MEDICOBIOLOGIC AND ORGANIZATIONAL ASPECTS OF MORTALITY FROM CANCER OF DIGESTIVE SYSTEM IN UKRAINE AFTER THE CHERNOBYL ACCIDENT

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Summary. The analysis of dynamics of mortality of organs of digestive system aimed at detection of its features in population of whole Ukraine and contaminated after the Chernobyl nuclear power plant accident oblasts has been performed. Mortality rates have been calculated on the personal patients' data from National Cancer Registry database; methods of descriptive epidemiology, medical and mathematical statistics have been used. The analysis covered all deaths from cancer in Ukrainian population in 1998-2011 and tabular retrospective incidence data of 1976-1996. It has been ascertained that mortality from digestive cancers in Ukrainian population has steadily increasing tendency, excluding for stomach cancer, with higher growth rates in the radiation contaminated oblasts. Main indices of oncological aid organization during 25 years after Chernobyl accident have positive changes, but one-year mortality rates for esophagus and stomach cancers in the contaminated territories exceed one in Ukraine. Results of this analysis become a scientific background for anti-cancer activity priorities taking into account the dynamic and territorial characteristics of the epidemiological process.

Key words: cancer mortality, cancer epidemiology, personal data.

Introduction. Consequences of the Chernobyl accident resulted in the radiation pollution of most oblast’s territories made a significant contribution

to the aggravation of the environment state in Ukraine. General mortality level keeps its high value and cardiovascular system diseases and malignant neoplasms cause 75% of deaths in Ukraine. Some previous studies concerned thorough research of digestive system cancer incidence level of Ukraine and contaminated regions, but mortality level remained unexplored. In the meantime, analysis of cancer mortality rates in Ukrainian population helps to estimate both impact of radiation on behaviour of oncological diseases and quality of oncological aid to the population suffered from radiation.

Materials and methods

Analysis of dynamic models of mortality from digestive organs cancer (esophagus, stomach, colon and rectum) during 36 years (1976-2011) was done for population of whole Ukraine and of the most contaminated after the Chernobyl accident territories (Vinnytska, Volynska, Zhytomyrska, Kyivska, Rivnenska, Chernigivska oblasts). The study was carried out using personal records of cancer patients accumulated in Ukrainian National Cancer Registry (NCR) database and official statistic tables of Ministry of Public Health (Form № 6) verified for completeness and reliability at the time of statistical examinations in the regions. Cancer mortality rates were calculated for both genders together in compliance with available data in the official statistic tables of 1976-1997. In this study, methods of statistic analysis accepted in descriptive epidemiology and oncology were used. Data check of personal data records in NCR database based on medical informatics principles has been performed.

Results

Both qualitative and quantitative analysis of cancer mortality was done for population of Ukraine and oblasts with official status of suffered from radiation after the Chernobyl accident. Dietary habits and food quality, nutrition with contaminated with radiation foodstuff against the background of tobacco and alcohol abuse caused the peculiarity of development of incidence and mortality from malignancies of digestive organs processes.

It was detected that both in 1986 and 2011 digestive organs cancers constitute 29.6 and 30.8 % of deaths from cancer, that is every third death was caused by this pathological state. In the contaminated oblasts share of deaths from esophagus and stomach cancers was higher then in whole Ukraine (Fig. 1).

Esophagus cancer mortality rate in 1976 was higher than average Ukrainian one in Vinnytska oblast only; in 1986 this rate was lower than in whole Ukraine in Volynska and Rivnenska oblasts only; in 1996 this tendency remained the same; in 2011 esophagus cancer mortality rates of all oblasts but Volynska were higher than average Ukrainian one (Table 1, Fig. 1-2). During 25 years after the accident level of mortality decreased in Ukraine and in Vinnytska, Kyivska, Chernigivska oblasts, its decline rates in these oblasts were higher than in whole Ukraine. In other regions under study mortality level increased from 5.6 % in Kyivska oblast to128.6 % - in Rivnenska. In the comparison of intervals 1986-1996 to 1996-2011 growth of esophagus cancer mortality rate in all oblasts but Vinnytska and Kyivska in the first interval (increment rates in the contaminated territories were 2-2.3 times higher than in Ukraine) vs. intensive decrease of this mortality level in all regions but Rivnenska oblast, where it grew up by 65.5 %, was revealed.

