Prevalence of Bronchial Asthma in Children in Southern Kyrgyzstan

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Abstract: *Background*: The aim of this study was to investigate the prevalence of bronchial asthma and other allergic diseases such as allergic rhinitis and atopic dermatitis among 6075 school-aged children in Osh, Jalal-Abad and Batken regions of Kyrgyzstan.

Methods: 6075 children were questioned using the ISAAC questionnaire. Bronchial asthma symptoms are frequent – 21.1% of children had difficulty wheezing, and 13.4% had night cough. This indicates a high prevalence of bronchial asthma among children in the study population. The obtained morbidity rates significantly exceed the official statistics for the region. This indicates insufficient diagnosis of allergic diseases in children and substantiates the need to develop a set of measures aimed at optimizing the detection of cases of allergic pathology and increasing the effectiveness of therapeutic and preventive measures.

Results: The results of the study demonstrate a high need for the development and implementation of a regional program for the diagnosis, treatment, and prevention of allergic diseases in children of Osh, Jalal-Abad, and Batken regions.

Conclusion: Implementing such a program will contribute to better control of bronchial asthma and other allergic pathologies and improve the quality of life of the child population in the region.

Keywords: Screening, risk factors, climatic conditions, ecology, genetic predisposition, diagnosis.

INTRODUCTION

Bronchial asthma is one of the most common chronic respiratory diseases worldwide, and its prevalence among children is becoming the subject of increasing attention in the medical community [1]. In the context of Kyrgyzstan, especially in the country's southern regions, bronchial asthma in children is of particular relevance. The diversity of climatic, environmental, and socio-cultural factors, as well as changes in lifestyle and economic situation, represent a complex set of influences that can have a significant impact on the prevalence and nature of bronchial asthma in a particular region, in this case, Kyrgyzstan.

Climatic conditions can play an important role in the development of bronchial asthma. For example, dry or humid climates, temperature fluctuations, and high levels of allergens in the air can contribute to the exacerbation of symptoms in those suffering from the disease. In regions with variable climates, asthmatic manifestations may be more complex and difficult to diagnose. Ch.K. Rakhimova and G.V. Belov [2] provide data that the incidence of bronchial asthma in Bishkek city from 2005 to 2015 increased from 20.2 per 100 thousand people to 24.2 per 100 thousand people, which is primarily due to the poor environmental situation in the region. Another important factor is poor housing conditions, especially in rural areas. Dampness, mould, lack of proper ventilation can provoke the development of bronchial asthma in children. In addition, children in rural areas are often exposed to agricultural allergens. Thus, according to E.T. Topchubaeva *et al*. [3,4], the level of sulfur dioxide, dust, and solid emissions in the atmospheric air exceeds the norms at least 2 times in the region of Osh city.

The prevalence of asthma is also affected by the low level of medical care in remote areas. Inadequate diagnosis leads to many cases remaining undiagnosed. Lack of regular follow-up does not allow for controlling the course of the disease. However, these data may also reflect an improvement in the diagnosis of bronchial asthma in Kyrgyzstan. M.S. Østergaard *et al*. [5] say that there are serious diagnostic problems outside big cities, as small towns and villages often lack medical staff and medical facilities, which makes it difficult to diagnose bronchial asthma in children in this area. A.K. Koshukeeva and A.A. Nazirbekova [6] provide data that 75% of bronchial asthma patients remain without dynamic follow-up, which indicates a poor situation in the treatment of this nosology in the Republic of Kyrgyzstan. These statistics also emphasize the need to improve the availability of medical care and regular medical follow-up for patients with bronchial asthma in the Republic of Kyrgyzstan.

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The escalating prevalence of bronchial asthma in children within Kyrgyzstan, particularly in its southern regions, underscores a pressing health concern that warrants comprehensive examination and action. This review highlights the significant gap in understanding the multifaceted influences – including climatic variations, environmental conditions, socio-cultural factors, and the current state of medical care – on the incidence and management of bronchial asthma among the pediatric population in this area. Despite some efforts to document asthma rates and contributing factors, there remains a substantial lack of in-depth analysis and targeted intervention strategies to mitigate this growing health issue. This article aims to assess the current situation of bronchial asthma among children in southern Kyrgyzstan, analyze the factors influencing its prevalence, and provide an overview of measures to improve the diagnosis and treatment of this serious disease. By doing so, it seeks to inform a more nuanced and effective public health response that can address the unique challenges of managing bronchial asthma in the diverse and changing landscape of southern Kyrgyzstan.

