was used for the statistical analysis. Statistically significant differences were accepted at  $p < 0.05$ .

Russian-language version of the standard questionnaire applied in international studies within ISAAC programme was used as a tool. Each questionnaire was accompanied with the information explaining the objective of the study. The study protocol was approved by the bioethics committee at the Yanka Kupala State University of Grodno. The list of the analyzed statistical indicators included physician-diagnosed asthma, as well as indications made by respondents about the presence of inflammatory respiratory diseases and

such symptoms as episodes of shortness of breath, wheezing, coughing and chest congestion (apart from acute infectious respiratory diseases) in the last 12 months of medical history of a patient.

## Results

833 questionnaires were analyzed. The group of respondents consisted of 272 men (32.7%) and 561 women (67.3%) (aged  $20.1 \pm 3.62$ ).

Table 1 presents the results of the study of the cases with determined diagnosis of asthma taking into account the gender. Statistically significant differences between the prevalence of certain respiratory diseases (chronic cases, and (or) obstructive bronchitis, pneumonia, allergic pathology of skin) depending on gender were not observed.

Asthma was diagnosed among 24 respondents (2.88% of all respondents), chronic bronchitis - among 58 respondents (6.96% of cases), obstructive bronchitis – among 21 respondents (2.52% of cases). The presence of the diagnosed cases of bronchitis and obstructive (asthmatic) bronchitis in medical history was observed 6.96% and 2.52% of the students respectively. Asthma was diagnosed among 13 men (4.78%), and among 11 (1.96%) women ( $p < 0.02$ ).

Table 1. Incidence of asthma, certain diseases of bronchi, diagnosed by the physician among 833 students from Grodno (abs /%) (relative frequencies and their 95% CI in the brackets)

Physician-diagnosed disease	Group of respondents (n = 833)		
	Male (n = 272) % 95% CI	Female (n=561) % 95% CI	Total % 95% CI
Bronchial asthma (n=24)	4.78±2.54 (2.24-7.32)	1.96±1.15* (0.81-3.11)	2.88±1.14 (1.74-4.02)
Chronic bronchitis (n=58)	4.04±2.34 (1.70-6.38)	8.38±2.29 (6.09-10.67)	6.96±1.73 (6.23-8.69)
Obstructive (asthmatic) bronchitis (n=21)	2.21±1.75 (0.46-3.96)	2.67±1.33 (1.34-4.0)	2.52±1.06 (1.46-3.58)
Risk group for asthma (n=32)	2.57±1.88 (0.69-4.45)	4.46±1.71 (2.75-6.17)	3.84±1.30 (2.54-5.14)
Hay fever (hay fever or seasonal allergic rhinoconjunctivitis, allergic rhinitis, allergic reaction to pollen) (n=53)	4.41±2.44 (1.97-6.85)	7.31±2.15 (5.16-9.46)	6.36±1.66 (4.7-8.02)
Eczema, atopic dermatitis (n=24)	2.94±2.01 (0.93-4.95)	2.85±1.38 (1.47-4.23)	2.88±1.14 (1.74-4.02)

\* - statistical significance level of chi2 test of differences between male and female ( $p < 0.05$ ).

Table 2 presents data on prevalence of respiratory symptoms that characterize possible masking of asthma by other respiratory diseases.

The last 12 months were characterized by relatively high incidence of wheeze or whistling in the chest (5.88%), as well as cough (excluding colds or infections) - the most characteristic which may be associated with the greater prevalence of asthma among patients.

Table 3 presents the results of a study of prevalence of respiratory symptoms among respondents with the physician-diagnosed asthma, chronic bronchitis (including obstructive), pneumonia, as well as among the individuals without these diagnoses.