Stomach constantly was on the 2nd place among the most frequent sites of cancer mortality in Ukraine. In 1976 average Ukrainian mortality rate for stomach cancer was 30.8 per 100000 of population and higher rates were in Zhytomyrska, Kyivska and Chernigivska oblasts; in 1986 average Ukrainian rate was exceeded in the same regions; in 1996 it was exceeded in all oblasts but Volynska and in 2011 – in Vinnytska, Kyivska and Chernigivska oblasts (Table 2, Fig. 4-5).

In 1976-1986 stomach cancer mortality rate was almost invariable. In 1986-2011 this rate decreased in all regions and its decline rate was higher than in whole Ukraine in Zhytomyrska and Kyivska oblasts only. In 1986-

1996 mortality rates have grown up in Rivnenska and Chernigivska oblasts and in 1996-2011 their decline rates increased in all oblasts by 23.9-44.7 %.

Level of mortality from colon cancer was growing in all regions under study but its value was lower than average Ukrainian one during all the period (Table 3, Fig.6-7).

Increment of colon cancer mortality rate in 1976-1986 was 55.1 % in Ukraine and 30.0-108.6 % in the contaminated territories; in 1986-2011 this rate increased by 51.7 % in Ukraine and in the contaminated territories but Kyivska oblast where registered higher increments – from 72.3 % in Vinnytska oblast to 88.9 % - in Chernigivska.

The highest increment rates of mortality from colon cancer in the contaminated areas were during the first 10 years after Chernobyl accident and in some regions exceeded 85 %. During 1996-2011 increment rates decreased and in Kyivska and Rivnenska oblasts mortality rate diminished.

Rectum cancer mortality constantly grew up in Ukraine but it has various increment rates in the contaminated oblasts (Table 4, Fig.8-9). In 1976 all these oblasts had lower levels of the mortality than average Ukrainian one. In 1986 the average level was exceeded in Zhytomyrska, Kyivska and Chernigivska oblasts, and in 2011 – in Vinnytska, Kyivska and Zhytomyrska oblasts.

In 1976-1986 rectum cancer mortality rate have grown up by 59.4 % in Ukraine and by 42.6-108.9 % - in all oblasts under study. In 1986-2011 this rate incremented in Vinnytska and Rivnenska oblasts – 3.0-3.6 times higher than in Ukraine, but it decreased in Volynska oblast.

Analysis of organization of oncological aid to digestive organs cancer patients was also done according to the main indices of its state: advanced stage, one-year mortality, percentage of treated patients and mortality-to-incidence ratio in 1986 and 2011. It was revealed that share of patients diagnosed with IV stage of the cancers in 2011 decreased 1.5-2.0 times in comparison with 1986. Positive changes were also revealed in percentage of

patients who received special treatment: it increased 1.5-4.0 times for various cancer sites. These improvements encouraged to expect reducing of mortality at least during the 1st year of the follow up. However, the comparison of this rate in 1986 and 2011 showed that esophagus cancer one-year mortality rate increased by 3.2 % in Ukraine and by 21-27 % - in Chernigivska and Rivnenska oblasts (Table 5). One-year mortality rate for stomach cancer remained almost unchanged in Ukraine and increased by 2-11 % in all oblasts under study but Chernigivska (Table 6). Colorectal one-year mortality has positively changed in whole Ukraine and in all regions (Table 7-8).