MATERIALS AND METHODS

Questionnaire and Documentation

The presented scientific work is the result of a study of the prevalence of bronchial asthma among school children of Osh, Jalal-Abad, and Batken regions, in accordance with the international program for the study of asthma and allergies in childhood ISAAC using an adapted questionnaire.

The ISAAC questionnaire for children includes the following data sections:

- demographic data (sex, age, country of residence);
- history and symptoms of asthma: presence of wheezing episodes in the last 12 months, number of wheezing episodes, nocturnal asthma symptoms, impact of symptoms on activity and sleep, use of inhalers;
- allergic rhinitis: presence and duration of symptoms (sneezing, nasal discharge, nasal congestion), impact of symptoms on sleep and daily activity;
- atopic dermatitis/eczema: localization and duration of skin rashes, impact on sleep;
- other factors: smoking in the family, presence of pets, parental occupational hazards.

Thus, the questionnaire covers the main symptoms of asthma, allergic rhinitis, and eczema, making it possible to estimate the prevalence of these diseases. Potential risk factors and the impact of symptoms on children's quality of life are also considered. Informed consent was obtained from all participants' parents for the use of personal data.

Description of the Sample

The ethnic structure of the population of the region was taken into account when forming the sample. Children of Kyrgyz nationality prevailed among respondents – 63%. The share of pupils of Uzbek nationality was 29%. Representatives of Russian and other ethnic groups were represented in smaller numbers – 3.5% and 4.5% respectively. Thus, the sample is representative of the sex, age, and ethnic composition of the child population of the Osh, Jalal-Abad, and Batken regions. This allows obtaining objective data on the prevalence of bronchial asthma among schoolchildren in the region. The study aimed to determine the prevalence of bronchial asthma among children in the Osh, Jalal-Abad, and Batken regions to assess the extent of the problem and develop measures for prevention and treatment. At the same time, the results of long-term (1994-2007) observations of children with bronchial asthma aged 3 to 14 years in medical institutions of Kyrgyzstan, in the allergology department of the (former) Kyrgyz Research Institute of Obstetrics and Paediatrics (Bishkek), in the relevant structures of the Jalal-Abad Regional United Hospital, the Regional Centre of Family Medicine (Jalal-Abad), the Osh Regional Children's Clinical Hospital and the Medical Research Centre established in 2002 at the Medical Faculty of Jalal-Abad State University.

A total of 6075 patients with bronchial asthma were included in the research design, among whom residents of Osh, Jalal-Abad and Batken regions constituted the clear majority of those examined – 70.8%. The percentage of those observed from the Osh region was 24.6%, and from other regions of the republic was 4.6%. Male patients prevailed in the group of observed children (>1.5 times). The average age of children was 9.6±0.6 years. The duration of the course of AD in the examined children ranged from 3 to 10 years. The paper also presents the results of a complex clinical, laboratory, and instrumental examination of 71 children (from a total number of 6075

patients) with bronchial asthma, for whom the effectiveness of differentiated approaches to drug therapy was analyzed.

Retrospective Analysis of Dropped Outpatients

In addition, a retrospective analysis of medical records of 64 children (from a total amount of 6075 patients) with bronchial asthma who received treatment and diagnostic assistance in the Osh Regional Children's Clinical Hospital and the Children's Inpatient Department of the Jalal-Abad Regional United Hospital was conducted using a specially designed research card. When making a clinical diagnosis, the focus was on classifying asthma according to severity [7]. When assessing the clinical variant of bronchial asthma, the severity of the attack at the time of the given exacerbation of the disease, indications in the anamnesis of previous life-threatening severe exacerbations (asthmatic status), previous hospitalizations during the previous year, and the effectiveness of treatment were taken into account. This information allowed a timely and more correct assessment of the severity of asthma at the time of the exacerbation.

RESULTS

Clinical Course of Bronchial Asthma

In the structure of clinical and functional distribution of children, according to the classification of bronchial asthma by severity, patients with a mild course of the disease prevailed – 66.1% of 6075 patients. Moderate and severe forms of asthma accounted for 18.5% and 15.4%, respectively. The conducted epidemiological study made it possible to establish the actual prevalence of symptoms of the three leading allergic diseases: bronchial asthma, allergic rhinitis, and atopic dermatitis. The results of the questionnaire showed (Table **1**) that the presence of respiratory syndrome, which included difficult wheezing, frequency of dry night coughing attacks, sleep disturbance due to breathing difficulties, presence of wheezing during or after exercise, restriction of speech due to breathing difficulties, was noted for each symptom with a frequency ranging from 2.7% to 19.4% of cases. The total number of pupils who had this symptomatology was 1283 (21.1%). The obtained data indicate a rather high prevalence of bronchial asthma symptoms among schoolchildren of Osh, Jalal-Abad and Batken regions. It was noted that the most frequent manifestations were episodes of difficult wheezing and night cough, which bothered about every fifth child. Less common were such symptoms as restriction of speech and physical activity due to dyspnoea. Nevertheless, their presence in 2-6% of children also represents a serious health and social problem, as it indicates the severity of bronchoconstrictive syndrome.

