

Regional Differentiation of Emissions and Risk Perception of Dust-Related Morbidity

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Annotation.

The article presents an analysis of regional differentiation of pollutant emissions into the atmospheric air of the Republic of Uzbekistan for a five-year period, as well as the results of a study of the subjective opinion of the population of Termez on the factors affecting their health, including dust-related diseases. It was found that the greatest contribution to air pollution is made by the Tashkent region (28.1% of the total emissions) and the city of Tashkent (14.4%). At the same time, the results of a questionnaire survey of the population of Termez showed that, despite the relatively low level of air pollution in the Surkhandarya region, the subjective perception of environmental risks remains high.

Keywords: emission, atmospheric pollution, dust etiology, risk perception, subjective perception, environmental risks, respiratory diseases.

Introduction

The problem of air pollution and its impact on public health is relevant for many regions of the world. According to the World Health Organization (WHO), air pollution is recognized as one of the leading risk factors for the development of various diseases, including respiratory diseases, cardiovascular diseases, and oncological diseases [4].

Studies of regional differentiation of pollutant emissions show that the level of air pollution varies significantly depending on the level of industrialization, climatic conditions and the structure of economic activity [1, 2]. In countries with developed industry, high concentrations of emissions are observed near large industrial centers, while in regions with a predominance of agriculture, pollution is more local [3, 5, 6]. A number of studies note that the transport sector, energy generating enterprises and industrial complexes are the main sources of emissions of harmful substances, such as particulate matter (PM₁₀ and PM_{2.5}), nitrogen oxides (NO) and sulfur dioxide (SO₂) [7, 8].

Particular attention is paid to the study of dust etiology of diseases, since PM_{2.5} particles are capable of penetrating deep into the lungs and causing chronic inflammatory processes. Studies in various countries have shown a link between increased levels of air pollution and an increase in cases of bronchitis, asthma, allergic rhinitis and other respiratory diseases [9, 10].

Risk perception, or the population's subjective perception of risk factors, is an important aspect in epidemiological studies. According to a number of scientific papers, public opinion about health risks often diverges from objective environmental monitoring data, which is due to both insufficient information and individual experience of living in polluted areas [11, 12]. Studying subjective assessments of the population allows identifying potential risk-inducing factors in the environmental monitoring system and adjusting the strategy of preventive measures [6].

Scientific research also highlights the importance of a comprehensive approach to assessing air pollution and morbidity, which includes both instrumental methods for measuring emissions and an analysis of public perception of risks. This is especially relevant for regions where objective pollution indicators are at an average level, but subjective assessments of the population indicate a high level of concern about possible health consequences [5].

Thus, the study of regional differentiation of pollutant emissions into the atmosphere in combination with the analysis of risk perception of the population allows not only to objectively assess the environmental situation, but also to take into account the social aspects of the perception of health and the environment.

The aim of the study was to assess regional differences in emissions of pollutants into the atmospheric air and to determine the population's subjective perception of the risk of morbidity, including dust-related diseases, for the further development of scientifically based preventive measures.

Materials and methods: This study used official statistical data for the period from 2018 to 2022. To analyze the dynamics of atmospheric emissions, units of measurement were used - thousands of tons per year. To assess the level of pollution, calculations of dynamics indicators were made, such as the average annual growth rate, maximum and minimum values, arithmetic mean values and standard deviations.

The methodology for conducting a study of general morbidity, including diseases of dust etiology, using a specially developed questionnaire, was the collection of data on the health status of respondents with an emphasis on identifying chronic diseases, as well as diseases associated with exposure to dust and other adverse environmental factors. Questionnaire for studying general morbidity and diseases of dust etiology, based on the classification of diseases ICD-10. In total, the questionnaire included 127 questions covering 19 classes of diseases. The questionnaire concluded with a question on external causes of morbidity. The results obtained were analyzed by the specific gravity of morbidity in the context of disease classes. For each class of diseases, an extensive indicator was calculated - the specific gravity of morbidity. Data processing and visualization of the results were carried out using the Microsoft program Excel.

Results and discussion

Atmospheric pollution is one of the key factors determining the level of environmental safety and sanitary and hygienic well-being of the population. An analysis of regional differentiation of pollutant emissions into the atmospheric air in the territory of the Republic of Uzbekistan for the period 2018-2022 was carried out. Within the framework of the study, special attention was paid to assessing the level of risk perception of air pollution by the population of the studied region.

The analysis of the regional characteristics of the average values of emission volumes for the five-year period under study allowed us to conclude that the average total volume of emissions into the atmosphere in the republic for the analyzed period was 2292.5 ± 2.63 thousand tons. The highest average total volume of emissions into the atmosphere occurred in the Tashkent region – 644.7 ± 4.72 thousand tons (28.1% of the total emissions). In turn, the city of Tashkent demonstrates 330.0 ± 1.10 thousand tons of emissions (14.4%) (Fig. 1).

