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## THE IMPACT OF TECHNOGENIC FACTORS ON HUMAN SKIN CANCER INCREASE IN THE ODESA REGION

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### Abstract

It is known that malignant diseases are one of the most important medico-biological and socio-economic problems in the world and, especially, in Ukraine. Cancer is a worldwide problem; about 2.9 million new cases of the disease are registered annually in the developed countries of the world and more than 3 million in developing countries. The causes of the face skin cancer like all other malignant neoplasms are not fully established. The pesticides are known to provide a wide range of effects on the human body and, in particular, a complex of various types of biological activity - cytogenetic, carcinogenic, teratogenic, embryotoxic, etc. The main purpose of this work is to determine the consequences of agrochemicals use in 1970-1990<sup>th</sup> on the human skin malignant neoplasms incidence increase after 1990 based on the statistical indicators evaluation in the department of dermatology and in the Zonal agrochemical laboratory. The characteristics of main factors of the anthropogenic impact on the environment, abundance and residual quantity of pesticides in the geological habitat of the Odessa region were examined. According to the method of correlation analysis the relation between application of pesticides and sickness rate of the cancer of the skin of face and body.

Authors conclude that Odesa region geological environment contamination with polyagrochemicals (soil cover, bottom sediments of reservoirs and watercourses, as well as groundwater) leads to toxic pollution of the biosphere and has a carcinogenic effect on the body, which ultimately leads to an increase in episodes of malignant neoplasms of the skin of the body in the Odesa region. The comparative analysis showed that the sickness rate of the cancer of skin of body in the village and urban sector is approximately equal. The uncontrolled use of pesticides from 1960 to 1990 had a negative impact on the formation of malignant neoplasms indexes in the Odesa Region, which increased significantly, especially over the last two decades.

**Key words: malignant diseases; skin cancer; pesticides; technogenic impactm Ukraine; Odesa region**

It is known that malignant diseases are one of the most important medico-biological and socio-economic problems in the world and, especially, in Ukraine. Cancer is a worldwide problem; about 2.9 million new cases of the disease are registered annually in the developed countries of the world and more than 3 million in developing countries.

The total cancer incidence in Ukraine over the last 10 years was about 160,000 patients per year. 100,000 people die from cancer every year.

The causes of the face skin cancer like all other malignant neoplasms are not fully established. The data of domestic and foreign authors indicate that skin cancer occurs against the background of precancerous and background conditions [1-3, 5, 6].

A special role has been attributed to technogenic factors in recent years occurred as consequences of agrochemicals which contribute to an increase in number of both the inflammatory skin diseases and cancer [4, 7-10].

The pesticides are known to provide a wide range of effects on the human body and, in particular, a complex of various types of biological activity - cytogenetic, carcinogenic, teratogenic, embryotoxic, etc.

We solved the following tasks.

1. To investigate and evaluate the impact of technogenic factors (chlorine and organophosphorus), namely, pesticides in the formation of oncological morbidity indicators of the human skin in the Odesa region.

2. To analyze the data of the Odesa Zonal Agrochemical Laboratory, regional sanitary and epidemiological service (SES) and indicators of morbidity of the population of the Odesa region during the period of investigation.

3. To provide a comparative analysis of skin cancer incidence in Odesa region with other regions of Ukraine.

**The purpose** of the study is to determine the consequences of agrochemicals use in 1970-1990<sup>th</sup> on the human skin malignant neoplasms incidence increase after 1990 based on the statistical indicators evaluation in the department of dermatology and in the Zonal agrochemical laboratory.

### **Materials and methods**

The laboratory indicators of the Odesa Zonal Agrochemical Laboratory, the regional SES on the use of polyagrochemicals throughout the period from 1960 till 1990 compared with the same indexes after 2000 were the material of the research.

The indexes of human skin morbidity were studied according to the statistical data of Odesa National Medical University Department of Dermatology. 3,000 disease histories of patients who were examined and treated in the Department of Dermatology from 1980 to 2008 were studied. A comparative statistical analysis of onco-otolaryngological disease indicators before and after 2000 was performed.