Table 2. Incidence of some respiratory symptoms among students from Grodno (abs /%)  
(relative frequencies and their 95% CI in the brackets)

Respiratory symptom, excluding colds or infections (last 12 months)	Group of respondents		
	Male (n = 272) % 95% CI	Female (n=561) % 95% CI	Total (n=833) % 95% CI
Dry cough at night apart from a cough associated with a cold or chest infection (n=55)	4.78±2.54 (2.24-7.32)	7.49±2.18 (5.31-9.67)	6.60±1.69 (4.91-8.39)
Cough that occurred with shortness of breath or rapid breathing (n=53)	4.41±2.44 (1.97-6.85)	7.31±2.15 (5.16-9.46)	6.36±1.66 (4.70-8.02)
Coughing fit at night (waking up at night due to cough) (n=51)	4.78±2,54 (2.24-7.32)	6.77±2.08 (4.69-8.85)	6.12±1.63 (4.49-75.8)
Congestion in the chest or bring up phlegm or mucus apart from colds (n=134)	15.07±4.25 (10.82-19.32)	16.58±3.08 (13.50-19.66)	16.09±2.50 (13.59-18.59)
Wheeze or whistling in the chest at any time in the past (n=189)	23.16±5.01 (18.15-28.17)	22.46±3.45 (19.01-25.91)	22.69±2.84 (19.85-25.53)
Wheezing or whistling in the chest in the past 12 months (n=67)	6.62±2.95 (3.67-9.57)	8.73±2.34 (6.39-11.07)	8.04±1.85 (6.19-9.89)

\* - statistical significance level of chi2 test of differences between male and female

Table 3. Proportion and RR (Relative Risk) of respiratory symptoms among healthy students and respondents with the diagnosed pathology (%)

Only	Respiratory symptom, excluding colds or infections (for the last 12 months)					
	Dry cough at night					
	Symptom “+”	Symptom “-”	RR	95% CI	P statistical differences in relation to RR=1.0	Percentage of positive symptoms, %
Lack of disease (n=569)	30	539	1.0			5.27
Asthma (n=24)	5	19	3.95	1.68-9.28	0.01	20.8
Chronic bronchitis (n=58)	6	52	1.96	0.85-4.52	0.1	10.34
Obstructive bronchitis (n=21)	4	17	3.61	1.40-9.32	0.01	19.04
Risk group for asthma (n=32)	6	26	3.56	1.60-7.92	0.01	18.75
Wheeze or whistling in the chest at any time in the past						
Lack of disease (n=569)	24	545	1.0			4.22
Asthma (n=24)	9	15	8.89	4.65-17.0	0.0001	37.5
Chronic bronchitis (n=59)	6	53	2.41	1.03-5.66	0.05	10.17
Obstructive bronchitis (n=21)	5	16	5.64	2.39-13.33	0.001	23.81
Risk group for asthma (n=32)	7	25	5.19	2.42-11.12	0.0001	21.9
Coughing fit at night (waking up at night due to cough)						
Lack of disease (n=569)	24	545	1.0			4.22
Asthma (n=24)	10	14	9.88	5.34-18.26	0.001	41.7
Chronic bronchitis (n=59)	4	55	1.61	0.58-4.48	0.36	6.78
Obstructive bronchitis (n=21)	3	18	3.39	1.11-10.36	0.04	14.29
Risk group for asthma (n=32)	8	24	5.93	2.89-12.14	0.001	25.0
Congestion in the chest or bring up phlegm or mucus						
Lack of disease (n=569)	82	487	1.0			14.41
Asthma (n=24)	6	18	1.73	0.84-3.57	0.13	25.0
Chronic bronchitis (n=59)	10	49	1.18	0.65-2.14	0.6	16.95
Obstructive bronchitis (n=21)	5	16	1.65	0.75-3.64	0.2	23.81
Risk group for asthma (n=32)	9	23	1.95	1.08-3.52	0.03	28.1
Wheeze or whistling in the chest at any time in the past						
Lack of disease (n=569)	88	481	1.0			
Asthma (n=24)	16	8	4.31	3.06-6.07	0.001	66.7
Chronic bronchitis (n=59)	26	33	2.85	2.02-4.03	0.001	44.07
Obstructive bronchitis (n=21)	10	11	3.08	1.89-5.02	0.001	47.62
Risk group for asthma (n=32)	19	13	3.84	2.72-5.42	0.001	59.4
Wheezing or whistling in the chest in the past 12 months						
Lack of disease (n=569)	29	540	1.0			5.10
Asthma (n=24)	5	19	4.09	1.74-9.63	0.01	20.8
Chronic bronchitis (n=59)	9	50	2.99	1.49-6.02	0.01	15.25
Obstructive bronchitis (n=21)	3	18	2.80	0.93-8.47	0.07	14.29
Risk group for asthma (n=32)	9	23	5.52	2.86-10.65	0.001	28.1
The presence of at least one of the three symptoms						
Lack of disease (n=569)	136	433	1.0			23.9
Asthma (n=24)	17	7	2.96	2.21-3.98	0.001	70.8
Chronic bronchitis (n=59)	32	27	2.27	1.72-2.99	0.001	54.24
Obstructive bronchitis (n=21)	12	9	2.39	1.61-3.56	0.001	57.14
Risk group for asthma (n=32)	20	12	2.61	1.93-3.55	0.001	62.5