Apparently considerable is mortality-to-incidence ratio, which can be indirect criteria of quality of medical aid to cancer patients. It was detected that this ratio became better for all cancer sites of digestive system both in whole Ukraine and in some regions with radiation control. The worst value showed esophagus cancer: in 2011 for every 100 new esophagus cancer incident cases 78 deaths from this cancer were registered. In Rivnenska oblast this ratio was above 100 %, that is, for every 100 new cancer cases 107 deaths from this cancer occurred. In 2011 mortality-to-incidence ratio for stomach cancer was 75.7 % in Ukraine and above 78 % in Vinnytska, Volynska and Chernigivska oblasts. For colon cancer this ratio became worse in all regions but Kyivska and Chernigivska oblasts. Improvement of the ratio was registered for rectum cancer in all contaminated territories but Zhytomyrska oblast where this ratio increased.

Summary. Analysis of mortality from cancer of digestive system in Ukraine and contaminated with radiation oblasts revealed sufficient contribution of this disease on the structure of cancer mortality as its share is above 30 %. While level of mortality from all cancers is decreasing colorectal cancer mortality rate is growing, and its increment rates are higher in the contaminated territories. Stomach cancer mortality rate decreased in Ukraine and all regions under study. Esophagus cancer mortality rate decreased in

Ukraine, Vinnytska and Chernigivska oblasts; in all other regions it was growing.

One-year mortality rate for all digestive system cancers remained high: from 30 % for colorectal cancer to 70 % for esophagus cancer. During whole period of the study mortality-to-incidence ratio have extremely high value; in 2011 it was practically higher 50-70 % for various cancer sites.

Thus, this study indicates significant problems in organization of oncological aid to digestive system cancer patients and necessity to take effective measures for it improvement in whole Ukraine and in the contaminated with radiation oblasts.

Table 1. Dynamics of cancer mortality, esophagus

Administrative territory	Rate per 100,000 of population				Increment rate (%)			
	1976	1986	1996	2011	1976-1986	1986-1996	1996-2011	1986-2011
Ukraine	2,3	3,4	4,0	3,2	47,8	17,6	-20,0	-5,9
Vinnytska	3,7	5,6	5,2	4,3	51,4	-10,7	-14,0	-23,2
Volynska	1,2	2,4	3,2	3,1	100	33,3	-3,1	29,2
Zhytomyrska	2,7	3,9	5,5	4,7	44,4	41,0	-14,5	20,5
Kyivska	2,9	5,0	5,0	3,8	72,4	--	-24,0	5,6
Rivnenska	0,7	2,1	2,9	4,8	200	38,1	65,5	128,6
Chernigivska	2,0	4,3	4,6	4,0	115	7,0	-13,0	-7,0

Table 2. Dynamics of cancer mortality, stomach

Administrative territory	Rate per 100,000 of population				Increment rate (%)			
	1976	1986	1996	2011	1976-1986	1986-1996	1996-2011	1986-2011
Ukraine	30,8	30,5	26,3	18,7	-1,0	-13,8	-28,9	-38,7
Vinnytska	25,3	27,4	27,3	21,5	8,3	-0,4	-21,2	-21,5
Volynska	26,5	24,3	19,7	15,0	-8,3	-18,9	-23,9	-38,3
Zhytomyrska	33,3	32,4	30,4	16,8	-2,7	-6,2	-44,7	-48,1
Kyivska	37,8	38,6	32,8	19,7	2,1	-15	-39,9	-49
Rivnenska	25,8	26,3	27,1	16,9	1,9	3,0	-37,6	-35,7
Chernigivska	42,2	34,7	37,6	25,1	-17,8	8,4	-33,2	-27,7

Table 3. Dynamics of cancer mortality, colon

Administrative territory	Rate per 100,000 of population				Increment rate (%)			
	1976	1986	1996	2011	1976-1986	1986-1996	1996-2011	1986-2011
Ukraine	5,7	8,9	11,0	13,5	55,1	23,6	22,7	51,7
Vinnytska	4,4	6,5	9,4	11,2	48,4	44,6	19,1	72,3
Volynska	3,1	4,4	6,6	8,0	42,7	50,0	21,2	81,8
Zhytomyrska	4,0	5,2	7,5	9,8	30,0	44,2	30,7	88,5
Kyivska	3,8	6,9	9,8	9,6	79,7	42,0	-2,0	39,1
Rivnenska	2,3	4,8	8,9	8,6	108,6	85,4	-3,4	79,2
Chernigivska	3,0	5,4	9,3	10,2	80,0	72,2	9,7	88,9

