Journal of Health Development
e2663-1776

A Brief Review

Analysis of the Influence of the Main Environmental Risk Factors on Children's Health Based on the Material of CIS countries: A Brief Review

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Received: February 13, 2026
Revised: February 27, 2026
Accepted: March 21, 2026
Published: April 30, 2026

Citation: Bagdat Imasheva, Kuandyk Askarov, Marat Imashev, Ainagul Tulegenova. Analysis of the influence of the main environmental risk factors on children's health based on the material of Russian studies (brief literature review). J Health Dev. 2026, 61 (2), jhd069. https://doi.org/10.32921/2663-1776-2025-61-1-jhd069

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Abstract

Currently, serious problems associated with environmental pollution are observed all over the world, especially in developing countries, which manifests itself in the form of a negative impact of environmental factors on the health of the population as a whole, especially on the health of the younger generation.

This study is an analytical review of scientific literature focused on the impact of environmental factors on children's health.

The materials used include published scientific articles, monographs, results of epidemiological and hygienic studies, as well as reports from international and national public health organizations. The main body of sources consists of studies conducted by Russian researchers, as well as data obtained in CIS countries and the Republic of Kazakhstan.

Epidemiological studies conducted in the CIS countries have established indisputable evidence that there is a reliable link between environmental pollution and morbidity and mortality from neoplasms and respiratory diseases. At the same time, there is no reliable data on the role of environmental factors in the development of chronic diseases in children and adolescents, including the study of the interaction between chemical, social, behavioral factors and the gene pool with the environment. That is, these studies had some limitations in studying the epidemiology of chronic diseases and environmental stress factors.

Keywords: environment, children's health, environmental factors.

1. Introduction

The concept of "children's health" includes not only the absence of diseases and physical disabilities, first of all it is a state of complete mental, mental, physical, social and moral well-being.

The analysis of modern scientific literature has shown that the environment remains the leading source of negative impact on human health. Indicators of children's physical health are the most sensitive indicators of the state of the environment, that is, it is necessary to take into account all the risks arising from the influence of environmental factors. There is no doubt that environmental pollutants that actually affect

the health of the child's body require constant assessment of their impact and sanitary supervision.

The purpose of the review: To analyze the published data on the impact of the main environmental risk factors on children's health based on research by scientists from neighboring countries and the Republic of Kazakhstan.

2. Materials and methods

This study is an analytical review of scientific literature focused on the impact of environmental factors on children's health.

The materials used include published scientific articles, monographs, results of epidemiological and hygienic studies, as well as reports from international and national public health organizations. The main body of sources consists of studies conducted by Russian researchers, as well as data obtained in CIS countries and the Republic of Kazakhstan.

The literature search was carried out using scientific databases such as eLIBRARY, PubMed, and Google Scholar, as well as official reports and methodological guidelines. Publications were selected based on the following inclusion criteria:

- availability of data on the impact of environmental factors (air, water, soil);
- studies focusing on children and adolescent health indicators;
- use of epidemiological, hygienic, or biomedical research methods;
- publications primarily from the last 15–20 years.

The methodological framework of the study included:

- systematic analysis and synthesis of scientific data;
- comparative analysis of findings from different studies;
- content analysis of publications by key areas (air pollution, water quality, chemical factors, anthropogenic load);
- elements of a risk-based approach to assessing the impact of environmental factors on population health.

For the interpretation of results, indicators such as morbidity rates, prevalence of chronic diseases, data on children's physical development, as well as information on exposure to specific pollutants (particulate matter, nitrogen oxides, sulfur oxides, heavy metals, etc.) were used.

A limitation of the study is the heterogeneity of methodological approaches in the analyzed works, as well as the limited comparability of data across different regions.

3. Results

The interest of scientists around the world is increasingly attracted by changing weather conditions and often associated air pollution. Thus, an increase in temperature increases the concentrations of chemicals typical of air pollution, which significantly increases the risks to the health of the population of large megacities [1]. Environmental pollution by toxic industrial emissions leads to an exacerbation of many chronic diseases in residents of industrial cities, primarily cardiovascular and pulmonary diseases (atherosclerosis, chronic bronchitis, lung cancer, etc.), diseases of the neurological and immune systems, gastrointestinal tract, etc. [2].