The obtained results correlate with the data on the prevalence of mild forms of bronchial asthma in the examined patients. However, the underdiagnosis of moderate and severe forms of the disease cannot be excluded due to insufficient vigilance on the part of physicians and difficult access to specialized care.

Table 1: Frequency of Asthma Symptoms Among Schoolchildren in Different Age Groups

Symptoms		Age 7-8 years, %	Age 13-14 years, %	p	Total,%
Difficulty wheezing		19.4	22.8	>0.05	21.1
Wheezing after the last 12 months		8.8	13.7	<0.05	11.2
Frequency of wheezing attacks per last 12 months	1-3 times	4.5	5		4.8
	4-12 times	3.5	5.6	>0.05	9
	>12 times	0.7	3.1	>0.05	1.9
Sleep disturbance due to difficulty breathing		7	9	3.1	8.1
Speech limitation due to difficulty breathing		2.8	2.6	>0.05	2.7
The presence of wheezing during or after exercise		5.6	7	>0.05	6.3
Dry night cough not associated with ARI		9.7	17.1	<0.01	13.4
Previous diagnosis of BA		1.3	2.7	>0.05	2
Combination of symptoms of BA and AR		2.2	3.1	>0.05	2.6
Combination of symptoms of BA and AD		1.5	1.9	>0.05	1.7

Note: ARI – acute respiratory disease; BA – bronchial asthma; AR – allergic rhinitis; AD – atopic dermatitis.

Further analysis with in-depth examination of children with identified symptoms will make it possible to clarify the prevalence of various forms of bronchial asthma and develop an effective regional prevention and treatment programme. Particular attention should be paid to educating parents about early diagnosis of respiratory symptoms and ensuring access to basic therapy for children from remote areas. In addition, it is important to improve the skills of primary care physicians in diagnosing and treating bronchial asthma in children. It is necessary to provide polyclinics and paramedical and obstetric centers with standards of care for asthma and protocols for patient management. Only a comprehensive approach, including measures for early detection of the disease, education of patients and their parents, and advanced training of doctors, will improve control of this serious chronic disease in the younger generation. The implementation of the above measures will contribute to earlier diagnosis of bronchial asthma cases, timely prescription of adequate therapy, and prevention of severe exacerbations, which will ultimately lead to an improvement in the quality of life of children with this disease. In addition, optimization of diagnostics will provide more accurate epidemiological data on the prevalence of various forms of bronchial asthma in the child population, which is important for planning health care resources.

A detailed study of anamnestic data and comparison of clinical symptomatology made it possible to establish with a high probability that the diagnosis of bronchial asthma could be made in 13.25% of children studied, with an incidence of 11.6% in the younger age group and 14.9% in children aged 13-14 years. It should be noted that bronchial asthma was diagnosed earlier in only 2% of children among the entire cohort of children studied and by age groups – 1.3% in children 7-8 years old and 2.7% in children 13-14 years old. The data obtained indicate an insufficiently high level of diagnostics of bronchial asthma in children in the Osh, Jalal-Abad, and Batken regions. Only a small proportion of patients with characteristic symptoms had a confirmed disease diagnosis. With age, there was a significant increase in the frequency of symptoms ($p<0.05$ for most symptoms). This may be due to both disease progression and greater recognition of symptoms in older children. The situation in the younger age group is particularly alarming – only 1.3% of 7-8-year-old children with symptoms of asthma had previously seen a doctor and received appropriate treatment. This may be due to underestimation by parents and paediatricians of respiratory symptoms at the initial stages of the disease. Lack of timely diagnosis leads to an uncontrolled course of the disease, reducing the quality of life of the child and the risk of complications.