Table 4. Dynamics of cancer mortality, rectum and anus

Administrative territory	Rate per 100,000 of population				Increment rate (%)			
	1976	1986	1996	2011	1976-1986	1986-1996	1996-2011	1986-2011
Ukraine	6,4	10,2	11,5	12,3	59,4	12,7	7,0	20,6
Vinnytska	5,4	7,7	8,6	12,6	42,6	11,7	46,5	63,6
Volynska	4,6	7,8	7,4	7,1	69,6	-5,1	-4,1	-9
Zhytomyrska	5,5	10,6	11,3	12,9	92,7	6,6	14,2	21,7
Kyivska	5,6	11,7	11,4	12,3	108,9	-2,6	7,9	5,6
Rivnenska	3,4	6,2	9,9	10,8	82,4	59,7	9,1	74,2
Chernigivska	5,6	10,7	10,2	11,9	91,1	-4,7	16,7	11,2

Table 5. Main indices of oncological aid organization to esophagus cancer patients.

Administrative territory	Stage IV, %		Died during the 1st year of the disease, %		Received special treatment, %		Mortality/incidence, %	
	1986	2011	1986	2011	1986	2011	1986	2011
Ukraine	31,9	18,4	65,4	68,6	34,0	50,7	85,0	78,0
Vinnytska	45,1	31,8	70,4	70,3	37,2	40,0	78,9	89,6
Volynska	17,2	31,1	77,4	46,2	14,0	68,9	80,0	70,5
Zhytomyrska	27,5	21,7	61,8	68,8	36,4	43,5	76,5	77,0
Kyivska	22,7	16,2	59,8	53,3	39,9	47,1	84,7	66,7
Rivnenska	32,3	16,7	48,3	75,0	27,5	45,2	84,0	106,7
Chernigivska	32,7	31,7	59,7	70,6	41,3	60,0	89,6	81,6

Table 6. Main indices of oncological aid organization to stomach cancer patients.

Administrative territory	Stage IV, %		Died during the 1st year of the disease, %		Received special treatment, %		Mortality/incidence, %	
	1986	2011	1986	2011	1986	2011	1986	2011
Ukraine	41,0	32,7	60,2	60,9	29,1	46,1	85,2	75,7

Vinnytska	42,0	30,4	56,7	61,6	24,5	38,3	76,1	79,3
Volynska	43,5	39,6	47,3	53,3	27,2	52,5	75,5	78,9
Zhytomyrska	43,5	40,9	62,1	62,6	28,0	35,1	78,3	72,7
Kyivska	33,5	35,8	44,3	55,3	29,6	55,9	80,2	73,5
Rivnenska	48,2	22,1	59,3	61,7	22,2	45,1	83,2	73,2
Chernigivska	48,5	46,8	71,6	60,2	35,2	53,5	78,3	78,7

Table 7. Main indices of oncological aid organization to colon cancer patients.

Administrative territory	Stage IV, %		Died during the 1st year of the disease, %		Received special treatment, %		Mortality/incidence, %	
	1986	2011	1986	2011	1986	2011	1986	2011
Ukraine	29,6	19,0	43,1	36,9	47,7	69,7	69,0	57,0
Vinnytska	22,8	14,5	39,3	35,1	35,1	63,3	51,2	57,1
Volynska	33,3	24,2	46,2	32,9	39,9	80,0	36,7	54,8
Zhytomyrska	29,2	29,6	40,5	35,6	32,5	74,4	41,9	54,1
Kyivska	21,0	19,1	39,4	31,4	50,7	81,9	49,3	44,2
Rivnenska	46,4	14,8	37,8	30,2	30,8	72,9	47,1	48,9
Chernigivska	25,9	25,0	45,3	33,5	51,9	79,4	50,0	48,8

Table 8. Main indices of oncological aid organization to rectum cancer patients.