The modern scientific and technological revolution is characterized by the rapid development of industry, electricity production and the expansion of the use of land, water and air modes of transport. These processes aggravate one of the most important problems of modern public health: increasing environmental pollution. The solution to this problem is not only to preserve natural resources for the further economic and social development of countries, but above all to ensure favorable sanitary conditions, primarily for the population, to prevent possible health consequences from environmental pollution, as well as to prevent harmful effects on current and future generations [3].

Environmental pollution affects human health in many ways and can affect almost all areas of human activity. The atmosphere and hydrosphere are the most mobile media, and pollution through them, especially the diffusion of their chemical elements, occurs much more actively than through the biosphere [4]. At this stage, the problem of environmental restoration has gone beyond the national level and has acquired an international character, causing constant concern to the United Nations. According to WHO, the health of the population depends on solving environmental problems from 25 to 40% or more, to a lesser extent on heredity and social conditions (20%), as well as on the state of health (10%) [5].

Mortality and disability indicators are crucial for the characteristics of public health, as they objectively characterize the damage to health due to irreversible losses (population decline and disability). In ecologically unfavorable urbanized regions with a large concentration of chemical industries, there is a sharp decrease in the birth rate, an increase in mortality rates from congenital anomalies and tumors, and an increase

in disability of the population [6]. Thus, a 2-3fold increase in mortality from cardiovascular diseases (correlation coefficient 0.95), from cancer (r=0.87) and from congenital deformities over the past decades indicate environmental problems associated with environmental factors, as a result of which there is a pronounced negative dynamics of primary disability and disability of the population, which increases the share of output disability of the population of industrial cities up to 2 times, especially with regard to environmentally caused classes of diseases (cancer, congenital deformities, coronary heart disease, mental retardation, etc.) [7].

According to research conducted by Russian scientists, with acute exposure to suspended particles at a daily concentration of 10 micrograms / m3 for 24 hours, the children's population has an increase in respiratory symptoms by 2.4%, and children with bronchial asthma have an increase in the frequency of seizures for every 10 micrograms / m3 by 3-5%. Chronic exposure to suspended substances leads to an increase in cases of bronchitis in children by 11% (for every 10 micrograms/ m3) in relation to the background level of morbidity. A regression relationship was also established between the daily level of hospitalization for bronchial asthma, heart disease and obstructive pulmonary disease and the levels of daily content of particulate matter, nitrogen dioxide and carbon monoxide in the atmosphere. A high correlation coefficient of hospitalization with respiratory diseases and changes in the daily concentration and content of gaseous pollutants in the atmospheric air was revealed for the population of all ages [8].

Thanks to modern technologies and the current development of medical science, it is safe to say that the health of children depends on a variety of environmental factors. A particularly pronounced problem is the hypersensitivity of children to environmental influences during critical periods of growth: during the intrauterine development of the child, in newborns and young children.

Scientists point to a pronounced tendency to deterioration in the health of children and adolescents around the world. Unfavorable shifts in the state of health in childhood are characterized by an increase in the prevalence of functional disorders and chronic diseases, a change in the structure of health disorders, and a deterioration in physical development indicators [9]. The analysis of adolescent morbidity showed an increase in the overall morbidity by 1.5 times. A significant increase was registered in diseases of the respiratory organs, eyes and their appendages, musculoskeletal system and digestive organs, as well as injuries, poisoning and pathology of the nervous system in older adolescents. The listed diseases in the structure of morbidity of adolescents totaled more than 80% [10].

According to modern concepts, a child's health is a state of vital activity corresponding to his biological age, harmonious physical development, the formation of adaptive and compensatory reactions in the process of formation, development and interaction with the environment. At the same time, it is important to note that the body of children is more sensitive to the effects of adverse environmental factors, since due to physiological characteristics, the growing body of a child can suffer even from low concentrations of harmful substances, being a kind of indicator of the state of the environmen [11].

Many environmental factors have a huge impact on the child's body, on his physical and mental development, including air pollution by various harmful emissions from industrial enterprises and exhaust gases of urban vehicles. Which have an impact on the metabolism, circulatory system, respiration, the digestive process and many other processes occurring in the growing body of children, directly affecting the emerging physiological functions.

A number of authors note an exacerbation of symptoms from the upper respiratory tract (rhinorrhea, cough, burning sensation) in children with an increase in the level of particulate matter in the atmospheric air. A relationship has been established between the increase in the incidence of acute bronchitis in children with an increase in the level of atmospheric air pollution of industrial cities with suspended solids and sulfur dioxide. When comparing the incidence of pneumonia and bronchial asthma in the children's population with the pollution of large cities, a distinct parallelism was recorded between the growth of these diseases and the severity of pollution of the air basin by industrial emissions [12].