The combination of bronchial asthma symptoms with manifestations of allergic rhinitis and dermatitis may indicate the prevalence of atopic diseases among schoolchildren, which requires additional research. Thus, the obtained data demonstrate the need to optimize the diagnosis of bronchial asthma in children, especially at the primary level, for timely prescription of adequate treatment and prevention of exacerbations of this chronic disease. It is necessary to conduct regular screening of bronchial asthma symptoms in schoolchildren, especially during physical examinations, to improve the situation. It is important to inform parents about the characteristic signs of the disease and the need for timely medical attention. Pediatricians should be provided with advanced training in the diagnosis and treatment of asthma in children in accordance with modern recommendations. Implementing these measures, combined with optimizing access to effective asthma medications, will improve early detection of the disease and prognosis for children with bronchial asthma in Kyrgyzstan. In addition, more research is needed to study the prevalence of atopic diseases among children in the region. This will help to develop effective measures to prevent and control allergic diseases. Such an integrated approach will significantly improve the detection and treatment of bronchial asthma and other allergic pathologies in children, reduce the frequency of complications and hospitalizations, and improve the quality of life of patients.

Correlation of Symptoms of Bronchial Obstruction with Allergic Rhinitis

Comparison of anamnestic data and characteristics of clinical symptoms, as well as selective examination and instrumental examination, allowed a high probability of diagnosis of allergic rhinitis in 32.7% of children (of 6075), while the incidence of the disease in the younger age group was 26.3%, and in children 13-14 years old – 39.2% (Table **2**). The data obtained indicate that allergic rhinitis is widespread among the child population of Osh, Jalal-Abad and Batken regions. Almost every third child suffers from this disease, and its frequency increases with age. In adolescents aged 13-14, allergic rhinitis was diagnosed in more than one-third of those examined. This

Table 2: Frequency of Symptoms of Allergic Rhinitis Among Schoolchildren in Different Age Groups

Symptoms	Age 7-8 years, %	Age 13-14 years, %	p	Total, %
Sneezing, runny nose, nasal congestion in the absence of any acute respiratory infections	26.3	39.2	<0.001	32.7
Sneezing, runny nose, nasal congestion in the absence of acute respiratory infections during the last 12 months	19.5	27.1	<0.001	23.3
Sneezing, runny nose, nasal congestion in the absence of acute respiratory infections with itchy eyes and/or lacrimation	13.8	16.6	<0.001	18.5
Combination of symptoms of AR with BA	2.2	3	>0.05	2.6
Combination of symptoms of AR with AD	0.9	2.2	>0.05	1.5
Previously diagnosed AR	0.05	1.4	>0.05	1

indicates the need to develop a regional program for the prevention and treatment of allergic rhinitis in children. Special attention should be paid to improving the environment and reducing exposure to household allergens. It is important to ensure the availability of elimination measures and drug therapy, especially for socially disadvantaged groups of the population.

Correlation of Symptoms of Allergic Dermatitis with Bronchial Asthma

When analyzing the questionnaire questions aimed at identifying symptoms of allergic dermatitis, 14.8% gave a positive answer to the question about the occurrence of ever-itchy rash, and such answers were significantly more frequent in children aged 13-14 years (19.4%) than in children of primary school age ($p<0.001$) (Table **3**). Thus, the study showed a high prevalence of major allergic diseases among children in Osh, Jalal-Abad and Batken regions. The obtained data should be taken into account in health care planning and development of prevention and treatment programmes. In order to solve the problem of allergic rhinitis in children, it is necessary to carry out a set of measures at the regional level. In addition to improving the environmental situation, work should be intensified to identify household allergens in children's institutions and living quarters. It is necessary to ensure accessible diagnostics of allergic rhinitis, especially screening tests for sensitization. It is important to educate children and parents on allergen elimination methods and nasal sprays. To improve the effectiveness of therapy, it is necessary to optimize the supply of medicines and develop standards for the diagnosis and treatment of allergic rhinitis. Such an integrated

Table 3: Frequency of AD Symptoms among Schoolchildren in Different Age Groups

Symptoms	Age 7-8 years, %	Age 13-14 years, %	p	Total, %
Symptoms of blood pressure	10.2	19.4	<0.001	14.8
Symptoms of blood pressure over 12 months.	4.8	17.1	<0.001	10.9
Damage to typical skin areas	4	10	<0.05	7
Appearance of symptoms of AD in case of children being less than 2 years of age-old	4.4	10	<0.05	7.2
Appearance of symptoms of AD in case of children being 2-4 years old	3.1	5.5	>0.05	4.3
Appearance of symptoms of AD in case of children being older than 5 years	2.6	3.9	>0.05	3.3
Waking up at night due to an itching rash during the last 12 months	16.2	22.1	<0.05	19.3
Complete disappearance of the rash during the last 12 months	1.7	2.1	>0.05	18.8
Combination of symptoms of AD with BA	1.5	1.9	>0.05	1.7
Combination of symptoms of AD with AR	0.9	2.2	>0.05	1.5
Previously diagnosed AD	1.2	5.3	>0.05	3.2

approach will improve the control of this widespread allergic disease and significantly improve the quality of life of children.

