

RATIONALE FOR THE NEED TO PREVENT ALLERGIC RHINITIS ACROSS THE VORONEZH REGION

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The allergic diseases, the major role in etiology of which is played by allergens present in ambient air, are common. To develop practical guidelines on prevention of allergic rhinitis as the most prevalent disorder in the structure of allergy, it is necessary to estimate all the conditions, both negatively and positively affecting this disorder. The study was aimed to assess factors affecting the incidence, detection, and registration of cases of allergic rhinitis in the Voronezh Region. The report forms № 12 and № 30 provided substantive inputs to the study, along with the laboratory test data provided by private clinics and the social and hygienic monitoring data. Epidemiological analysis was performed by retrospective method; the territories were ranked by various indicators; the correlation analysis method was applied. We determined the incidence rates and the districts at high risk of allergic rhinitis (pollinosis) in all population groups for the period 2012–2021. We determined the structure of aeroallergens identified in private healthcare institutions, assessed the staffing levels of allergists in the public institutions of the Voronezh Region, and identified significant environmental factors. The identified features of the prevalence, diagnosis, and registration of allergic rhinitis in the Voronezh Region can be used to improve preventive measures targeting this allergic disorder.

Keywords: allergic rhinitis, aeroallergens, pollinosis, diagnosis, report forms, adverse factors, prevention

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ОБОСНОВАНИЕ НЕОБХОДИМОСТИ ПРОФИЛАКТИКИ АЛЛЕРГИЧЕСКОГО РИНИТА НА ТЕРРИТОРИИ ВОРОНЕЖСКОЙ ОБЛАСТИ

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Аллергические заболевания, основное значение в этиологии которых принадлежит аллергенам атмосферного воздуха, распространены повсеместно. Для разработки практических рекомендаций по предупреждению возникновения аллергического ринита как самого распространенного заболевания в структуре аллергии необходимо оценить все условия, как отрицательно, так и положительно влияющие на данную патологию. Целью исследования было проанализировать факторы, влияющие на заболеваемость, выявление и учет случаев аллергического ринита на территории Воронежской области. Основными материалами для исследования послужили учетно-отчетные формы № 12 и № 30, данные лабораторных исследований частных клиник и социально-гигиенического мониторинга. Выполнен эпидемиологический анализ с применением ретроспективного метода, проведено ранжирование территорий по различным показателям, применен метод корреляционного анализа. Определены уровни заболеваемости, а также районы высокого риска в отношении аллергического ринита (поллиноза) среди всех групп населения за период с 2012 по 2021 г. Определена структура аэроаллергенов, выявленных в частных учреждениях здравоохранения, выполнено исследование наполнения штатных должностей врачей-аллергологов в государственных учреждениях Воронежской области, выявлены значимые факторы окружающей среды. Выявленные особенности распространения, диагностики и регистрации аллергического ринита на территории Воронежской области могут быть использованы для совершенствования профилактических мероприятий в отношении данной аллергопатологии.

Ключевые слова: аллергический ринит, аэроаллергены, поллиноз, диагностика, отчетные формы, неблагоприятные факторы, профилактика

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The importance of the issue of allergic diseases can hardly be overestimated considering high prevalence of such disorders [1]. The most common manifestation of allergy is represented by rhinitis, the role in etiology of which can be played by various agents from the environment: pollen, dust, household, animal, fungal, insect agents [2, 3]. Detriment of the patients' quality of life together with substantial cost of treatment and prevention make the research focused on this disorder more and more relevant every year [4, 5].

Despite the fact that allergy occupies a significant position in the overall morbidity structure, there are still significant differences

between the statistically recorded and undocumented cases [6, 7]. The existence of various statistics systems makes it impossible to reflect the true picture of incidence among various population groups [8, 9]. A significant place in detection of allergic diseases is given to private medical practice, however, the data acquired by this healthcare sector are not available for full-fledged statistical analysis [10].

The impact of environmental factors of the allergic diseases is examined from different perspectives. The climate change and the increase in the levels of pollutants in ambient air result in the altered pathogenesis of allergic reactions [11–13].

Accumulation of adverse factors reducing the human body resistance becomes possible in the urban environment, where intense anthropogenic activity is observed [14–16].

In this regard, the study was aimed to determine the factors affecting the incidence, detection, and registration of cases of allergic rhinitis in the Voronezh Region.

