THE INFLUENCE OF AIR POLLUTION ON MORBIDITY POPULATION OF SUMY REGION

Anatoliy Kornus
Sumy State Pedagogical University, Ukraine

As we know, human health and its morbidity are determined by four groups of factors: genetic health (20%), lifestyle and quality of food (50%) of the environment (20%) and level of health care (10%). On average 45% of toxic substances enter the human body with food, 30% – from drinking water, the rest – through the air. However, given airtechnogenic water and soil pollution, and along with them food, air pollution, in our opinion, is one of the most negative impacts on the population health. It leads to a large number of diseases that can cause of mortality.

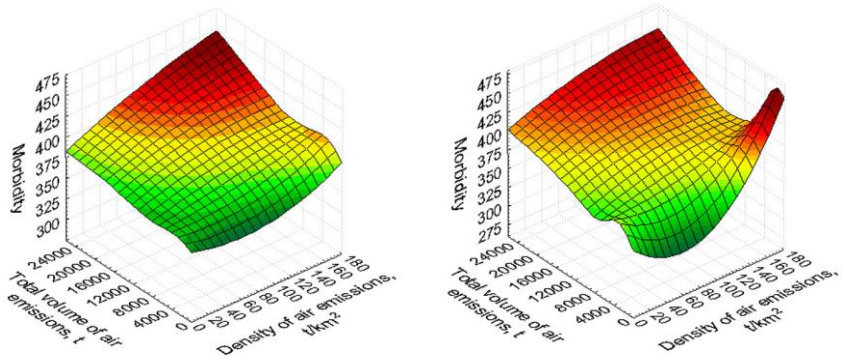
Explanation of the role of environmental factors in shaping the overall health of the population and finding dependencies and relationships between these phenomena is, in our opinion, perhaps the most important problem in the regional environmental analysis. However, reaction to the influence of different natural and economic factors are very difficult, so finding the relationships between severity and specificity of the environmental situation and level of morbidity is a key point in the implementation of health monitoring and environmental monitoring in general. To do this we must apply the most adequate methods of data processing that can clearly interpret the results. In modern conditions the application of quantitative methods of analysis necessary to obtain informative and objective results.

As an example application of such quantitative methods we present calculation of dependence of the oncology morbidity of population of the Sumy region from of ecological state of the air. Cancer chosen based on the fact that they are reliable markers that characterize the general state of health, and air – on the basis of the above arguments about its specific role in the negative health effects. To find the above-mentioned dependence we have used method pair and multiple correlations. Correlations were visualized using *2D* scatterplots that show the relationship between two variables X and Y (eg, morbidity and air emissions). For most indicators obtained average values of the coefficients of pair correlation (r = 0.4-0.46), which have been checked for authenticity by using of the V. Chervyakov criterion. Correlation analysis allows us not only to determine the closeness of the connection between events, but also empirical formulas to calculate dependencies, according to which for some features you can find others.

The relationship between cancer morbidity and total volume of emissions is expressed by a linear regression $y = –19952.6+65,7x$ ($r = 0.46$), the relationship between cancer incidence of population and density of pollutants emissions $y = –189.3+0.59x$ ($r = 0.44$), the connection between cancer rates and the amount of emissions from stationary sources of air pollution can be described by the equation $y = –8.13+0.03x$ ($r = 0.4$), and the relationship between the oncology incidence of the population and the amount of emissions from mobile sources $y = –9842,2+34x$ ($r = 0.4$).

The coefficient of multiple correlation of the most significant (r = 0.52) was in clarifying the dependence of population morbidity from the total volume and density of emissions. Therefore, this connection has been studied more by constructing *3D* surface graphs. Used for plotting the points fit a three-dimensional scatter plot. Instead of the original data points on the statistical charts of this type is represented by the surface, which is a smooth image data obtained by using one of the possible procedures for adjustment or conversion. This representation allows revealing hidden data structure and the relationship between three variables (emission of pollutants into the atmosphere, their density and cancer incidence of population).

After analyzing several types of graphs of surfaces which can be adjusted to our data and various smoothing methods (from simple linear function of surface features to which "smooth" the data and approximate the surface with a given level of density) in our study, we decided on the method of distance weighted least squares and method of bicubic spline smoothing (Fig. 1). These methods of surface fitting can be useful for finding non-linear and non-monotonous relationships between medical-environmental and ecological indicators.



a) b)

Figure 1. *3D* surface graphs of depending of the population oncology morbidity (cases per 100,000 populations) on the total volume and density of air emissions of Sumy region: a) the method of smoothing splines, b) the method of distance weighted least squares.

The study showed the importance and need for medical and environmental research in the environmental analysis, which should become an integral component. It was found that the level of oncology morbidity depends on the level of air pollution, given the quantitative expression of this dependence.