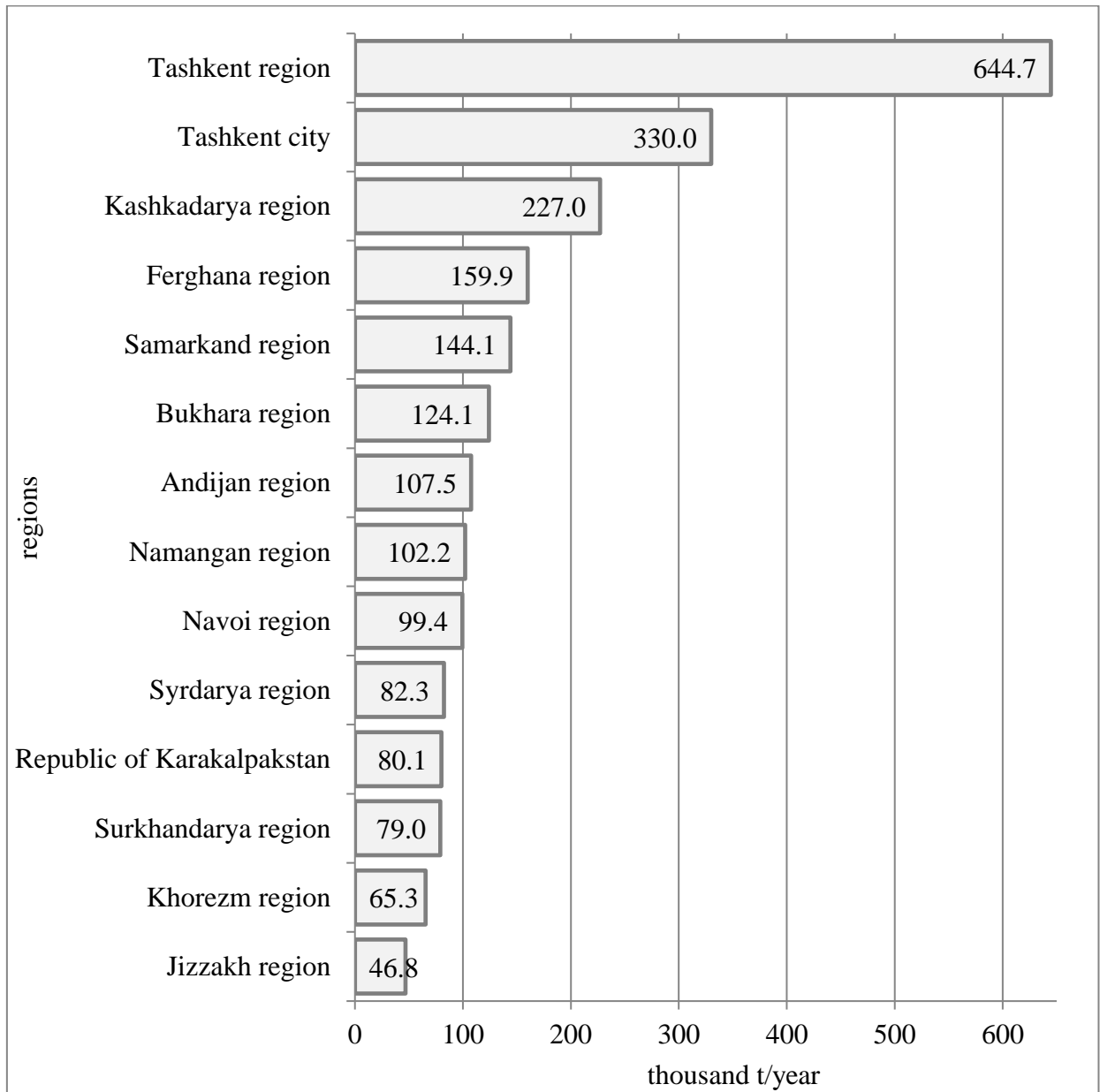


Figure 1. Regional characteristics of average values of pollutant emissions into the atmospheric air of the Republic of Uzbekistan for the period 2018–2022, thousand tons per year.

The next most polluted regions are Kashkadarya region (227.0 ± 1.92 thousand tons, 9.9%), Fergana region (227.0 ± 1.92 thousand tons, 7.0%) and Samarkand region (144.1 ± 1.33 thousand tons, 6.3%). The average level of emissions was recorded in Bukhara (124.1 ± 0.92 thousand tons, 5.4%), Andijan (107.5 ± 1.77 thousand tons, 4.7%) and Namangan (102.2 ± 2.99 thousand tons, 4.5%) regions. The minimum emission values were noted in Jizzakh (46.8 ± 2.19 thousand tons, 2.0%) and Khorezm (65.3 ± 0.62 thousand tons, 2.8%) regions.