Studies by authors from far abroad devoted to the study of the influence of adverse environmental factors on the child's body note that in almost every industrial metropolis there is an increase in the prevalence of respiratory and ENT diseases when exposed to elevated levels of harmful substances in the air. The most significant increase in the morbidity of the child population compared with the control groups was found in industrial cities of the USA, Canada, Italy, Germany (chemical and petrochemical production), Latin America, China, Brazil (metallurgical production). Scientists also note an increase in the incidence of the urinary system and gastrointestinal tract, which may be due to the use of poor-quality drinking water.

It was revealed that respiratory diseases occupy leading places in the pathology of childhood and have the greatest share in the structure of childhood

morbidity. The study of the incidence of acute respiratory infections of the upper respiratory tract in children in industrial megacities revealed a pronounced connection between them and atmospheric air pollution by emissions of hydrogen sulfide, sulfur dioxide and nitrogen, suspended particles and carbon monoxide. The high morbidity of children is probably associated not only with the irritating effect on the mucous membrane of the respiratory organs of harmful impurities exceeding the maximum permissible concentrations, but also with a general decrease in the body's resistance to harmful external influences. Respiratory diseases also occupy a leading position in the overall structure of the morbidity of the population in large cities, where the inhaled air is polluted with industrial emissions containing formaldehyde, nitrogen dioxide and sulfur, etc. The first place in the structure of respiratory morbidity in children was occupied by obstructive bronchitis and stenosing laryngotracheitis, which was confirmed by the high dependence of periods of exacerbation on unfavorable environmental conditions in megacities [13,14].

A strong correlation has been established between the morbidity of the respiratory and digestive organs of the urban population, especially in children, and the excess of permissible concentrations of phenol, hydrogen sulfide and nitrogen dioxide in the atmospheric air. A direct relationship has also been established between the excess of the permissible level of ammonia and hydrogen chloride vapors in the air and the incidence of respiratory and cardiovascular diseases in the children's population [25]. After studying the influence of air pollution with phenol, acetone and formaldehyde on the state of external respiration in children, it was found that in areas with a high index of technogenic load, the frequency of deviations of functional indicators, such as vital capacity of the lungs, the maximum rate of inhalation and exhalation, increases from their proper values, which causes an increase in the serum content of immunoglobulin E and indicates a high probability of developing obstructive diseases.

When studying the health status of children under 6 years of age in ecologically unfavorable areas, their higher incidence was revealed. In preschool children living in areas with varying degrees of atmospheric air pollution, significant deviations of anthropometric indicators (reduction in body length and weight) were revealed than in children of control groups, which is apparently explained by the manifestations of protective and compensatory reactions of the child's body aimed at its optimal adaptation to negative environmental factors. In addition, a high incidence of liver and kidney diseases in children has been established, which is obviously due to the presence of chlorine-containing hydrocarbons in the inhaled air. The majority of children living under conditions of high anthropogenic load had excessive fat deposition, which indicates metabolic disorders, especially lipid metabolism [15].

A group of scientists, F.F. Dautov and others (2007) note that in the structure of the general morbidity of children living in unfavorable environmental conditions, as a rule, a high level of allergic diseases is established, which is associated with the nonspecific effect of chemicals in the composition of atmospheric air on the immune response of the child's body, violating the mechanism of resistance to chemical agents. Unfavorable environmental conditions contribute to a decrease in the adaptive capacity of the body and an increase in morbidity.

When studying the relationship between concentrations of chemicals in the atmospheric air and the prevalence of allergic diseases in children, pronounced correlations between concentrations of sulfur dioxide, hydrogen sulfide, carbon monoxide and the prevalence and frequency of exacerbation of allergic diseases (asthma, bronchitis, rhinitis and dermatitis) were also revealed. The analysis of the connection of urban air pollution with the prevalence of bronchial asthma among the children's population revealed the dominant role of vehicle exhaust gases, namely nitrogen oxides, the concentration of which exceeded the maximum single MPC by up to 30 times. It was also found that the greatest prevalence of allergic diseases among children living in the territory with an excess of the permissible level of chlorine and its compounds in the air (up to 10 times the MPC).