### **Results**

The analyzed material of the Odesa Zonal agrochemical laboratory and the regional SES for the period throughout 1960 till 1990 and from 2000 till the present time showed widespread and uncontrolled use of pesticides during 30 years (1960-1990). The system of accounting for the use of pesticides was not sufficiently complete which made it difficult to determine their structure and total mass. Undoubtedly, this caused a certain toxic effect on the biosphere and had a negative impact on the formation of health indicators of the population of Ukraine and Odesa region.

According to the data of the Zonal agrochemical laboratory and the regional SES, in 1960-1990 there was a significant excess of chlorine and organophosphorus standards in the soil (the first object) in the amount of DDT by 2-8 times and the gamma isomer of hexachlorocyclohexane (HCCH) by 2 times. Important: in the USSR from 1970 to 1980<sup>th</sup>, DDT and gamma-HCCG were prohibited for use due to their carcinogenic effect [10].

The bottom sediments of reservoirs and drains of the region represented the other object of pollution. Almost everywhere, bottom sediments contain residual amounts of organochlorine and some other classes of pesticides. Their prevalence is 80-100%. Since the organochlorine pesticides content in bottom sediments and in water is in dynamic equilibrium, this entails their inevitable presence in the water of these objects. Since the organochlorine pesticides content in the water of reservoirs and drains for fishing purposes is

not allowed, the fish for food purposes of all surface waters of the Odesa region is associated with a health risk. The dangerous content of pesticides of this class in fish tissues was discovered by M.F. Nazarenko (1996). In connection with granosan and pesticides use, high mercury contamination of fish was found during 1988-1990 [10].

The third important object is nitrate pollution of groundwater from livestock waste, silage fermentation, mineralization (decomposition) of various organic residues and nitrogen fertilizers.

Phosphogypsum was used longer time for the chemical reclamation of saline soils in the Odesa region. This product released during the sulfuric acid decomposition of natural phosphates for phosphorus fertilizers. Thus, this meliorant (phosphogypsum) contains uranium, radium, thorium and other radioactive elements [4, 7].

Currently, laboratory data indicate the presence of residues of agrochemicals in agricultural products and confirm the presence of residual amounts of pesticides in plant products, including those whose presence is not allowed by existing regulations [7]. It should be emphasized that a high, but initially low level of food contamination with agrochemicals due to their prolonged action can be potentially dangerous. Unfortunately, after 1990, there was no State Program to ensure control over the process of applying fertilizers to the soil.

A comparison of the indicator of total morbidity and soil load with pesticides by Ukrainian regions is shown on Fig. 1. One could see that morbidity is generally higher in those regions where the mass of applied pesticides is greater.

Thus, in the Odesa region, the mass of used pesticides reached more than 6,000 tons/km<sup>2</sup> per year, which led, in our opinion, to the largest increase in human skin cancer and other localizations from 1990 to the present (390 patients per 100,000 population).

Fig. 1 reflects that the soil loading with pesticides was not uniform across regions. So, for example, the load module in this period in Kyiv and Mykolaiv Regions, etc. was from 2000 to 4000 tons/km<sup>2</sup> per year. These indexes also indicate that the soil is overloaded, but much less than in the Odesa Region.

It should be mentioned that in the 50s and 60s of the 20th century, the pesticide load per km<sup>2</sup> per year ranged from 30 to 90 kg.

The analysis of skin cancer incidence rate distribution by regions of Ukraine (Fig. 2) showed a significant increase in the rate of skin cancer in the Odesa region during 1991-2000 compared to 1968-1972.