METHODS

The study was carried out in the Voronezh Region in 2012–2022. A retrospective method was used to analyze statistical forms № 12 “Information on the number of disorders reported in patients living in the service area of medical institution” and № 30 “Information on the medical institution”. The territories were ranked by the incidence rate of pollinosis (number of cases per 1000 population), forest cover (% of land area covered by forests), long-time annual average levels of nitrates in drinking water (mg/dm³) and food products (mg/kg) by entering the values in the Morbidity Rate Ranking software (Burdenko Voronezh State Medical University; Russia). The data of laboratory allergy tests provided by private clinics were analyzed.

Statistical processing of the results was performed using the My Office Standard software package (New Cloud Technologies; Russia). The correlation analysis method involving calculation of the Pearson correlation coefficient (*r*) was applied, along with assessing the significance of differences between the incidence rate of pollinosis and the forest cover, presence of ragweed, and meteorological phenomena using the Student's *t*-test (*t*). The differences were considered significant when the statistical error probability was below 5% ($p < 0.05$). The data were presented as the mean (*M*) and error of the mean (*m*).

RESULTS

Assessment of statistical forms has confirmed annual recording of the cases of allergic rhinitis (pollinosis) in the Voronezh Region. The differences in incidence rate between the districts of the region are reported for all population groups. According to the ranking of territories, high risk of the disease based on the incidence rate in adult population is reported for eight districts, while that based on the incidence rate in children and adolescents is reported for seven districts (Table 1).

The following incidence rates per 1000 population were assigned high rank in each group: 1.43–3.99 cases, 5.16–12.02 cases, and 3.3–6.63 cases for adults, adolescents, and children, respectively. Match of the data of the territories with high risk of the disease for the studied groups was reported for the Ramonsky District, where the long-time annual average incidence of pollinosis per 1000 population was 2.24 cases for adult population, 6.14 cases for adolescents, 4.23 cases for pediatric population.

Assessment of the data of statistical form № 30 “Information on the medical institution” showed that in the studied period the maximum staffing level of allergists in public institutions was achieved in 2016: 29.25 staffing positions, 12.8% of which were not occupied by physicians of appropriate specialty. The averaged data show that 15.23% remain unoccupied every year. The thorough assessment of the report form revealed the lack of staffing positions of allergists in public medical institutions in 30 districts of the region out of 31, as well as in two administrative territories out of three. It was found that there were physicians of this specialty in the Liskinsky District and in the city district of Voronezh.

It should be noted that allergic rhinitis recorded in the report form №12 is a disorder caused by plant pollen. That is why the cases of rhinitis of other etiology are not reflected in statistical documents.

The structure of aeroallergens causing allergic rhinitis in the population of Voronezh Region was assessed based on the data of laboratory testing for IgE provided by private clinics. A total of 100,000 tests were performed during the studied period, among them more than 20,000 were positive. The allergens contributing to pollinosis were detected more than 13,000 times. The tests for IgE against pollen allergens were positive in more than 6000 cases. IgE against house dust allergens were identified in more than 4000 blood tests. Molds as allergic agents were identified in about 2000 tests. Statistical analysis showed that pollen allergens constituted a significant part of the structure of all aeroallergens. The next place was occupied by house dust allergens, while mold allergens were the least abundant (Fig. 1).

Among positive tests for plant pollen allergens, the leading place was occupied by allergens from birch and ragweed (Fig. 2). The other allergens from pollen of trees and grass

Table 1. Territories at high risk based on the incidence rate of pollinosis (number of cases per 1000 population)

Adult population LTAAI (<i>M</i> ± <i>m</i>)	Adolescents LTAAI (<i>M</i> ± <i>m</i>)	Pediatric population LTAAI (<i>M</i> ± <i>m</i>)
Kamensky District (3.84 ± 0.15)	Talovsky District (10.6 ± 1.42)	Bogucharsky District (6.44 ± 0.19)
Verkhnemamonsky District (3.07 ± 0.04)	Bogucharsky District (8.9 ± 0.47)	City district of Voronezh (5.13 ± 0.12)
Ertilsky District (2.57 ± 0.05)	Borisoglebsky District (6.7 ± 0.14)	Ramonsky District (4.23 ± 0.31)
Ramonsky District (2.24 ± 0.04)	Ramonsky District (6.1 ± 0.62)	Liskinsky District (4.03 ± 0.06)
Ostrogzhsky District (2.08 ± 0.02)	Semiluksky District (4.9 ± 0.47)	Povorinsky District (3.98 ± 0.15)
Paninsky District (1.52 ± 0.02)	Kamensky District (4.5 ± 1.14)	Ertilsky District (3.87 ± 0.09)
Povorinsky District (1.47 ± 0.06)	City district of Voronezh (5.3 ± 0.12)	Kashirsky District (3.68 ± 0.38)
Liskinsky District (1.44 ± 0.01)		