In modern conditions, a person has to come into contact with chemicals to which he has not developed adaptive reactions, and protective mechanisms are not fixed at the genetic level. Thus, as a result of exposure to a foreign agent, pathological changes appear in the most vulnerable systems and organs of the human body, and more often in children, pregnant women and the elderly, that is, in weaker structural and functional links of society. The health indicators of women and children are an objective assessment of the health of the population and an indicator of the assessment of the environmental situation of any state. Undoubtedly, the effects of environmental pollutants such as formaldehyde, lead, benz(a)pyrene and heavy metal compounds have been reducing fertility and increasing the proportion of cardiopulmonary pathology in the structure of general morbidity over the past decades [16,17].

It is known that the pathology of the cardiovascular system is one of the leading causes of mortality. O.Y. Katulskaya (2010) conducted a study of the cardiovascular system of children in the city of

Angarsk, whose atmospheric air is polluted mainly with nitrogen dioxide (up to 3 MPC), formaldehyde (up to 1.9 MPC), phenol and carbon monoxide (up to 1.5 MPC). The author proved that up to 30% of changes in the incidence of cardiovascular diseases in children can be attributed to the influence of atmospheric pollution, 35.5% of children have reduced adaptive capabilities. With age, the mobilization of body systems occurs, followed by a normotonic reaction in the majority of the examined [18].

Y.A. Rakhmanin and co-authors (2018) point to the prospects of using methods of noninvasive biochemical diagnostics in the study of the health status of the population. The authors conducted a comprehensive biochemical study of the health status of children living in regions with different levels of environmental pollution (Moscow, Cherepovets, etc.). A clear relationship was revealed between the degree of atmospheric air pollution and the percentage of children with stable changes in biochemical parameters [19].

Currently, a person is constantly in a complex interaction with a complex of harmful factors of anthropogenic origin, including carcinogenic substances that can lead to the development of oncological diseases. The key factor in the formation of this formidable pathology is air pollution with polycyclic aromatic hydrocarbons, including benz(a)pyrene. The content of benz (a)pyrene in the environment is considered one of the main indicators of the carcinogenic load on humans. The main sources of the formation and release of benz(a)pyrene into the atmosphere are enterprises of ferrous and non-ferrous metallurgy, thermal power engineering, mechanical engineering, petrochemical and rubber industry [20,21,22].

According to Russian scientists, industrial cities with an increased level of oncological morbidity associated with a high level of environmental pollution with carcinogens (copper, nickel, polycyclic aromatic hydrocarbons) include Norilsk (copper and nickel smelting, petrochemistry and production of chlorine-containing substances), Magnitogorsk, Kamensk Uralsky, Novokuznetsk (steel production, aluminum smelting). Thus, studies conducted in large industrial centers have found that long-term air pollution with polycyclic aromatic hydrocarbons, estimated by benz(a)pyrene at the level of 8-9 MPC, leads to a statistically significant increase in the incidence of lung cancer in the population. An increased concentration of benz(a)pyrene in the urine of children attending schools located at a distance of up to 2 km from metallurgical enterprises was also revealed, which indicates the presence of a high aerogenic risk to the health of school-age children [23].

One of the main problems of our time is the intensive pollution of ground and surface waters and land resources by industrial enterprises, motor transport, unorganized household and industrial waste. This phenomenon may turn out to be a kind of "time bomb", since the consequences of exposure to negative environmental factors quite often manifest themselves many years later.

Anthropogenic pollution of drinking water, along with other environmental factors, is an intensive factor affecting human health. Since the beginning of this century, scientists have noted that almost all wastewater from industrial cities of post-Soviet states has an increased content of nitrates, petroleum products, volatile phenols, which shows a high level of contamination of drinking water with volatile organochlorine compounds with mutagenic and carcinogenic activity. The presence of organochlorine compounds in water is associated with the processes of excessive chlorination, as well as with the flow of chlorine-containing effluents from petrochemical industries and the metallurgical industry.

In particular, in post-Soviet countries, up to 60% of the population uses water for drinking purposes that does not meet hygienic standards and is dangerous in epidemiological and toxicological terms. Russia and Kazakhstan are characterized by the presence of pollutants such as iron (up to 8 MPC), turbidity (up to 4 MPC), chromaticity (up to 1.4 MPC), nitrates and fluorine content in the range of 0.12-0.23 mg/l among the priority indicators determining the poor quality of drinking water. The sum of the ratios of chemicals of 1-2 hazard classes was for Cd, Ni, Si, Br, B, Pb > 1 [43]. In large industrial cities, the total atmospheric air pollution calculated by a complex indicator for nitrogen dioxide, sulfur dioxide and hydrogen sulfide was significantly higher up to 3 times. According to the maximum single concentrations, the levels of atmospheric air pollution in large industrial cities with metals (chromium, cadmium, zinc) were 1.5 to 3 times higher [24].