The Relative Risk  $> 1$  means that the experimental group event develops more frequently than in the control (lack of disease).

The frequency of determination of diagnostic symptoms among respondents with diagnosed asthma did not vary according to gender. The most common symptoms were: expressed difficulty in breathing (wheezing or whistling in the chest during the last 12 months), coughing at night without acute respiratory viral infection, waking up at night because of choking sensation, and combination of these characteristics. It should be pointed out, that most respondents with diagnosed asthma took anti-asthmatic drugs, which indicates the presence of attacks and severity of the disease state.

Significant characteristics for the diagnosis of obstructive bronchitis were high frequency of such symptoms of asthma as asthma attacks at rest, waking up at night caused by choking sensation (11-12%), severe breathing problems and various combinations of asthma respiratory symptoms. In order to identify the risk groups and liability to asthma, the group of respondents was chosen. The group consisted of respondents with the most characteristic respiratory symptoms of the disease. This risk group included 32 respondents (3.84%), which can be assigned to a group with possible asthma according to diagnostic criteria.

## Discussion

In modern epidemiological studies asthma is diagnosed by 2 ways: with the help of standardized questionnaires for large population groups, filled in with the involvement of patients (physician-diagnosed disease and asthma like respiratory symptoms are being analyzed), as well as according to the presence of increased bronchial reactivity evaluated functionally with the help of special tests of instrumental and laboratory diagnostics (histamine, cold air, exercises, spirometry) [8].

On the one hand, the usage of questionnaires can inflate prevalence rates, but on the other, it can detect undiagnosed cases. For example, epidemiological data indicate a higher incidence of respiratory symptoms among people living in Western Europe in comparison to the countries of Northern and Eastern Europe. Thus, according to standardized research data, wheezing in the chest occurred in 9.7% of the population of Western Europe and in 6.8% of representatives from Eastern European countries [4,8]. During the last 12 months asthma attacks were registered on the average among 4.5% of respondents from Western Europe. In Eastern and Northern Europe, the figures were much smaller - about 2.5%.

In Russia and CIS countries, there are few examples of individual research dedicated to evaluation of the prevalence rate of asthma by using standardized methodology. Data collected in the course of a single well-known study on the epidemiology of respiratory

symptoms and allergies among children in Belarus [9] indicate low prevalence of this disease in Belarus.

Based on the epidemiological situation observed, we can assume the existence of bronchial asthma being hidden under the diagnosis of obstructive bronchitis. The next stage of verification of the diagnosis should be the clinical stage with the diagnosed bronchial reactivity evaluated functionally by using special tests (spirometry, skin allergy tests, etc.), that is supposed to be carried out at the next stage of the study.