Atmospheric pollution is a significant medical and hygienic problem, since its main components (suspended particles PM_{10} and $PM_{2.5}$, nitrogen dioxide NO_2 , sulfur dioxide SO_2 , carbon monoxide CO , volatile organic compounds) have a negative impact on the human body, especially on the respiratory and cardiovascular systems. The greatest danger is posed by suspended particles (PM_{10} and $PM_{2.5}$), which contribute to the development of chronic bronchopulmonary diseases (COPD, bronchial asthma) and cardiovascular pathologies. Sulfur and nitrogen oxides (SO_2 , NO_2) irritate the mucous membranes of the respiratory tract, cause inflammatory reactions, and increase the risk of bronchospasm in people predisposed to allergic diseases. Volatile organic compounds (benzene,

formaldehyde) have proven carcinogenic effects and contribute to the accumulation of mutagenic compounds in the body.

An analysis of regional differentiation of pollutant emissions showed that the level of air pollution varies depending on industrial load, transport infrastructure and climatic conditions. However, high concentrations of emissions do not always correlate with the level of public concern about the state of the environment and health risks. For a deeper understanding of the perception of environmental threats and their impact on subjective assessment of morbidity, an assessment of risk perception was conducted in the Surkhandarya region. Despite the fact that this region is not among the most polluted, studying the subjective opinion of the population on risk-inducing health factors provides an opportunity to identify hidden discrepancies between objective data on emissions and public perception of threats, which is key to the formation of effective preventive strategies.

To study the subjective opinion of the population about general morbidity, including diseases of dust etiology, 502 residents of the city of Termez, Surkhandarya region, were surveyed.

The analysis of the data presented in the table shows that out of the total number of identified diseases (3568 cases) among the population of Termez, the largest number of cases were observed in class X diseases - respiratory diseases (550 cases, which is 15.4% of the total number of diseases) and in class XI diseases - diseases of the digestive system (500 cases, or 14.01%). Also, a fairly high proportion was recorded for class I diseases - infectious and parasitic diseases (7.4%), for class XIV - diseases of the genitourinary system (6.7%). A significant number of cases were also observed for class IX diseases - diseases of the circulatory system (6.2%).

In the structure of morbidity among residents of the city of Termez, several key nosologies and their share in the total number of diseases can be identified. In first place in prevalence were diseases of the respiratory system (class X), which made up 15.4% and were formed due to such nosologies as influenza (44.8%), bronchitis (16.3%) and allergic rhinitis (14.1%). The next group were diseases of the digestive system (class XI), which made up 14.01% and were formed due to dental caries (31.5%), gastritis (21.5%) and hernia (10.4%). In the structure of infectious and parasitic diseases (class I), which made up 7.43%, the highest share was viral hepatitis (15.9%), dysentery (12.7%) and herpes (10.4%) (Fig. 2).