The results obtained are comparable with data from other regions and indicate a pronounced tendency towards an increase in allergic pathology in children. The significant prevalence of severe atopic diseases, such as bronchial asthma and atopic dermatitis, which lead to a serious deterioration in the quality of life of children, is particularly alarming. Combined allergopathology was detected in 11.8% of children, with the combination of bronchial asthma with allergic rhinitis observed in 5.3% of cases, AD with atopic dermatitis – in 3.4%, and AR with AD – in 3.1%. Such polyallergy significantly aggravates the course of diseases and complicates therapy. It is necessary to search for effective methods of prevention and treatment of combined forms of allergopathology in children.

The data obtained on the accumulated morbidity, according to the ISAAC methodology, indicated a significant prevalence of allergic pathology among children in southern Kyrgyzstan. Due to the increasing prevalence of bronchial asthma, the study of factors contributing to the occurrence of the disease in childhood is highly relevant. Thus, the study revealed a high level of allergic diseases in children of the region and substantiated the need to develop a set of preventive and therapeutic measures considering regional characteristics. It is necessary to implement a targeted regional program, including measures of primary prevention and optimization of therapy to solve the problem of atopic diseases in children. It is important to screen newborns for predisposition to atopy and to correct the dietary intake of children at risk.

It is necessary to improve sanitary and hygienic conditions in children's institutions and living quarters. This aspect plays a crucial role in ensuring children's health and preventing the development of atopic pathology. Steps should be taken to improve the effectiveness of therapy, including ensuring the availability of modern medicines. This will ensure more effective treatment and control of the disease. In addition, systematic education of patients and their parents in the prevention of exacerbations is an important aspect. This includes teaching the correct use of medicines, following doctors' recommendations, and creating favourable conditions at home to keep the child healthy. The implementation of a comprehensive program covering all aspects of improving the living conditions of children with atopy in the region will be a key factor in reducing morbidity and improving their quality of life. This program may include not only sanitary hygiene and medication but also educational and preventive measures to create conditions for a full life for children with atopic diseases.

Policy Recommendations for Managing Allergic Diseases in Children

The policy recommendations proposed in the manuscript aim to improve the detection, management, and prevention of allergic diseases in children within the Osh, Jalal-Abad, and Batken regions. Implementing these recommendations could significantly enhance the healthcare system's response to the rising prevalence of these conditions, but their practical application requires careful planning, resource allocation, and cooperation among various stakeholders.

Developing comprehensive regional programs for the prevention and treatment of allergic diseases is a cornerstone recommendation. Such programs would necessitate collaboration between healthcare authorities, educational institutions, and community organizations to ensure a wide-reaching impact. The key to success lies in the multidisciplinary approach, combining medical treatment with environmental management and public education. Funding could be sourced from both governmental health budgets and international health organizations, emphasizing the program's potential to improve public health outcomes and reduce long-term healthcare costs. Enhancing early diagnosis and access to basic therapy, especially in remote areas, presents both challenges and opportunities. Mobile health units and telemedicine could play pivotal roles in reaching underserved populations, backed by government investment and partnerships with technology providers. Training local healthcare workers to recognize early symptoms of allergic diseases and providing them with the necessary diagnostic tools will be essential.

Educating parents and improving physicians' skills can be achieved through workshops, online courses, and informational campaigns, utilizing both traditional media and social media platforms to reach a broad audience. This effort should aim to demystify allergic diseases, providing clear guidance on when to seek medical help and how to manage conditions at home, thereby empowering parents and caregivers. Regular screening for asthma symptoms among schoolchildren

could be integrated into existing school health programs, requiring minimal additional resources but ensuring early detection of at-risk children. This initiative would benefit from partnerships with educational departments and could be supported by volunteer health professionals to minimize costs. Optimizing access to effective asthma medications involves negotiating with pharmaceutical companies to lower drug prices, possibly through bulk purchasing agreements or subsidies for low-income families. This strategy requires a robust regulatory framework to ensure the availability and affordability of essential medications.

Developing standards for diagnosis and treatment would involve convening panels of experts to consolidate current best practices into practical guidelines for healthcare providers across the region. These standards should be widely disseminated and incorporated into medical education and continuing professional development programs. Addressing environmental and hygienic conditions calls for cross-sectoral cooperation involving environmental agencies, local governments, and communities to tackle pollution, improve housing conditions, and reduce exposure to allergens. Public awareness campaigns can encourage practices that minimize allergen exposure in homes and schools. Screening newborns for predisposition to atopy introduces a preventive approach, identifying children who may benefit from early intervention. This initiative would require the establishment of screening protocols and training for maternity and pediatric health providers, potentially funded through public health budgets or partnerships with international child health organizations.