Note: LTAAI — long-time annual average incidence.

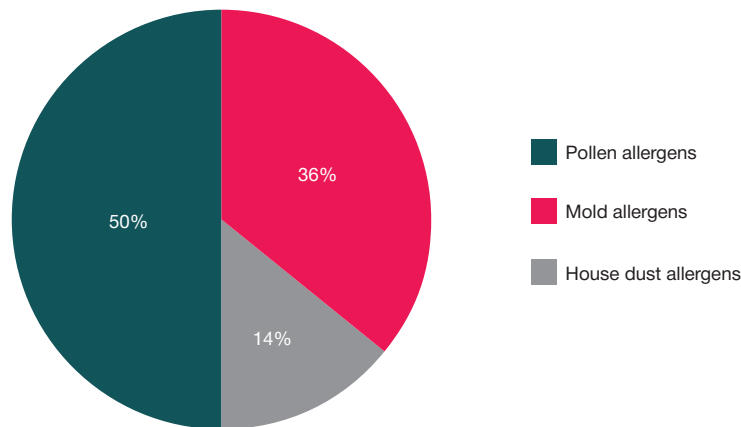


Fig. 1. Laboratory tests for significant aeroallergens – data provided by private clinics (%)

constituted a smaller fraction of the structure of specific IgE detection in blood.

Due to identification of priority pollen allergens, we performed search for the data on the quantitative distribution of significant plants across the territory of Voronezh Region. The regional forest cover assessment data confirmed a considerable spread of plants capable of causing the symptoms of allergic rhinitis [17]. Birch was among the major forest-forming tree species in the region [18]. Ranking the district of the region by forest cover made it possible to determine the territories where birch was most likely to grow (Table 2).

The search for correlation between the incidence rate of pollinosis and the forest cover revealed a significant correlation between these characteristics ($r = 0.45$ at test. = 2.79 > $t_{crit.} = 2.31$ for pediatric incidence and $r = 0.44$ at test. = 2.74 > $t_{crit.} = 2.31$ for adolescent incidence).

No less important is ragweed as a more aggressive allergic agent growing in 19 districts of the region, as well as in the city districts of Voronezh and Borisoglebsk [19]. The presence of ragweed also significantly correlates with the incidence of pollinosis among children and adolescents ($r = 0.42$ at test. = 2.61 > $t_{crit.} = 2.31$ for children and $r = 0.50$ at test. = 3.22 > $t_{crit.} = 2.31$ for adolescents). The correlation between the forest cover, presence of ragweed, and the incidence of pollinosis among children and adolescents of the Voronezh Region is moderate.

The spread of plant pollen is strongly influenced by meteorological conditions. It is well known that pollen spreads over vast distances in dry, windy weather, and vice versa, the spread slows down when it's calm, rainy, and the air humidity is high [20]. We assessed air temperature and rainfalls reported in the Voronezh Region throughout the studied period.

The studied meteorological phenomena were characterized by uneven distribution in the assessed period. To search for the correlation between the incidence rate of pollinosis in the population and the selected meteorological factors, we decided to analyze the months of predominant pollination of allergenic plants, from early spring (March) to mid-fall (October).

The correlation analysis performed revealed a strong correlation between air temperature and pediatric incidence in territorial aspect ($r = 0.73$ at $t_{est.} = 3.03 > t_{tabl.} = 2.3$, $p < 0.05$). When assessing the correlation between the rainfalls and the incidence, the decrease in pollinosis rate with increasing amount of rain was observed, however, this correlation was not significant, which could be due to the need of recording the rainfall frequency.