It should be noted that both in atmospheric air and water bodies, transformations of substances entering them can occur with the formation of new chemical contaminants. An indirect sign of ongoing transformations in the atmospheric air may be a discrepancy between the recorded average annual concentrations (mg/m3) and the emission capacity (t/year). For example, in the city of Ust-Kamenogorsk, over the past 20 years, there has been a discrepancy between the emission power and the recorded concentrations of carbon monoxide, sulfur dioxide and trioxide, hydrogen fluoride and chloride, tri- and dimethylamines, sulfuric acid and formaldehyde. Total pollution of atmospheric air in all functional zones at

considerable distances from stationary sources with carbon disulfide, sulfur trioxide and chlorine-containing compounds suggests that their additional formation occurs in the atmosphere. One of the conditions for transformation may be the presence in the atmospheric air of metals (manganese, lead, nickel, etc.) acting as catalysts [45].

Currently, the so-called risk approach is used to assess the impact of environmental factors on the health of the population, according to which the fundamental criteria for assessing both individual environmental factors and their combinations should be indicators of the risk of their impact on the health of children and the population as a whole. The risk assessment procedure is aimed at solving the most important practical tasks and making responsible management decisions. In recent years, there have been many works devoted to assessing the risk to public health from adverse environmental factors [25].

N.N. Filatov and co-authors (2009), I.P. Saldan and co-authors (2010), S.G. Fokin (2010), studying the influence of chemical pollution of atmospheric air on the health of the population of large cities, assessed the state of atmospheric air as unfavorable for the health of the population, especially children and adolescents. A powerful source of atmospheric air pollution is automobile transport, so the probability of developing cancer throughout a person's life from exposure to benzene is 1.5 * 10-4, from exposure to formaldehyde 1.2* 10-4. The combined effect of these carcinogens causes a total carcinogenic risk of 2.7 *10-4, that is, it is in the signal range, indicating a potential carcinogenic danger to the population and a critical level of atmospheric air pollution. The risk of non-carcinogenic effects from atmospheric air calculated for priority pollutants (nitrogen and sulfur dioxide, carbon monoxide, suspended solids, formaldehyde, phenol) exceeds the acceptable level by 10 times.

V.M. Prusakov and co-authors (2020) indicate that the environmentally determined risks of general morbidity of all classes of diseases of the child and adult population exceed in industrial cities. The authors note that the contribution of environmentally caused diseases to the formation of the general morbidity of the population, as well as the proportion of the incidence of malignant neoplasms, has been steadily increasing over the years, where the following substances are the most priority causes of the occurrence of environmentally caused disorders: formaldehyde, suspended solids and nitrogen dioxide [26].

A high degree of environmental risk indicates the need for urgent environmental protection and rehabilitation and adaptation measures. Of particular importance is the development of programs for the improvement of the children's population. The authors point out that a set of measures for the medical and environmental rehabilitation of the population aimed at stimulating the elimination of toxic substances from the body is one of the ways to manage risk.

Scientists of the Pacific Medical University (2020), who conducted long-term monitoring of the health of schoolchildren aged 7-17 years, confirmed the general trend towards the deterioration of the health of the child population. They found that during the observation period, the average number of morphofunctional abnormalities and chronic diseases at the stage of clinical remission increased, for example, about 41% of schoolchildren had chronic diseases, and the frequency of their registration increased with age. In the course of school education, the prevalence of chronic diseases increased and the frequency of diseases of the musculoskeletal system, the organ of vision and the digestive system increased. Among the revealed pathology, posture disorders (42%), caries (39%) and myopia (25%) were more often registered.

An important indicator characterizing the health of children is considered to be physical development, reflecting the influence of environmental factors on the growing organism and being prognostically significant for the state of health in adulthood. Numerous studies indicate the multidirectional dynamics of the physical development of modern children and adolescents. Thus, a comparative analysis of the physical development of schoolchildren showed that a significant part of children aged 8-15 years (44%) had an average level of physical development, while 45% of students had high and very high indicators, and 11% had below average and low. Gender peculiarities were also revealed: the proportion of students with high physical development indicators was twice as high among boys, and with average – among girls. Also, the surveyed had a tendency to increase the indicators of physical development in comparison with their peers in 1998 and 2004 [27].