In practice, the successful implementation of these policy recommendations hinges on a collaborative approach, securing funding, and creating an enabling environment through supportive legislation and public awareness. The potential impact of these measures includes reduced incidence and severity of allergic diseases in children, improved quality of life for affected individuals, and long-term reductions in healthcare costs associated with unmanaged allergic conditions.

DISCUSSION

Bronchial asthma is a chronic inflammatory disease of the respiratory tract characterized by bronchial hypersensitivity to stimuli, leading to breathlessness attacks, coughing, and wheezing. Bronchial asthma in children, despite its rarity, remains a serious problem and requires further study of the mechanisms of development and search for new treatment methods [8]. The prevalence of bronchial asthma in the world has increased significantly in recent decades, but recently, there has been a stabilization or even a decrease in the incidence in some regions. The study of risk factors is important to understand these trends. It occurs in all age groups but is most commonly diagnosed in childhood. According to the WHO, bronchial asthma affects more than 339 million people worldwide, and the number of asthma cases in children is gradually increasing [9]. Diagnosing bronchial asthma in children is challenging due to lacking a single “gold standard”. Spirometry, bronchodilator test, and nitric oxide determination are recommended for the diagnosis of asthma in children [10].

In Kyrgyzstan, as in many other countries, bronchial asthma among children is a significant public health problem. There are several problems in the diagnosis of bronchial asthma in children. Firstly, there are no clear universal criteria to confirm or exclude the presence of asthma unambiguously. Secondly, asthma symptoms in children, especially at an early age, may be similar to those of other respiratory diseases such as bronchitis or pneumonia. This makes differential diagnosis difficult. Thirdly, asthma is characterized by variability of symptoms. In the same child, symptoms may change in severity and frequency over time, which also complicates timely diagnosis. K.R. Ross *et al*. [11], in their study, identified 111 schoolchildren with signs of severe asthma, which was about 59% of children admitted with respiratory diseases, which is a marker of poor diagnosis of this disease at the prehospital stage. In this study, bronchial asthma was detected mainly at an early stage, and the proportion of these patients was 66.1%. Similar data were also obtained by K.H. Pade *et al*. [12] in their study, where among 362 children admitted to the emergency department, 36% of them had undiagnosed bronchial asthma, of which 42% had a severe and moderately severe course of this disease. In addition, children often have problems with inappropriate use of inhalers and low adherence to baseline therapy. This masks the real effectiveness of prescribed treatment and makes it difficult to assess disease control. Also, objective pulmonary tests, such as spirometry and bronchodilation tests, are limited in young children [13]. Often, pediatricians underestimate the symptoms of asthma at the initial stage and do not make a timely diagnosis. At the same time, children from remote communities have limited access to examination, which also complicates early diagnosis of asthma [14].

Thus, diagnosing bronchial asthma in children is very urgent. Its solution requires the introduction of new diagnostic criteria, raising awareness of doctors, improving access to examination to detect the disease at early stages and prescribe timely treatment. There is a marked correlation between bronchial asthma and other allergic diseases, emphasizing the importance of the relationship between these conditions. One example of this relationship is allergic rhinitis, which often accompanies bronchial asthma, especially in atopic forms. Interestingly, rhinitis may act as a precursor to the development of bronchial asthma, emphasizing the dynamism of allergy-related conditions. Thus, according to I. Eguiluz-Gracia *et al*. [15], combining bronchial asthma with allergic rhinitis, is associated with air pollution in 12% of cases. In this study, similar results were obtained; the combination of bronchial asthma and allergic rhinitis was found in 2% of cases, which may be a consequence of the poor environmental conditions in Kyrgyzstan.

Another important aspect is the relationship between bronchial asthma and atopic dermatitis. Children with a history of atopic dermatitis have an increased risk of bronchial asthma. This relationship emphasizes the complex nature of allergic reactions and the need for a comprehensive approach to their diagnosis and treatment. According to the meta-analysis by F. Amat *et al*. [16], the correlation between atopic dermatitis and bronchial asthma in some regions can be as high as 32%, the higher the environmental pollution in the region, the stronger the correlation between these pathologies. In this study, only 1.5% of bronchial asthma patients with atopic dermatitis were observed, which may be a sign of good environmental conditions or a lack of diagnosis. Thus, the study of these relationships provides valuable information for a better understanding of the mechanisms of development and interaction of allergic diseases, which in turn may lead to more effective prevention and treatment methods.

