

**Prevalence of risk factors of allergic diseases among children aged 8-9 years in Poltava region (the results of the first stage of the research)**

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**Abstract**

**Introduction.** According to the European Academy of Allergology and Clinical Immunology (EAACI, 2016), allergy is the most common chronic disease in Europe.

**The aim of the investigation** is to study the spread of risk factors of allergic reactions in children who are 8-9 years old of Poltava region.

**Materials and methods.** The investigation included two stages: the 1<sup>st</sup> contained interviewing; the 2<sup>nd</sup> one – additional clinical and lab investigation of children, who require the further diagnosis specification.

**Results of the investigation and their discussion.** 1068 children who are 8-9 years old were interviewed based on questionnaires: 56,2% males and 43,8% females. Children were divided into residents (49,2%), and villagers (50,8%). In order to identify allergic diseases the division in family was the next: the presence of bronchial asthma was present in 38 people (3,6%), allergic rhinitis or allergic conjunctivitis – 128 people (12,0%), atopic dermatitis – 54 people (5,1%), food allergy – 129 people (12,1%), medicinal allergy – 25 people (11,7%).

Analyzing the influence of trigger factors, it should be noted that in the risk group there are children who received cow's milk as substitutes for breast milk (38.1%), children who had a history of helminthal invasion (19.6%), children where parents smoke (45.9%),

one third of parents (31.9%) complained of frequent respiratory viral infections in their children.

**Conclusion.** Presented epidemiological investigation allowed studying the prevalence of diagnosed allergic diseases in children of Poltava region and determining children's category who require additional diagnostics of chronic allergic diseases.

**Key words:** allergic diseases, prevalence, children, Poltava region.

### **Introduction.**

According to the European Academy of Allergology and Clinical Immunology (EAACI, 2016), allergy is the most common chronic disease in Europe. Nowadays, this pathology is a global medical and social problem, because up to 40% of the Earth's population has allergic diseases, among children's population up to 15%. [1]. So, allergic rhinitis is registered in 23-30% of population in Europe and in 12-30% of residents of the USA but some epidemiological data between countries can vary from 2,9% to 54,1%. The increase of the spread of allergic diseases is connected with changes of environment, lifestyle, nutrition, and the increase of allergic load.

In Ukraine, from 10 to 15% of the population suffers from allergic diseases according to statistics, which is considerably less than world indicators. [2]. These indicators are based on indices of patient's visit to doctors and do not determine the spread of allergic diseases. Based on epidemiological investigations by ISAAC method (International Study of Asthma and Allergies in Childhood) in different countries the most widespread allergic diseases in children are atopic dermatitis (AD), allergic rhinitis (AR) and bronchial asthma (BA) [3, 4]. When studying the spread of allergy it is necessary to pay attention to comorbidity and interrelation between diseases. It is known that in 20-60 % of patients who suffer from atopic dermatitis there is risk of bronchial asthma, and in 30 – 45% – allergic rhinitis, 15 – 40%

patients who suffer from allergic rhinitis there is risk factor for bronchial asthma and in 76 – 80 % patients with BA can be diagnosed by allergic rhinitis [5, 6].

The development of allergic reactions in people who are prone to atopy realization is called «atopic march». The first step of the development of allergy is dietary allergy, which is manifested by dermatitis in infants, after that there is sensitivity to domestic allergens and dust allergens and there is respiratory type of allergosis such as allergic rhinitis or bronchial asthma. The wide spread of allergic diseases, inadequate diagnostics and inadequate treatment is prone to the improvement of early diagnostics and further management of such patients.

**The aim of the investigation** is to study the spread of risk factors of allergic reactions in children who are 8-9 years old of Poltava region.

#### **Materials and methods.**

The study was done according to the scheme of prescriptive screening, such as the basic program of allergological examination in organized teams, and included two stages: the first one included an examination of the established and approved sample; 2nd - an additional clinical and laboratory examination of a part of the children who needed further management and diagnosis specification. Prescriptive screening was done in order to reduce the time of examination for further comparative analysis for dynamic examination. Such approach allows determining the disease on different stages and also donozological types that can not only diagnose the disease but also predict the possible tendency to changes.

The preparatory phase of our study was to create an effective team that included a training group that was responsible for organizing screening, and familiarizing the medical staff with the methodology of questioning, collecting and transmitting data, and a practically oriented group that carried out clinical and additional examinations including allergy. Questionnaires were done among schoolchildren of primary classes (8-9 aged children).