Not only meteorological phenomena are important, but also the ambient air condition, since air pollution can affect both plant allergens through precipitation of hazardous substances onto pollen grains and humans through reduction of their resistance [21–23]. Contamination with airborne pollutants in the Voronezh region was recorded throughout the assessed period. Furthermore, the diversity of pollutants and districts, where the excess of MPC was recorded, was significantly reduced by the year 2022. Suspended solids in ambient air were the only pollutant recorded throughout the studied period. This indicator exceeded maximum permissible concentration in all the territories, where there were monitoring sites, except for Ostrogozhsky District, where non-compliance with the suspended solids standard was reported in 2009 for the last time.

Human body can be also adversely affected through drinking water and food products. The social and hygienic monitoring data indicate high levels of contamination of these media with such pollutants, as nitrates.

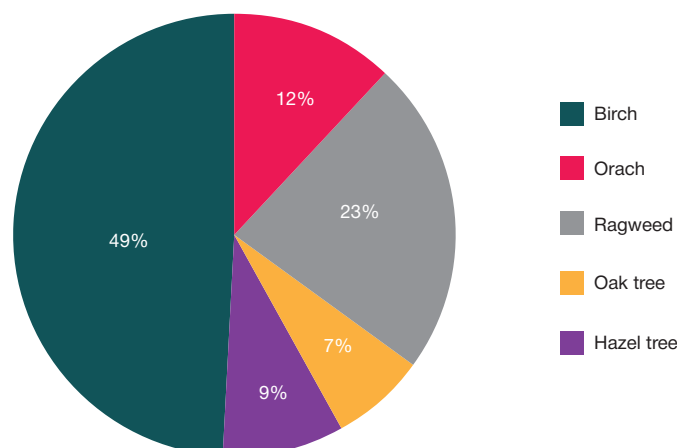


Fig. 2. Structure of pollen allergens — laboratory tests performed by private clinics (%)

Table 2. Territories with high forest cover, %

District	Forest cover
Ramonsky	29.7
Bobrovsky	25.4
Bogucharsky	21.2
Talovsky	19.8
Pavlovsky	19.7
Liskinsky	18.1
Khokholsky	17.5
Buturlinovskiy	16.3
Novousmanskoy	16.2
Povorinsky	15.6

The long-time annual average nitrate level in drinking water of the Voronezh Region is 12.2 ± 2.7 mg/dm³. Five territories of the region rank high by the levels of studied contaminants. The highest levels of nitrate pollution are found in the Ramonsky District (56 mg/dm³).

The nitrate contamination of food products in the Voronezh Region also reaches considerable levels. Contamination of fruit and vegetables is reported annually, it is found in 92.4% of the tested samples. Ranking the territories of the region by the long-time annual average nitrate contamination levels allowed us to distinguish five districts, where the nitrate levels in fruit and vegetables exceeded 198.3 mg/kg. Such districts include Verkhnemamonsky District (236.39 mg/kg), Rossoshansky District (251.02 mg/kg), Repyovskiy District (216.65 mg/kg), Khokholsky District (207.83 mg/kg), and Pavlovskiy District (201.14 mg/kg).

DISCUSSION

The review of official statistics revealed the lack of full-fledged recording of various allergic rhinitis forms. Despite significant contribution of pollen allergens to the structure of aeroallergens, house dust and molds also contribute to the development of symptoms worsening the quality of human life and leading to substantial economic costs. Assessment of the spread of allergenic plants, meteorological conditions and the

correlation analysis of the above factors and the incidence of pollinosis demonstrated a significant correlation between the studied indicators. The analysis of contamination in the most important components of the environment enabled distinguishing the territories with high contamination rate of the media that were extremely important for maintaining human health and the ability to resist various aggressive exposures.

Aeropalinological analysis of the territory of Voronezh Region would significantly expand the study, however, it is difficult to perform due to technical restrictions. The reports of the researchers from the Krasnodar Krai and the Ryazan Region provide a detailed pollen monitoring [24, 25]. Studying pollen in the region is a promising direction to help the population to prevent pollinosis. In the process of scientific research on the topic, the reports of scientists studying the structure and problems of allergological services in their countries were found, which confirmed the relevance of the research topic [26, 27].

CONCLUSIONS

The study of the incidence of allergic rhinitis in the Voronezh Region and consideration of the factors affecting the incidence rate, diagnosis and recording of this disorder make it possible to use the findings to develop the hygienic practical guidelines on prevention of the studied disorder.

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