## Conclusions

The level of asthma diagnosis among the group of students from Grodno is low and comparable to the epidemiological data on the results of previous studies and situation in neighboring countries. Low prevalence of the disease in Grodno and Grodno region may be associated with underdiagnosis of asthma. According to the frequency of respiratory symptoms indicating obscure presence of asthma, the data obtained are similar to the results of a study in neighboring countries and assume possibility of underdiagnosis of asthma. Studying the spread of asthma and respiratory symptoms may provide a basis for development and implementation of prevention programmes, as well as help to evaluate their effectiveness at the regional and international levels.

Taking into account the potential impact of factors of underdiagnosis of asthma, the cause and frequency of results falsification in diagnostic practice still remain unknown. Part of asthma cases may fall under the diagnosis of chronic and (or) obstructive bronchitis, which are diagnosed among respondents with relatively high frequency.

While modeling the study based on obtained epidemiological data and taking into account suspicion of asthma, an extra group with respiratory symptoms suggestive of asthma (risk group) and requiring further in-depth study was determined.

In prospect, it is planned to conduct the clinical study using spirometry, skin tests and stress tests to assess bronchial hyper responsiveness in three groups formed on the basis of the results of applying a standardized questionnaire: with a diagnosis of asthma, obstructive (chronic) bronchitis (asthma is not diagnosed) and respondents without this pathology that could verify the diagnosis and show a real situation of hypo or over-diagnosis of asthma.

## References

1. Pearce N, Ait-Khaled N, Beasley R, et al. Worldwide trends in the prevalence of asthma symptoms: phase III of the International Study of Asthma and Allergies in Childhood (ISAAC). *Thorax* 2007; 62: 758-66.
2. Mallol J, Crane J, von Mutius E, Odhiambo J, Keil U, Stewart A. ISAAC Phase Three Study Group. The International Study of Asthma and Allergies in Childhood (ISAAC) Phase Three: A global synthesis. *Allerg Immunol Madrid* 2013; 41(2): 73-85.
3. Ellwood P, Asher MI, Beasley R, Clayton TO, Stewart AW, and the ISAAC Steering Committee. The International Study of Asthma and Allergies in Childhood (ISAAC): Phase Three rationale and methods. *Int J Tuberc Lung Dis* 2005; 9(1): 10-6.
4. Breborowicz A, Lis G, Cichočka-Jarosz E, et al. Prevalence and severity of asthma symptoms in schoolchildren in Poland (ISAAC study). *J Pediatr Pol* 2005; 80: 866-73.
5. Vasilevsky I. Zabolevajemost bronhialnoj astmoj detej Resubliki Belarus po rezultatam dlitelnogo monitoringa. [Russian] *Meditsinskaja panorama* 2004; 10: 45-9.
6. Kramer MS, Matush L, Bogdanovich N, Dahhou M, Platt RW, Mazer B. The low prevalence of allergic disease in Eastern Europe. *Clin Exp Allergy* 2009; 39(5): 708-16.
7. Levy ML, Fletcher M, Price DB, Hausen T, Halbert RJ, Yawn BP. International Primary Care Respiratory Group (IPCRG) Guidelines: diagnosis of respiratory diseases in primary care. *Prim Care Respir J* 2006; 15(1): 20-34.
8. Zejda JE, Kowalska M. Risk factors for asthma in school children – results of a seven-year follow-up. *Centr Europ J Public Health* 2003; 11: 154-59.
9. Shpakou A, Brozek G, Stryzhak A, Neviartovich T, Zejda J. Allergic diseases and respiratory symptoms in urban and rural children in Grodno Region (Belarus). *Pediatr Allergy Immunol* 2012; 23: 339-46.

### Correspondence Address:

Andrei Shpakou, PhD,  
Department of Sport Medicine and Rehabilitation,  
Yanka Kupala State University of Grodno,  
Belarus, Grodno, 230023, 22 Ozheshko  
Phone: +375 152 754 601,  
Fax +375 152 731 910  
E-mail: shpakov@grsu.by

Received: 03.08.2014

Reviewed: 26.08.2014

Accepted: 27.08.2014