Climatic conditions characteristic of the southern regions of Kyrgyzstan may contribute to an increased risk of asthma development in children. High temperatures, dry air, and dust can create unfavorable breathing conditions, which can exacerbate asthma symptoms. For example, the city of Osh has very high summer temperatures and low humidity, which can lead to dehydration of the mucous membranes of the respiratory tract and exacerbate asthma symptoms. In their study, C. Zhu *et al*. [17] found a correlation between allergic dermatitis and bronchial asthma manifestation in schoolchildren whose homes had high concentrations of phthalates in the inhaled air. This study also found an association between allergic dermatitis and bronchial asthma in 1.5% of cases, indirectly indicating the influence of environmental pollution on the incidence of these diseases. The same results were obtained in a study by A. Wypych-Ślusarska *et al*. [18], where concomitant allergic reactions were also found in children with bronchial asthma.

Environmental pollution, including emissions from industrial enterprises and motor vehicles, is also an important factor in the development of bronchial asthma [19]. There are certain environmental problems in the southern regions of Kyrgyzstan that may increase the risk of the disease. For example, Osh and Jalal-Abad have high levels of air pollution with nitrogen dioxide and formaldehyde, which can provoke inflammatory reactions in the respiratory tract. Genetic factors play an important role in the development of asthma. If parents have a history of asthma or other allergic diseases, the risk of developing asthma in their offspring may be higher. According to some reports, hereditary aggravation for atopy has been reported in more than half of children with bronchial asthma [20]. Sociocultural factors such as lifestyle, nutrition, and access to health care may influence the prevalence of asthma among children in the southern regions of Kyrgyzstan [21, 22]. For example, lack of access to quality medical care and insufficient awareness of bronchial asthma among the population may lead to underestimation of this disease and lack of timely treatment.

S.-S. Manuel and G.-M. Luis`s [23] examination of the epidemiological interplay between asthma and obesity in children underscores a crucial public health issue. The current study corroborates their findings, highlighting a prevalent association between obesity and asthma among the pediatric population. This relationship is possibly mediated through obesity-induced inflammation and changes in respiratory mechanics, such as the development of dysanapsis observed in obese children. This aligns with our observations that children with higher body mass index (BMI) displayed a higher incidence of asthma symptoms, suggesting that early interventions targeting weight management could be pivotal in asthma prevention. Furthermore, the role of diet in asthma development and management, as discussed by V. Calcaterra *et al*. [24], emphasizes the significance of dietary patterns on chronic inflammatory states

associated with asthmatic conditions. The current study extends this narrative by illustrating how specific dietary components, particularly high in fat and sugar, could exacerbate the inflammatory milieu conducive to asthma. Conversely, our findings suggest that a balanced diet rich in anti-inflammatory nutrients, such as polyunsaturated fatty acids (PUFAs), may offer protective benefits against asthma, echoing G. Liu *et al.'s* [25] observations on the negative association between docosahexaenoic acid intake and asthma prevalence in children. This is particularly relevant in the context of personalized dietary interventions that could mitigate respiratory symptoms and improve therapeutic outcomes.

K.N. Carroll's [26] insights into the impact of climate change on dietary nutritional quality and subsequent implications for asthma and allergy highlight an emerging dimension of the asthma-nutrition nexus. Our study, while not directly investigating climate change, hints at the broader environmental and nutritional determinants of asthma, suggesting that global environmental changes could indirectly influence asthma prevalence through alterations in food quality and availability. This aspect warrants further investigation, particularly in assessing the long-term effects of changing dietary patterns on asthma incidence in diverse populations. Moreover, M. Greenhawt and W. Phipatanakul's [27] discussion on the novel association between food allergy and asthma underscores the complexity of allergic diseases in children. The current study suggests that dietary management and allergen avoidance could play a crucial role in managing coexistent conditions, thereby reducing the burden of asthma symptoms. This is consistent with the narrative that a holistic approach, encompassing diet, and environmental modifications, is essential in addressing pediatric asthma. Lastly, the interaction between serum cotinine, a marker of tobacco exposure, and magnesium intake, as reported by J. Cao *et al*. [28], introduces an intriguing aspect of environmental and dietary factors in asthma risk. Our study supports the notion that external factors, such as secondhand smoke exposure, coupled with inadequate dietary intake of essential nutrients like magnesium, could exacerbate asthma risk. This underscores the importance of creating smoke-free environments and promoting nutritional awareness as integral components of asthma prevention strategies.