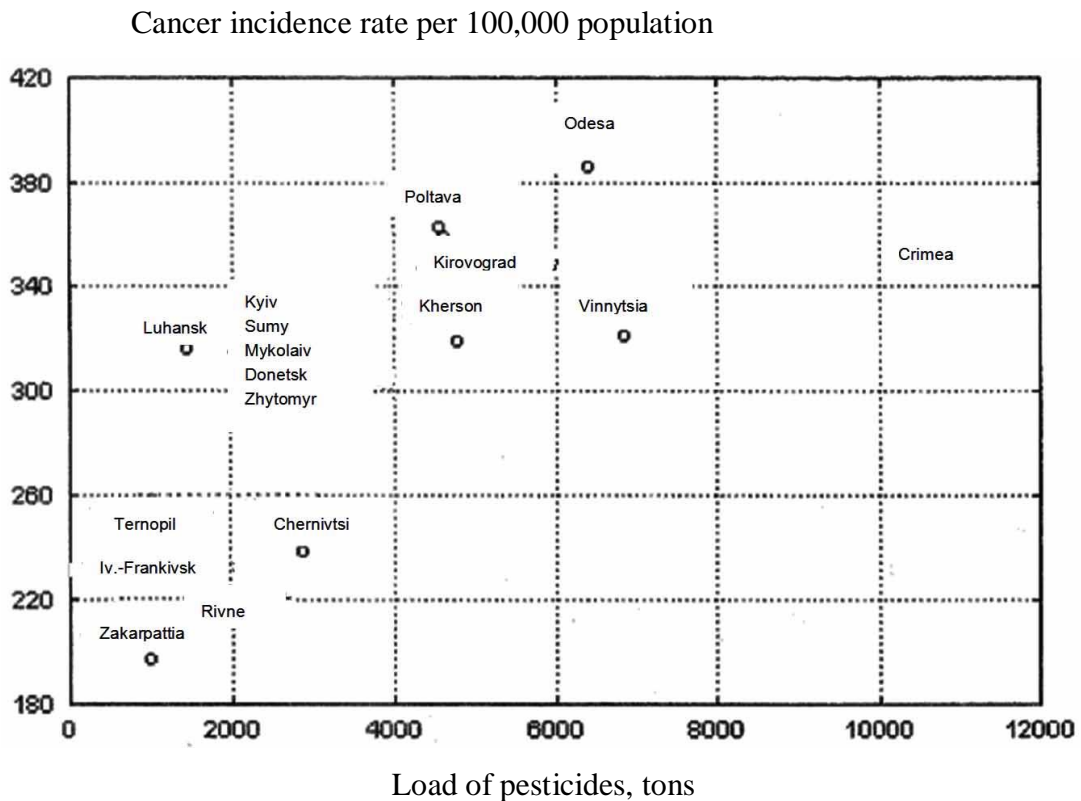


Fig. 1. The relationship of the cancer incidence rate (1991) with the average annual load of pesticides on the sown area for 1960-1990<sup>th</sup>

Thus, throughout the period 1990-2000, an average of 390 patients who first fell ill with skin cancer of the face and trunk were registered in the department of dermatology. For comparison, up to 100 patients with this pathology were diagnosed during the period of 1980-1990<sup>th</sup>.

Out of 390 patients in 1990-2000, an average of 196-192 rural and 194-198 urban patients were identified. These data also confirm the malignant neoplasms growth in the Odesa region and speak of an equalization of the city/village ratio of patients.

The dynamic rows in Fig. 3 show the incidence in the Odesa Region during 1978 till 2000, and across Ukraine throughout 1980-2000. These indexes confirm the annual increase in patients with malignant neoplasms in Ukraine and a significant increase in the Odesa Region.