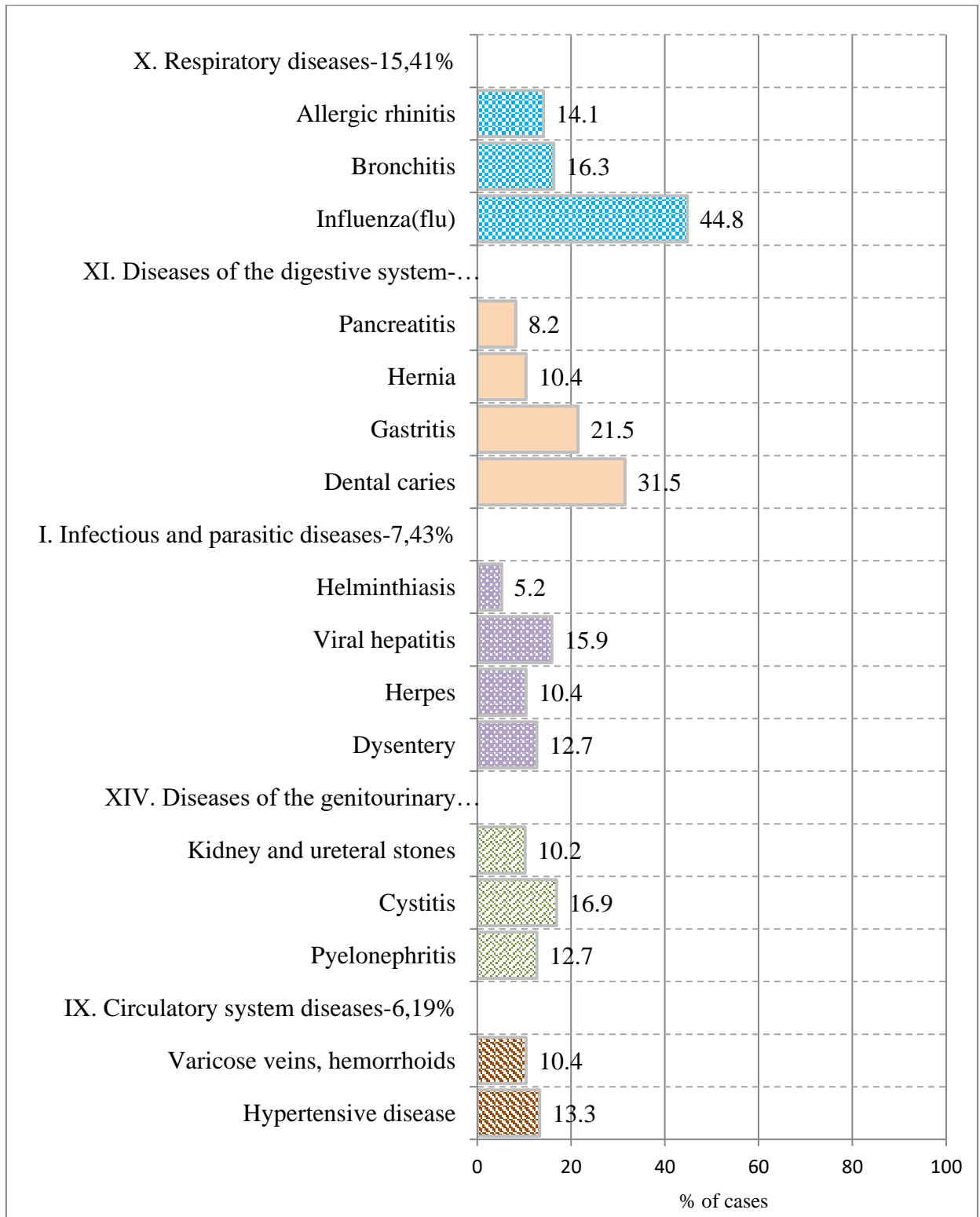


Figure 2. The proportion of nosologies in the overall structure of identified diseases among residents of Termez, survey results, % of cases

During a questionnaire survey among residents of the city of Termez, their opinions on the influence of various external factors on health were studied, the results of which are presented in Table 1.

Table 1.

Results of a questionnaire survey of the population of Termez on external causes of diseases (n = 502 people)

Answer options	Number of cases, abs .	% of cases
1. Transport accidents	32	6,4
2. Overheating or heat stroke	54	10,8
3. Hypothermia	20	4
4. The impact of weather changes on health	249	49,6
5. The impact of gas and dust pollution on health	76	15,1
6. Alcohol	30	6
7. Smoking	23	4,6
8. Work-related factors	51	10,2
9. Or other (write):	58	11,6
Total number of responses received	593	

Several key external factors influencing the health of the population of Termez were identified. The most significant of these was the change in weather conditions, which was noted by 49.6% of respondents. Gas pollution and dustiness were mentioned by 15.1% of respondents, overheating or heat stroke - 10.8%, and 10.2% named factors related to working conditions.

Conclusions

1. An analysis of average emission volumes over a five-year period showed that the total emission into the atmosphere in the republic amounted to 2292.5 ± 2.63 thousand tons, with Tashkent region (644.7 ± 4.72 thousand tons, 28.1%) and Tashkent city (330.0 ± 1.10 thousand tons, 14.4%) making the largest contribution to pollution. High emission levels were also recorded in Kashkadarya (9.9%), Fergana (7.0%) and Samarkand (6.3%) regions, while the minimum figures were noted in Jizzakh (2.0%) and Khorezm (2.8%) regions, which indicates significant regional differentiation of air pollution.

2. An analysis of the results of the assessment of the subjective opinion of the population on general morbidity, including diseases of dust etiology among the population of Termez, based on the data of the questionnaire survey showed that the largest share of cases falls on respiratory diseases (15.4%), mainly influenza (44.8%), bronchitis (16.3%) and allergic rhinitis (14.1%). According to respondents, the key external factors affecting health were changes in weather conditions (49.6% of respondents) and gas pollution and dustiness of the atmospheric air 15.1% of respondents.

3. Despite the fact that Surkhandarya region is not among the leading regions in terms of air pollution, the study of the subjective opinion of the population on risk-inducing health factors made it possible to establish the presence of respondents' concerns about the state of the environment and its impact on health.

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