During epidemiological investigation an analysis of positive answers about the presence of atopic dermatitis, allergic rhinitis and bronchial asthma and it allowed characterizing the prevalence of allergic disease. Positive answers to questions related to the symptoms of an allergic pathology in children with unidentified diagnosis, characterized the rate of symptoms of allergic disease and it was the basis for the selection of questionnaires for the second stage of the examination. It should be noted that further diagnostics complaints of patients and data of anamnesis; physical examination with additional index determination SCORAD (Severity scoring of atopic dermatitis) in children with atopic dermatitis; asthma and rhinoscopy in patients with allergic rhinitis; the analysis of allergic experiment and results of lab methods with additional determination of general and specific IgE. Statistical processing of data was carried out using a one-dimensional distribution with a description of one variable in the conditions of the corresponding units of analysis with the creation of the frequency division of individual cases, that is, the submission of a set of cases of the model that fall into each of the categories of values of the variable. During the second stage of the study, the factors that are manifested as significant predictors of the development of allergy will be tested by multifactorial analysis using the method of logistic regression.

### **Results and their discussion.**

An analysis of received results of the first stage of an examination was the next. 1068 children who are 8-9 years old were interviewed based on questionnaires. 600 (56,2%) males and 468 (43,8%) females were involved in this group. Based on the place of residence children were divided into residents (525) (49,2%), and villagers (543) (50,8%). In order to identify allergic diseases the division in family was the next: the presence of bronchial asthma was present in 38 people (3,6%), allergic rhinitis or allergic conjunctivitis – 128 people (12,0%), atopic dermatitis – 54 people (5,1%), food allergy – 129 people (12,1%), medicinal allergy – 25 people (11,7%).

The role of genetic factor of atopy realization which is hereditary is an important. So, 30% of children whose parents suffer from allergic disease have also allergy by Cooke. If a child has aggravated allergic anamnesis by mother right, the possibility of the disease increases to 50%; if allergic pathology is present in father and mother the possibility of the disease increases to 75%. An analysis of genetic predisposition indicates the risk of allergic pathology and it depends on the stage of affinity.

The first table indicates the percentage of children who suffer from dietary allergy (9,5%) (table. 1). Received data are based on anamnesis and products which cause allergic disease. It is necessary to use the number of additional methods of investigation to examine respondents but this group of patients should be examined more detailed.

Table 1.

The spread of allergic diseases of children who are 8-9 years old of Poltava region

Disease	Absolute number	%
Atopic dermatitis	54	5,1
Allergic rhinitis or allergic conjunctivitis	82	7,7
Bronchial asthma	17	1,6
Dietary allergy	101	9,5
Medical allergy	45	4,2

The next stage of the development of allergic disease presents allergic rhinitis (7,7%), which is one of the most widespread pathology of respiratory tract. It should be noted that allergic rhinitis is not easy determined and requires specialized medical care (Fig. 1). It is necessary to address to the physician at once but patients individually buy medicines and after that address to the GP and to allergologist.

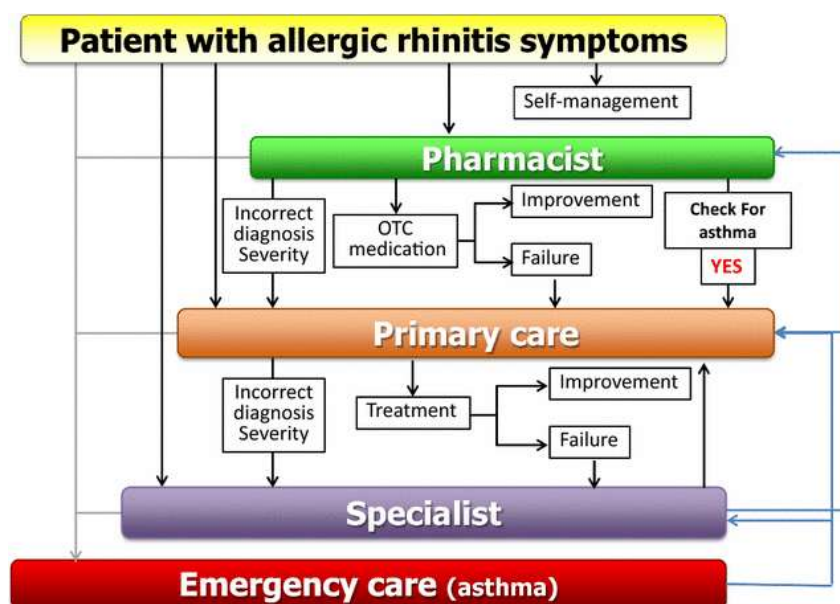


Figure 1. The patient's route with allergic rhinitis (Bousquet та ін. [7, 8])

European countries made an enormous step to manage such patients. Electronic program was developed based on Android and iOS, which includes analogue scales (Visual Analogue Scale) by defining and controlling the source of allergic disease especially allergic rhinitis [9]. Using different electronic models patients are able to receive data about allergen load in environment and physicians can monitor the patient's condition and individually make a treatment [10].