One of the characteristics of physical development is its harmony. Currently, there is a tendency to increase the number of children with disharmonious and sharply disharmonious development. Thus, when analyzing the health status of schoolchildren, it was found that 68.1% had harmonious physical development, 25.8% had disharmonious, and 6.1% of students had sharply disharmonious. This analysis of the physical development of children and adolescents showed that disharmonious development was reflected by excess or deficiency of body weight, which were found in 23.7% of girls and 32.2% of boys, sharply disharmonious was revealed in 11.6 and 12.8% of the observed, respectively.

It is known that the health status of the younger generation is formed under the influence of a complex

of biomedical, environmental, socio-economic and other factors. The establishment, study and ranking of these determinants will make it possible to justify priority preventive measures to prevent possible deviations in the state of health of children and adolescents [28].

A comparative analysis of anthropometric indicators of school-age children was also carried out in the city of Almaty, where residents lived in two different sanitary zones of the city, differing in total coefficients of atmospheric air quality (clean and dirty). It was found that annual increases in body length were higher in children in the "clean zone", and children living in the "dirty zone" differed in a significant increase in body weight. Ahmad and co-authors (2019) suggested that environmental pollution can be considered as a condition that has a significant impact on human ontogenetic development.

It is known that an important place in the totality of factors affecting the health of children is occupied by determinants that affect the learning process in educational organizations. These are the so-called risk factors: the intensity of the educational process, stressful pedagogical tactics, deficiencies in the system of physical education and hypokinesia, non-compliance with the regime of study and rest, sleep and outdoor activities, problems of organizing proper nutrition and medical care [29]. Thus, as a result of a sanitary and hygienic survey of educational organizations of large Russian cities, the following factors were identified within the school environment that adversely affect the health of children: high academic loads, irrational organization of the educational process, non-compliance with hygienic regulations for seating students, insufficient conditions for physical education, violation of the requirements for light and air-heat regime.

Yu.A. Rakhmanin (2017) points out that priority scientific and practical research in the field of human ecology and environmental hygiene are the following areas: development of a knowledge system that allows taking into account the characteristics of public health risk to the impact of harmful environmental factors; in-depth study of the mechanisms and general patterns of the negative impact of environmental factors on the body and the development of recovery methods the health of the population with eco-related pathology.

Currently, indicators are used to assess the carcinogenic risk, taking into account the probabilities of the corresponding disease at different levels of exposure. This makes it possible to assess the level of general morbidity in populations of different numbers for any period of time, and not the carcinogenic risk is assessed as the ratio of the effective concentration to the reference concentration or dose. On this basis, work has been carried out to assess the risks to public health from emissions from landfills of solid household waste, thermal power and coal industry enterprises, and especially in recent decades at oil refining and crystalline silicon production enterprises, as well as in mining and processing plants [30]. The works of a number of Russian scientists, S.L. Avaliani and co-authors, A.V. Kiselyov and co-authors are devoted to modern methodological problems of health risk assessment and harmonization of atmospheric pollution standards in accordance with international requirements. They have carried out work to assess the risk of mortality of the population and to study the carcinogenic risk associated with emissions of pollutants into the atmospheric air in large centers of non-ferrous and ferrous metallurgy and coal industry enterprises.

It is necessary to emphasize the different attitudes to the preservation of health among urban and rural populations. In industrial cities, serious attention is paid to environmental protection and attempts are being made to solve existing environmental problems, taking into account the "contribution" of industrial production to environmental pollution and its negative impact on the health of citizens. At the same time, the rural population is characterized by an indifferent attitude to their health and a low assessment of the importance and quality of medical services, and here factors such as deteriorating living conditions in rural areas, low incomes, increased alcohol consumption, and the difficult state of the social sphere also negatively affect the health of the population.

Heavy metal salts accumulate in the soils of cities and rural areas. Currently, industrial enterprises, urbanized territories and transport arteries are significant sources of formation and accumulation of lead compounds in environmental objects, mainly in soils (a toxic metal of the 1st hazard class). The proportion of technogenic lead in natural environments, including in the soils of industrial regions, exceeds its natural background by one or two orders of magnitude. The residual concentration of toxic technogenic precipitation products in quantities exceeding the critical parameters of the recreational capacity of soils in polluted territories over time turns these soils into independent, long-functioning sources of secondary emissions, which become a factor of particularly adverse environmental impact on the contacting population [31].