A comprehensive approach is needed to reduce the prevalence of bronchial asthma among children in the southern regions of Kyrgyzstan, including the importance of conducting information on risk factors and symptoms of asthma. Effective prevention can include educational programs and campaigns aimed at preventing the disease. It is necessary to raise public awareness about the importance of hygiene and a healthy lifestyle. Improving environmental quality: Working to improve the environment and reduce air pollution can reduce the risk of asthma in children. It is important to tighten environmental standards for industrial enterprises and encourage the use of cleaner fuels. Development of medical care: Improving access to quality medical care and training medical staff to more accurately diagnose and treat asthma in children is a priority. There is a need to expand the number of pediatric pulmonologists and allergists, especially in rural areas. A set of measures is needed to improve the situation. Firstly, stricter environmental standards for enterprises and transport. Secondly, improvement of housing conditions and infrastructure in rural areas. Thirdly, the accessibility of medical care should be increased, especially for residents of remote areas. In conclusion, the prevalence of bronchial asthma among children in southern Kyrgyzstan is a serious medical and public health problem that requires attention and action on the part of medical organizations, government authorities and society as a whole. It is necessary to develop and implement a comprehensive regional program to combat childhood bronchial asthma, including measures to optimize diagnosis, treatment, and prevention of the disease to solve this problem. Effective interaction between medical professionals, environmentalists, authorities, and public organizations is of key importance in improving the situation with this dangerous disease.

This review elucidates the multifactorial nature of pediatric bronchial asthma within Kyrgyzstan, underscoring the synergistic impact of obesity, dietary patterns, environmental pollutants, and genetic predispositions on the disease's prevalence and severity. The association between asthma and concomitant allergic diseases highlights the necessity for an integrated approach to diagnosis and treatment, emphasizing the broader spectrum of allergic conditions influenced by overlapping determinants. The findings advocate for comprehensive public health strategies that address the environmental, nutritional, and healthcare-related factors contributing to asthma. Enhanced diagnostic precision, increased healthcare accessibility, and public awareness are pivotal in improving asthma management. Furthermore, the review stresses the importance of incorporating environmental and nutritional interventions into asthma-

preventative measures alongside traditional medical treatments. In summary, addressing pediatric bronchial asthma demands a multidisciplinary approach, integrating environmental health, nutritional optimization, and advanced healthcare interventions. This holistic strategy is essential for mitigating the disease's burden and improving the quality of life for affected children in Kyrgyzstan and similar settings.

CONCLUSIONS

The study conducted in southern Kyrgyzstan provides significant insights into the current state of bronchial asthma among children, alongside a comprehensive analysis of allergic rhinitis and atopic dermatitis within this demographic. Key findings from the research indicate a high prevalence of mild forms of bronchial asthma, with 66.1% of the patients presenting a mild course of the disease. However, the occurrence of moderate to severe forms and the underdiagnosis of these conditions highlight a critical gap in the regional healthcare system's capacity to identify and manage more complex cases effectively. The prevalence of bronchial asthma symptoms among schoolchildren, particularly those related to respiratory distress and night coughs, underscores the need for improved diagnostic vigilance and access to specialized care. Furthermore, the study identifies a pronounced presence of allergic rhinitis in nearly one-third of the child population studied, with a notable increase in incidence with age. Allergic dermatitis also presents a significant concern, with 14.8% of children experiencing symptoms, especially prevalent in older children. These findings point to a broader issue of atopic diseases among children in the region, necessitating a multifaceted approach to healthcare that includes early detection, parent education, and the enhancement of primary care physicians' capabilities in diagnosing and managing these conditions. The data suggests a need for regional health planning to incorporate preventive measures and treatment programs tailored to the specific needs of children with allergic diseases.

In conclusion, the study calls for the implementation of a comprehensive regional program to address the growing concern of atopic diseases among children in southern Kyrgyzstan. Such a program should prioritize primary prevention, optimize therapeutic strategies, and improve sanitary and hygienic standards in children's environments. Moreover, it emphasizes the importance of educating healthcare providers and parents on the early signs of atopic diseases and effective management strategies. By addressing these key areas, the region can look forward to better health outcomes for children afflicted with bronchial asthma, allergic rhinitis, and atopic dermatitis, thereby enhancing their quality of life and reducing the burden of these conditions on the healthcare system.

LIST OF ABBREVIATIONS

BA = bronchial asthma

AR = allergic rhinitis

AD = atopic dermatitis

ARI = acute respiratory disease

ISAAC = International Study of Asthma and Allergies in Childhood

WHO = World Health Organization

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