

THE CURRENT STATE OF THE PROBLEM OF ASSESSING THE RISK TO POPULATION HEALTH ASSOCIATED WITH AIR POLLUTION

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Relevance of the Study. Risk assessment methodology is currently a widely recognized and essential tool for characterizing the impact of environmental factors on public health and for making management decisions. However, despite the large number of studies assessing health risks from chronic (long-term) exposure to atmospheric pollution, the problem of characterizing short-term (acute) exposures remains insufficiently addressed. In recent years, the issue of protecting human health from acute exposure to chemicals (CS) has become particularly pressing due to the increased likelihood of accidents and disasters at potentially hazardous sites, the threat of terrorist attacks, the consequences of natural hazards, and the emergence of numerous clinical and epidemiological studies demonstrating the high risk to human health from short-term exposure to elevated levels of air pollution. Risk assessments have been conducted in several regions of Uzbekistan. However, a comparative assessment of chronic and acute health risks for the population of Tashkent, the largest city, has not been conducted. Some studies have focused on the hygienic assessment of certain urban planning decisions or risk characterization in individual administrative districts. Therefore, research assessing the public health risks from exposure to chemical pollutants in the air is a pressing task in organizing and implementing social and hygienic monitoring.

An important problem in improving the risk assessment methodology remains the further concept of developing modern computer databases and software systems aimed at studying health risks and information support for risk assessment in the system of social and hygienic monitoring.

Our research was carried out in accordance with the planned topics of the Laboratory for Comprehensive Assessment of the Risk of Impact of Environmental Factors of the State Research Institute of Human Ecology and Environmental Hygiene named after A.N. Sysin, Russian Academy of Medical Sciences: "Develop a system of methods and criteria for assessing the hazard of exposure to chemicals on public health using computer technologies; "Methodological support for research on assessing the health risks of environmental pollution (State registration number 01.2.00 103540)", "Reducing the risks and mitigating the consequences of natural and man-made emergencies until 2025", as well as the Decree of the Government of Tashkent No. 283-PP "On the implementation of the plan for the development of science and technology in the interests of the city in 2024" and the plan for research and development work for 2021.

The objective of the research is to develop a set of methods and an information and forecasting system for scientific and methodological support for assessing risks and damage to public health from short-term and chronic exposure to chemicals.

Research objectives:

1. Create specialized information databases (DB) on criteria for assessing health risks from acute and chronic exposure to chemical air pollution, taking into account demographic

indicators and population morbidity rates, and develop methods for characterizing health damage based on epidemiological concentration-response relationships.

2. Develop a concept for the creation of specialized modules of the integrated computer information and forecasting system TERA, designed to assess the risk and damage to health from exposure to chemicals polluting the atmospheric air.

3. Conduct practical testing of the developed criteria and computer system in studies to assess the risk and damage to the health of the population of Moscow from short-term and long-term exposure to chemical substances polluting the atmospheric air.

Study results: Assessing the public health risk associated with exposure to atmospheric air pollution should be based not only on an analysis of the likelihood of chronic general toxic and carcinogenic effects, but also on an assessment of the risks associated with short-term exposure to chemical compounds. To characterize the risks of acute exposure, it is advisable to use a set of indicators, including hazard coefficients and indices, exposure profiles, and a wide range of additional exposure outcomes.

Specialized information databases and calculation and forecasting modules have been developed for the integrated computer system TERA, ensuring the implementation of all stages of risk assessment for acute and chronic exposure to chemicals polluting the atmosphere ("Rapid Assessment of the Risk of Atmospheric Pollution"), as well as the assessment of health damage from exposure to chemicals polluting the atmosphere ("EpidCalc").

The total individual carcinogenic risk associated with exposure to controlled air pollutants in Tashkent ranges from 1.5 (Northern Administrative District) to 5.1 (Central Administrative District) additional cases per 10,000 residents, which is close to risk values previously identified in many large cities. The damage caused by these exposures amounts to 2,986 cases of cancer over 70 years (43 cases per year) for the entire population of Tashkent. The leading ranks in terms of total carcinogenic risk among all administrative districts are occupied by the Central Administrative District (5.1E-4), Zelenograd (4.9E-4), and the Eastern Administrative District (4.9E-4). Benzene and formaldehyde, which are part of air pollution emitted by motor vehicles, make the greatest contribution to the carcinogenic risk.

The highest total non-carcinogenic risk is observed in the Southern Administrative District (SAO) - (24.8), and the lowest - in the Northern Administrative District (NAO) - (12.1). When adding territory-specific chemical pollutants to the hazard index, the highest values of the hazard index for the development of non-carcinogenic effects were found in the Eastern Administrative District - 82.3, the Southern Administrative District - 59.4, and Elenograd - 23.3. Exposure to chemicals polluting the atmospheric air has the greatest impact on the respiratory system, the cardiovascular system, and the development of growing organisms. Typical air pollutants can cause an increase in mortality and hospitalizations for respiratory and cardiovascular diseases. Acute exposure to these chemicals may be associated with approximately 11,000 additional cases of total death annually, with exposure to suspended matter accounting for more than 50% of this contribution, and chronic exposure to suspended matter may be associated with up to 27,000 additional cases of total death.

A hygienic assessment of the sanitary and epidemiological situation during the period of elevated air temperatures and forest fires in the summer of 2022, conducted using a set of methods and criteria for assessing the acute effects of chemicals, revealed that fine suspended particles were the leading adverse factor during this period, with maximum PM2.5

concentrations reaching 0.6 mg/m³. The obtained data on the danger of the observed situation were confirmed by a retrospective analysis of actual health indicators: in the summer of 2022, emergency medical care visits increased by an average of 8%, and hospitalizations for cardiovascular and respiratory diseases increased by an average of 15% compared to the same months in 2024.

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