Cancer incidence rate per 100,000 population

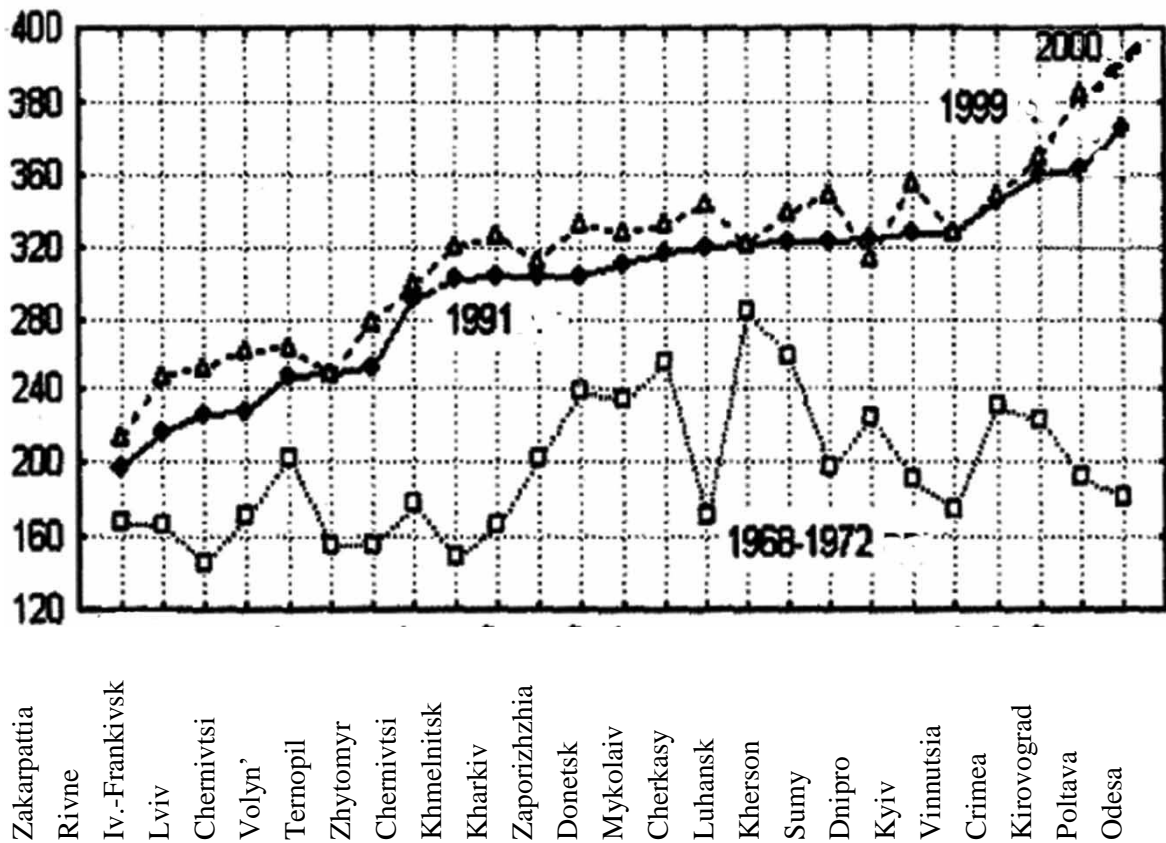


Fig. 2. Distribution of the cancer incidence rate by Ukrainian regions during 1968-1972 and in during 1991-2000

### Discussion

On the basis of the above, it is possible to emphasize the existing connection between man-made factors and the incidence of malignant neoplasms of the upper respiratory tract.

The analysis of data presented in Figs. 1-3 also establishes the growth of malignant neoplasms in those regions of Ukraine where the use of agrochemicals was greater.

Contamination of the geological environment of the Odesa region with polyagrochemicals (soil cover, bottom sediments of reservoirs and watercourses, as well as groundwater) leads to toxic pollution of the biosphere and has a carcinogenic effect on the body, which ultimately leads to an increase in episodes of malignant neoplasms of the skin of the body in the Odesa region.