Thus, according to many researchers in the field of hygiene and ecology, an unfavorable environmental situation leads to a deterioration of demographic indicators, especially to an increase in acute and chronic diseases in children. In recent years, negative trends in the field of child health protection have clearly

emerged, causing great concern and requiring an urgent solution to the problems that arise. A steady upward trend in almost all classes of diseases, especially respiratory diseases, allergic conditions, infectious and parasitic diseases coincide with weakened immunity, which corresponds to statistics.

From birth, children are exposed to a complex complex of climatic, chemical, radioactive, noise and other factors that directly affect their health. The main reasons for the decline in health include the impact on the child's health of adverse environmental factors, an increase in the number of medications taken by children, changes in lifestyle and nutrition, including the mother's refusal to breastfeed.

Currently, the concept of "children's health" includes not only the absence of diseases and physical disabilities, but above all a state of complete mental, mental, physical, social and moral well-being. That is, health is closely related to the concept of quality of life. In this regard, healthrelated problems should be considered as a medical and social model, including preventive and rehabilitative measures affecting the medical, psychological and social aspects of a child's life.

Since the beginning of the new millennium, there has been a tendency to increase the overall morbidity of the child population with a total increase of 7% in 2010, reaching 2,995 per 1,000 children. An increase in the frequency of diseases of the endocrine system, diseases of the nervous system, the eye and its accessory apparatus, diseases of the digestive system, diseases of the musculoskeletal system and genitourinary system and congenital malformations. More than half of all cases of diseases are respiratory diseases (52.04%), followed by diseases of the skin and subcutaneous tissue (5.70%), diseases of the digestive system (5.12%), injuries and poisoning (4.92%), diseases of the eye and its accessory apparatus (4.78%), infectious and parasitic diseases (4.50%) [32].

According to the VAZ data (2019), in the structure of the general morbidity of children, respiratory diseases consistently occupy the first place 121,964.3 cases per 100 thousand children. It is also known that the etiology and pathogenesis of many diseases, including in childhood, is mainly due to the negative influence of environmental factors, including, first of all, the intensification of lipid peroxidation processes. It has been established that the epithelium of the respiratory tract is a target for reactive oxygen species formed under the influence of endogenous and exogenous factors [72-74]. In conditions of aerogenic multicomponent pollution, 53.0-74.1% of exposed children with respiratory diseases develop oxidative stress due to the increased content of toluene, phenol, manganese in their blood and depletion of antioxidant protection and antioxidant activity of the child's body [33].

4. Discussion

The results of this review confirm that environmental factors play a significant role in shaping children’s health, particularly in industrial and urbanized regions. The analyzed studies consistently demonstrate a stable association between air pollution and an increased incidence of respiratory diseases, which occupy a leading position in the structure of childhood morbidity. In addition to respiratory pathology, the data indicate a growing contribution of environmental factors to the development of allergic, cardiovascular, and metabolic disorders in children.

A key observation is the increased sensitivity of the child’s organism to low concentrations of pollutants, especially during critical periods of growth and development. This supports the concept that children represent a vulnerable population group and can serve as an indicator of environmental well-being. At the same time, the interaction of environmental, social, and behavioral factors complicates the assessment of causal relationships and requires a comprehensive approach.

Differences in the results of individual studies may be explained by variations in methodological approaches, levels of pollution, and regional characteristics. Nevertheless, the overall trend indicates a deterioration in children’s health indicators associated with increasing anthropogenic burden. The use of a risk-based approach appears to be a promising tool for assessing and managing health threats related to environmental factors.

The obtained data highlight the need to strengthen environmental monitoring systems and implement preventive measures aimed at reducing children’s exposure to harmful factors. Further research should focus on conducting longitudinal studies and integrating biomedical, environmental, and social data to achieve a deeper understanding of the mechanisms underlying environmentally related diseases.

5. Conclusion

From all of the above, it can be concluded that the analysis of literature sources indicate a negative impact of environmental factors on the health of the child population as production emissions and the index of opsness of pollution increase. However, when analyzing foreign literary sources, there is a certain

inconsistency regarding how and to what extent the population is at risk from environmental pollution, and this issue requires further comprehensive study. Quantitative characterization of the risk of environmental pollution on children's health in large industrial cities where industrial enterprises (metallurgical, thermal power and coal industries) are located is an urgent issue today and requires further research to clarify the basic biomedical parameters of children's health, early detection, treatment and rehabilitation of diseases in children.