Using such concept «single respiratory system – single disease», allergic rhinitis can not be considered without the item «danger of the asthma», so the presence of allergic process in upper regions of respiratory airways and it forms the background for asthma development. Comorbidity model demonstrates that patients with allergic rhinitis presents the risk group of BA and otherwise: about 80% of patients with asthma have signs of allergic rhinitis [11, 12]. That is why the analysis of clinical symptoms characterizing hyperactivity of the bronchi has allowed detecting a group of patients for further examination for suspected bronchial obstruction (Table 2).

Table 2.

Factors of preclinical condition which were detected during questionnaires in 8-9 aged children of Poltava region

Symptoms	Absolute number (n)	Children with allergic diseases (%)
Reccurent bronchitis with temperature rise	148 (13,6)	46 (4,3)
Cough, rales, breathlessness after physical exertion	100 (9,4)	38 (3,6)
Cough attacks at night and in the morning	66 (6,2)	25 (2,3)
Bronchitis with breathlessness and rales	132 (12,4)	48 (4,5)
Long-lasting cough after viral infection	157 (14,7)	56 (5,2)
Chronic cough	149 (13,9)	46 (4,3)
Long-lasting nasal discharge	281 (26,3)	102 (9,5)
Cough or whistling breath during weather change or humidity	52 (4,9)	17 (1,6)
The improvement of bronchodilators	199 (18,6)	54 (5,1)
Itching, skin redness	56 (5,2)	34 (3,2)
Skin rashes	72 (6,7)	35 (3,3)

The risk group allowed identifying positive responses to the following symptoms: recurrent bronchitis without temperature rise; cough, wheezing, breathlessness after exercise; cough attacks at night or in the morning; bronchitis with breathlessness and whistling breath; cough or whistling breath during weather, temperature, humidity change; the effectiveness of bronchodilator therapy. Actually these children will be examined by a doctor-allergist with a recommendation for further examination and for diagnosis specification.

Analyzing the influence of trigger factors which are responsible for allergic pathology development it should be noted that the risk group contains children (40%) received cow's milk instead of breast feeding (Table 3).

Table 3.

The spread of risk factors of 8-9 aged children of Poltava region

(one-dimensional division of some cases)

Criterion	Allowable	Frequency	Percents	The percent of allowable	Accumulated percent
Overweight in child	No	999	93,5	93,5	93,5
	Yes	69	6,5	6,5	100,0
Breast feeding	No	118	11,0	11,0	11,0
	Yes	950	89,0	89,0	100,0
Cow's milk instead of breast feeding	No	660	61,8	61,9	61,9
	Yes	407	38,1	38,1	100,0
Dietary milk	No	1000	93,6	93,6	93,6
	Yes	68	6,4	6,4	100,0
Helminthiasis in history taking	No	859	80,4	80,4	80,4
	Yes	209	19,6	19,6	100,0
Smoking	No	578	54,1	54,1	54,1
	Yes	490	45,9	45,9	100,0
Acute respiratory infections	No	727	68,1	68,1	68,1
	Yes	341	31,9	31,9	100,0
	Total	1068	100,0	100,0	

Allergy to cow's milk is often the first manifestation of dietary allergy that occurs in infants and often precedes the emergence of further food sensitization, especially to eggs and peanuts [13]. Immune-mediated reactions to cow's milk protein can be either IgE-dependent ("immediate-type") or IgE-independent or cell-mediated ("immediate" type) and manifested by anaphylaxis, generalized systemic reactions, gastrointestinal, skin and respiratory reactions. Patients with IgE – dependent disturbances usually have positive skin tests or serum IgE – antibodies to milk. So, sensitivity to cow's milk can be manifested by different clinical



symptoms. Detailed anamnesis and additional lab investigations usually allow determining recommendations.

It is well known that the nature of feeding, diet, and the abuse of certain types of food also becomes a significant trigger factor that determines the sensitization process, affects the microflora, changes the immune response and ultimately promotes the formation of persistent allergy. These criteria can be detailed.