Cancer incidence rate per 100,000 population

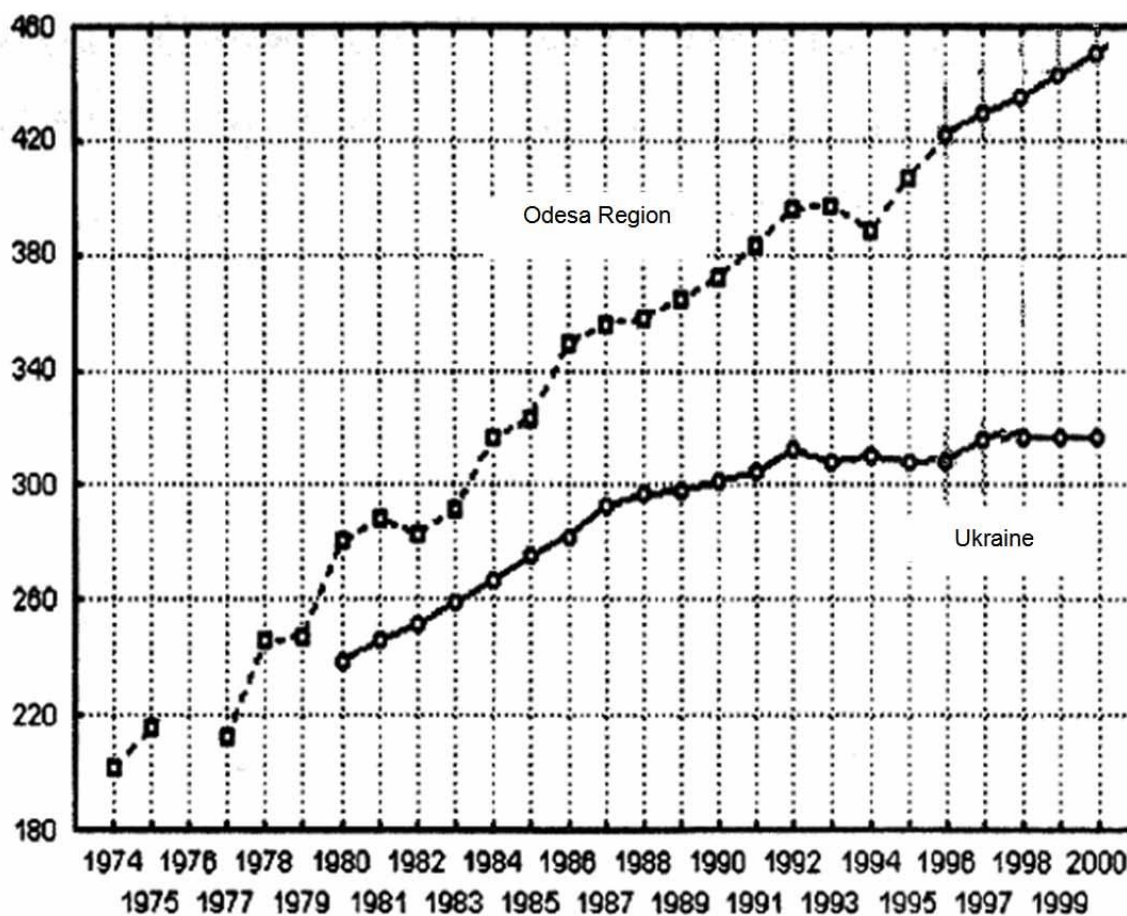


Fig. 3. Dynamics of the incidence of malignant neoplasms in Ukraine and Odesa region

2. The uncontrolled use of pesticides (6000 tons/km<sup>2</sup> per year) from 1960 to 1990 had a negative impact on the formation of malignant neoplasms indexes in the Odesa Region, which increased significantly, especially over the last two decades.

### Conclusions

1. Contamination of the geological environment of the Odesa region with polyagrochemicals (soil cover, bottom sediments of reservoirs and watercourses, as well as groundwater) leads to toxic pollution of the biosphere and has a carcinogenic effect on the body, which ultimately leads to an increase in episodes of malignant neoplasms of the skin of the body in the Odesa region.

2. The uncontrolled use of pesticides (6000 tons/km<sup>2</sup> per year) from 1960 to 1990 had a negative impact on the formation of malignant neoplasms indexes in the Odesa Region which increased significantly, especially over the last two decades.

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## Author Contributions

Conceptualization, (M.M. Lebedyuk & F.D. Yevchev); methodology, (M.M. Lebedyuk & F.D. Yevchev); formal analysis, (M.M. Lebedyuk); data curation, (F.D. Yevchev); writing—original draft preparation, (M.M. Lebedyuk); writing—review and editing, (F.D. Yevchev); supervision, (M.M. Lebedyuk & F.D. Yevchev).

All authors have read and agreed to the published version of the manuscript.

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### **Institutional Review Board Statement**

This scientific report did not require IRB approval, any patients were used to receive the information.

### **Informed Consent Statement**

The retrospective analysis of material was used. Written informed consent from the patients was not necessary to publish this paper.

### **Data Availability Statement**

The authors confirm that data supporting the results of this study are available in the materials of the Odesa Zonal Agrochemical Laboratory, regional sanitary and epidemiological service. The data presented in this study are available on request from the corresponding author.

### **Conflicts of Interest**

The authors declare no conflict of interest.