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FORECASTING OF ENVIRONMENTALLY-RELATED RISKS OF DISEASE DEVELOPMENT

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Abstract. *An atmospheric air quality was studied according to phenol, formaldehyde, benzene, xylene, toluene, a comparative analysis of the incidence rates of the child population, calculation and assessment of carcinogenic and non-carcinogenic risks for the child population in the studied cities in dynamics. According to the results of the hygienic assessment of atmospheric air pollution in the studied cities, it was found that on average during the observation period, formaldehyde concentrations statistically significantly exceeded the MPC by 3.19-4.58 times. In Kamyanske, an excess of phenol was observed on average by 2.11 times, and the levels of aromatic hydrocarbons did not exceed the MPC. The population carcinogenic risk for the city of Dnipro is 4980 additional cases of cancer from exposure to benzene and 133 additional cases from exposure to formaldehyde in a population cohort of 1 million people. For Kryvyi Rih, these indicators will be 1864 additional cases of cancer from exposure to benzene and 136 cases from exposure to formaldehyde in a population cohort of 1 million people. In the city of Kamianske, 3818 additional cases of cancer from exposure to benzene and 133 cases from exposure to formaldehyde in a population cohort of 1 million people are predicted. According to the results of the conducted studies, it was found that the total non-carcinogenic risk is highest in Kamianske HI total = 5.84, in Dnipro HI total = 5.1, and in Kryvyi Rih – HI total = 4.15. In the studied cities, an unacceptable non-carcinogenic risk was established for the respiratory system, CNS, and immune system. In Kamianske, an unacceptable non-carcinogenic risk was noted for the cardiovascular system.*

Key words: *atmospheric air; phenol; formaldehyde; aromatic hydrocarbons; morbidity; risks.*

Introduction.

The results of many years of research show that in industrial cities of Ukraine there is stable air pollution with harmful chemicals that pose a danger to the environment and human health. Special attention needs to be paid to the study of inhalation of pollutants from atmospheric air to the child's body, since due to the physiological characteristics of development, chemicals are more easily adsorbed, and less effective biotransformation of ecotoxicants leads to the accumulation of chemicals in the child's body.

The goal is to improve the system of measures to reduce the negative impact of polluted atmospheric air on the health of children living in an industrial region.

A source: [1,2,3,4,5]

Main text

Materials and methods. An ecological and hygienic assessment of pollutant enterprises and emissions from stationary sources of industrial cities (Dnipro, Kamianske, Kryvyi Rih, Novomoskovsk) was carried out, atmospheric air quality was studied according to phenol, formaldehyde, benzene, xylene, toluene, a comparative analysis of the incidence rates of the child population, calculation and assessment of carcinogenic and non-carcinogenic risks for the child population in the studied cities in dynamics for the period 2013-2021.

Results. The highest volume of emissions of specific pollutants into the atmospheric air from stationary sources of pollution was found in the city of Kryvyi Rih - an average of 16.00 (95% CI 8.53-23.47) thousand tons per year, which is statistically significant 4.53 times higher than in the city of Dnipro, 6.13 higher than in the city of Kamyanske and 997.3 times higher than in Novomoskovsk ($p<0.001$). According to the results of the hygienic assessment of atmospheric air pollution in the studied cities, it was found that on average during the observation period, formaldehyde concentrations statistically significantly exceeded the MPC by 3.19-4.58 times. In Kamyanske, an excess of phenol was observed on average by 2.11 times, and the levels of aromatic hydrocarbons did not exceed the MPC. Analysis of the morbidity rate of the child population of the studied cities allowed us to establish that in the cities of Dnipro, Kamyanske, and Kryvyi Rih, the level of general childhood morbidity was statistically significantly higher by 4-15% on average than in the Dnipropetrovsk region as a whole and by 14-37% higher than in Novomoskovsk ($p<0.05$). The incidence of respiratory diseases in children in the studied cities is statistically significantly higher by 13-39% than in Novomoskovsk ($p<0.001$). The highest incidence of circulatory system diseases in children was found in Dnipro (102.8 (95% CI 92.7-112.9)) per 10 thousand children, which is statistically significantly higher by 96% than in Kryvyi Rih (52.4 (95% CI 46.15-58.65) per 10 thousand children) and 56% higher than in Kamianske (65.9 (95% CI 57.46-74.27) per 10 thousand children) ($p<0.001$). In the cities of Dnipro, Kryvyi Rih and Kamianske, the incidence of children with CSC diseases is statistically

significantly 2.25-4.43 times higher than in the control city (23.2 (95% CI 15.95-30.42) per 10 thousand children) ($p<0.001$). The population carcinogenic risk for the city of Dnipro is 4980 additional cases of cancer from exposure to benzene and 133 additional cases from exposure to formaldehyde in a population cohort of 1 million people. For Kryvyi Rih, these indicators will be 1864 additional cases of cancer from exposure to benzene and 136 cases from exposure to formaldehyde in a population cohort of 1 million people. In the city of Kamianske, 3818 additional cases of cancer from exposure to benzene and 133 cases from exposure to formaldehyde in a population cohort of 1 million people are predicted. According to the results of the conducted studies, it was found that the total non-carcinogenic risk is highest in Kamianske HI total = 5.84, in Dnipro HI total = 5.1, and in Kryvyi Rih – HI total = 4.15. In the studied cities, an unacceptable non-carcinogenic risk was established for the respiratory system, CNS, and immune system. In Kamianske, an unacceptable non-carcinogenic risk was noted for the cardiovascular system.

Conclusion.

Based on the analysis and generalization of the results obtained, methodological approaches to diagnosing and predicting environmentally-related risks of developing diseases in the child population were substantiated; priority sources of atmospheric air pollution of industrial cities with aromatic hydrocarbons, phenol, and formaldehyde were identified.

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