Financing and conflict of interest. The article is the product of a study carried out within the framework of the "implementation of the Work Plan for 2022-2023 of the RSE at the National Center for Public Health of the Ministry of Health of the Republic of Kazakhstan and the United Nations Children's Fund (UNICEF) in the Republic of Kazakhstan". The authors declare that there is no conflict of interest.

Conflict of interests. Authors must declare the absence of a conflict of interest.

Author contributions. Conceptualisation – B.I.; methodology – B.I., K.A.; formal analysis – M.A., A.T.; writing (original draft preparation) – B.I., K.A.; writing (review and edition) – B.I.

All authors have read, agreed to release version of a manuscript.

AI Disclosure. The authors used Grammarly to refine the grammar and language of the manuscript. The final version is edited by the authors.

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ТМД елдері материалдары негізінде қоршаған орта тәуекелінің негізгі факторларының балалар денсаулығына әсерін талдау: Қысқаша шолу

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Түйіндеме

Қазіргі уақытта бүкіл әлемде, әсіресе дамушы елдерде қоршаған ортаның ластануымен байланысты күрделі проблемалар байқалуда, олар қоршаған орта факторларының жалпы халықтың денсаулығына, әсіресе өскелең ұрпақтың денсаулығына теріс әсер етуінен көрінеді.

Бұл зерттеу қоршаған орта факторларының балалар денсаулығына әсеріне бағытталған ғылыми әдебиеттерге аналитикалық шолу болып табылады. Пайдаланылған материалдарға жарияланған ғылыми мақалалар, монографиялар, эпидемиологиялық және гигиеналық зерттеулердің нәтижелері, сондай-ақ халықаралық және ұлттық денсаулық сақтау ұйымдарының есептері енгізілді. Дереккөздердің негізгі бөлігі ресейлік зерттеушілер жүргізген зерттеулерден, сондай-ақ ТМД елдерінде және Қазақстан Республикасында алынған деректерден тұрады.

ТМД елдерінде жүргізілген эпидемиологиялық зерттеулер қоршаған ортаның ластануы мен онкологиялық және респираторлық аурулардан болатын сырқаттанушылық пен өлім арасындағы сенімді байланыстың сенімді дәлелдерін көрсетті. Сонымен қатар, балалар мен жасөспірімдердің созылмалы ауруларының дамуындағы экологиялық факторлардың рөлі туралы нақты деректер, оның ішінде химиялық, әлеуметтік, мінез-құлық және генофонд факторларының өзара әрекеттесуін зерттеу жеткіліксіз. Сондықтан бұл зерттеулер созылмалы аурулардың эпидемиологиясын және қоршаған ортаның стресс факторларын түсінуде кейбір шектеулерге ие болды.

Түйін сөздер: қоршаған орта, балалар денсаулығы, қоршаған орта факторлары.

Анализ влияния основных факторов риска окружающей среды на здоровье детей на основе материалов СНГ: Краткий обзор

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Резюме

В настоящее время во всем мире, особенно в развивающихся странах, наблюдаются серьезные проблемы, связанные с загрязнением окружающей среды, которые проявляются в виде негативного воздействия факторов окружающей среды на здоровье населения в целом, особенно на здоровье молодого поколения.

Данное исследование представляет собой аналитический обзор научной литературы, посвященной влиянию факторов окружающей среды на здоровье детей. В качестве материалов использованы опубликованные научные статьи, монографии, результаты эпидемиологических и гигиенических исследований, а также отчеты международных и национальных организаций здравоохранения. Основной массив источников состоит из исследований, проведенных российскими учеными, а также данных, полученных в странах СНГ и Республике Казахстан.

Эпидемиологические исследования, проведенные в странах СНГ, установили неопровержимые доказательства наличия надежной связи между загрязнением окружающей среды и заболеваемостью и смертностью от новообразований и респираторных заболеваний. В то же время отсутствуют достоверные данные о роли факторов окружающей среды в развитии хронических заболеваний у детей и подростков, включая изучение взаимодействия химических, социальных, поведенческих факторов и генофонда с окружающей средой. То есть, эти исследования имели некоторые ограничения в изучении эпидемиологии хронических заболеваний и факторов стресса окружающей среды.

Ключевые слова: окружающая среда, здоровье детей, факторы окружающей среды.

https://doi.org/10.32921/2663-1776-2026-61-2-jhd069