Helminthiasis is one of the most trigger factors. About 20% of respondents of our questionnaire responded «yes» on the presence of helminthiasis in child's anamnesis. It should be noted that helminths are presented by bacteria, fungi and viruses by their immunosuppressive properties. Allergic and immunosuppressive action of helminths causes toxic and allergic reactions that lead to skin rashes, decrease of immune resistance and anaphylaxis. On the one side, helminths can induce the formation of a stable secondary immunodeficiency, as a consequence of prolonged inhibition of the immune system, and on the other one, promote immunological hypereactivity by the development of allergic reactions. The course of allergic diseases in the background of helminthiasis can take non-controlling severe nature, namely, the disease becomes resistant to basic and allergen-specific therapy.

When studying the prevalence of risk factors it should be emphasized the role of smoking in the family is great and important. In 45.9% of examined in our investigation, in families where parents smoke, almost half of the children are subject to daily exposure to tobacco smoke. Recently, scientists have found that children whose parents smoked at the time of conception they are three times more likely to suffer from asthma than children of non-smokers [14]. They proved that the health of the future child is influenced by the way of life not only of the mother but also - father. By the way, the risk of asthma development in a child increases depending on the term of a harmful habit, that is, the longer the future father

smokes, the greater chances of the asthma development in child. During the analysis, specialists have determined that the highest risk of asthma was in children whose parents began to smoke even in adolescence (up to 15 years). Children of parents who started smoking before impregnation suffer from asthma from infancy. Scientists prove that fetal abnormalities cause genetic damages and smoking leads to such disorders as BA.

Viral infections of respiratory airways are often precursors of infants but patients who suffer asthma can be important factors of disease manifestation and confound the course of the disease affecting the control of symptoms. Results of questionnaires demonstrate that third part of parents (31,9%) complains of often respiratory infections. Data of latest years demonstrate the dependence of rhinovirus, respiratory and syncytial virus and episodes weezing, determining them as critical factors of the development of asthma in children of 6 years old [15]. New realization of asthma pathogenesis allows considering the important role of infectious factor which penetrating into an organism with genetic atopy and promotes allergic inflammation (Figure 2).

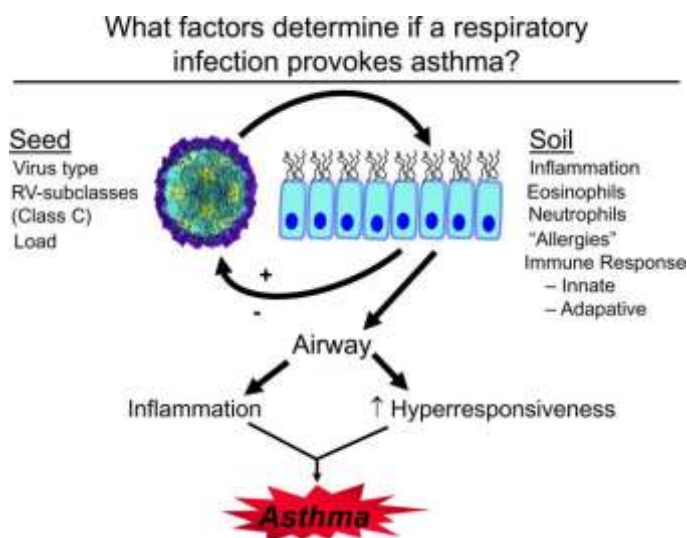


Figure 2. The role of viral infection in asthma (William W Busse and others [15])

Respiratory viruses damage palpebrating epithelium of mucous membrane of the respiratory tract, increase the penetration for allergens, toxic substances and sensitivity of irritants of receptors of submucosa layer of bronchi. So they increase bronchial hyperactivity

and promote the development of bronchospasm. Inflammatory processes which are developed by viral action and cause swelling of the mucous membrane, hypersecretion of viscid mucus mucociliary transport deterioration. So, viruses inhibit the activity of macrophages and decrease topical nonspecific immunity. There are conditions for bacterial or viral and bacterial infections and it causes the severe course of the disease, change of clinical picture of the disease.

Many questions have not decided yet namely the issue about allergic inflammation with multiple genetic modifications which occur as respiratory viruses and take as dysfunction of respiratory airways. These questions will be an important step to understand the pathogenesis of allergic diseases especially asthma and the effectiveness of the treatment.

### **Conclusion.**

Of course, allergic pathology is the group of heterogenetic diseases which as rule are associated with complex influence of trigger factors and the role of such factors forms the personal model of pattern interrelation that indicates individual peculiarities of the course of clinical symptomatics.

In general presented epidemiological investigation allowed studying the prevalence (the frequency of cases of disease in definite group of population) of diagnosed allergic diseases in children of Poltava region and determining children's category who require additional diagnostics of chronic allergic diseases.

### **Literature**

1. Pawankar R, Canonica GW, Holgate ST, et al. The WAO White Book on Allergy (Update. 2013).
2. Agafonova I. A., Lenkova G. V., Khlyzina E.T. Epidemiologicheskaya kharakteristika allergicheskikh zabolevaniy v Dnepropetrovskom regione [Epidemiology of allergic diseases in the Dnipropetrovsk region]. *Novosti meditsiny i farmatsii*. 2010;322:5-7.

3. ISAAC Steering Committee. Worldwide variations in the prevalence of asthma symptoms: the International Study of Asthma and Allergies in Childhood (ISAAC) Eur Respir J. 1998;12:315–335. doi: 10.1183/09031936.98.12020315.
4. Breborowicz A, Lis G, Cichocka-Jarosz E, et al. Prevalence and severity of asthma symptoms in schoolchildren in Poland (ISAAC study). J Pediatr Pol 2005;80:866-73.
5. Ballardini N , Kull I , Lind T et al. Development and comorbidity of eczema, asthma and rhinitis to age 12: data from the BAMSE birth cohort: Allergy.2012;67:537-544. doi.org/10.1111/j.1398-9995.2012.02786.x.
6. Sakevych VD, Kutsenko NL, Mykytiuk MV, Kaïdashev IP. Clinical course and characteristics of cellular and humoral immunity in patients with allergic rhinitis. Lik Sprava. 2014 Jan-Feb;(1-2):15-20.
7. Bousquet J, Addis A, Adcock I, Agache I, Agusti A, Alonso A, et al. Integrated care pathways for airway diseases (AIRWAYS-ICPs). Eur Respir J. 2014;44(2):304–23. doi: 10.1183/09031936.00014614.
8. Bousquet J, Barbara C, Bateman E, Bel E, Bewick M, Chavannes NH, et al. AIRWAYS-ICPs (European Innovation Partnership on Active and Healthy Ageing) from concept to implementation. Eur Respir J. 2016;47(4):1028–33. doi: 10.1183/13993003.01856-2015.
9. Bousquet J, Hellings PW, Agache I, Bedbrook A, Bachert C, Bergmann KC, et al. ARIA 2016: care pathways implementing emerging technologies for predictive medicine in rhinitis and asthma across the life cycle. Clin Transl Allergy. 2016;6:47. doi: 10.1186/s13601-016-0137-4.

10. Bousquet J, O’Hehir RE, Anto JM, D’Amato G, Mosges R, Hellings PW, et al. Assessment of thunderstorm-induced asthma using Google Trends. *J Allergy Clin Immunol.* 2017;140(3):891–3.e7. doi: 10.1016/j.jaci.2017.04.042.
11. Brozek JL, Bousquet J, Baena-Cagnani CE, Bonini S, Canonica GW, Casale TB, et al. Allergic Rhinitis and its Impact on Asthma (ARIA) guidelines: 2010 revision. *J Allergy Clin Immunol* 2010;126:466-476 doi: 10.1016/j.jaci.2010.06.047.
12. Katelaris CH, Lee BW, Potter PC, Maspero JF, Cingi C, Lopatin A, et al. Prevalence and diversity of allergic rhinitis in regions of the world beyond Europe and North America. *Clin Exp Allergy* 2012;42:186- 207 doi: 10.1111/j.1365-2222.2011.03891.x.
13. Kryuchko TO, Nesina IM, Tkachenko OY. Diagnostic algorithm and peculiarities of monitoring for infants with disorders of the gastrointestinal tract. *Wiad Lek.* 2017;70(2 pt 2):275-281.
14. Gonzalez-Barcala FJ, Pertega S, Sampedro M, Lastres JS, Gonzalez MA, Bamonde L, Garnelo L, Castro TP, Valdés-Cuadrado L, Carreira JM, Moure JD, Silvarrey AL. Impact of parental smoking on childhood asthma. *J Pediatr (Rio J).* 2013 May-Jun;89(3):294-9. doi: 10.1016/j.jpmed.2012.11.001.
15. William W Busse, Robert F Lemanske Jr, James E Gern. Role of viral respiratory infections in asthma and asthma exacerbations. *Lancet.* 2010 Sep 4; 376(9743): 826–834. doi: 10.1016/S0140-6736(10)61380-3.

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