Administrative territory	Stage IV, %		Died during the 1st year of the disease, %		Received special treatment, %		Mortality/incidence, %	
	1986	2011	1986	2011	1986	2011	1986	2011
Ukraine	23,7	15,3	33,4	31,1	47,0	71,8	77,9	59,4
Vinnytska	23,8	11,4	29,4	28,2	37,8	67,6	67,0	62,4
Volynska	26,4	20,8	36,6	25,0	41,7	77,9	59,5	47,7

Zhytomyrska	29,0	17,0	30,9	26,2	37,6	67,9	77,4	79,1
Kyivska	19,8	18,3	29,0	27,0	63,6	74,2	76,5	56,9
Rivnenska	29,0	14,4	27,9	28,4	34,7	75,3	64,6	57,8
Chernigivska	21,7	23,9	40,2	30,5	58,8	78,8	92,2	49,2

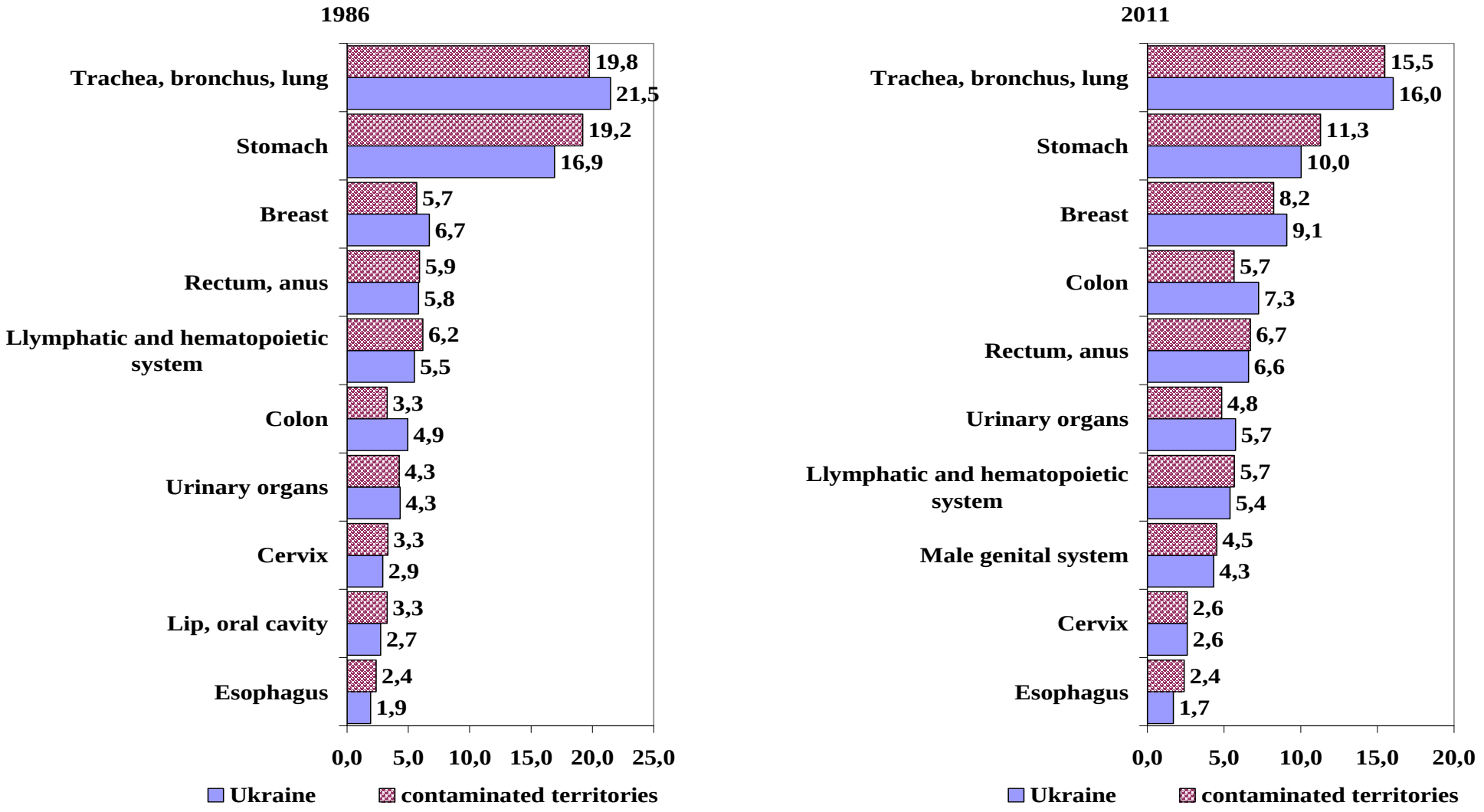

Figure 1. 10 most frequent sites of cancer mortality in Ukraine and contaminated oblasts, 1986 vs. 2011 (%)

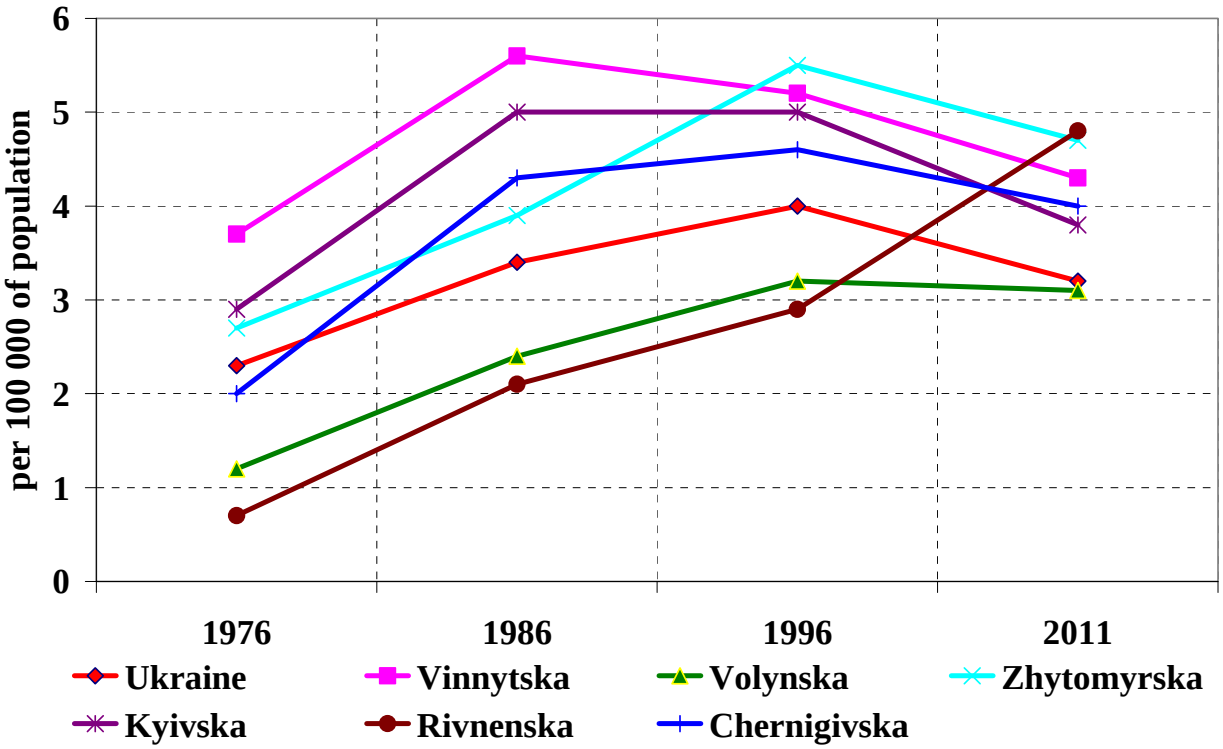

Figure 2. Cancer mortality in 1976-2011, esophagus

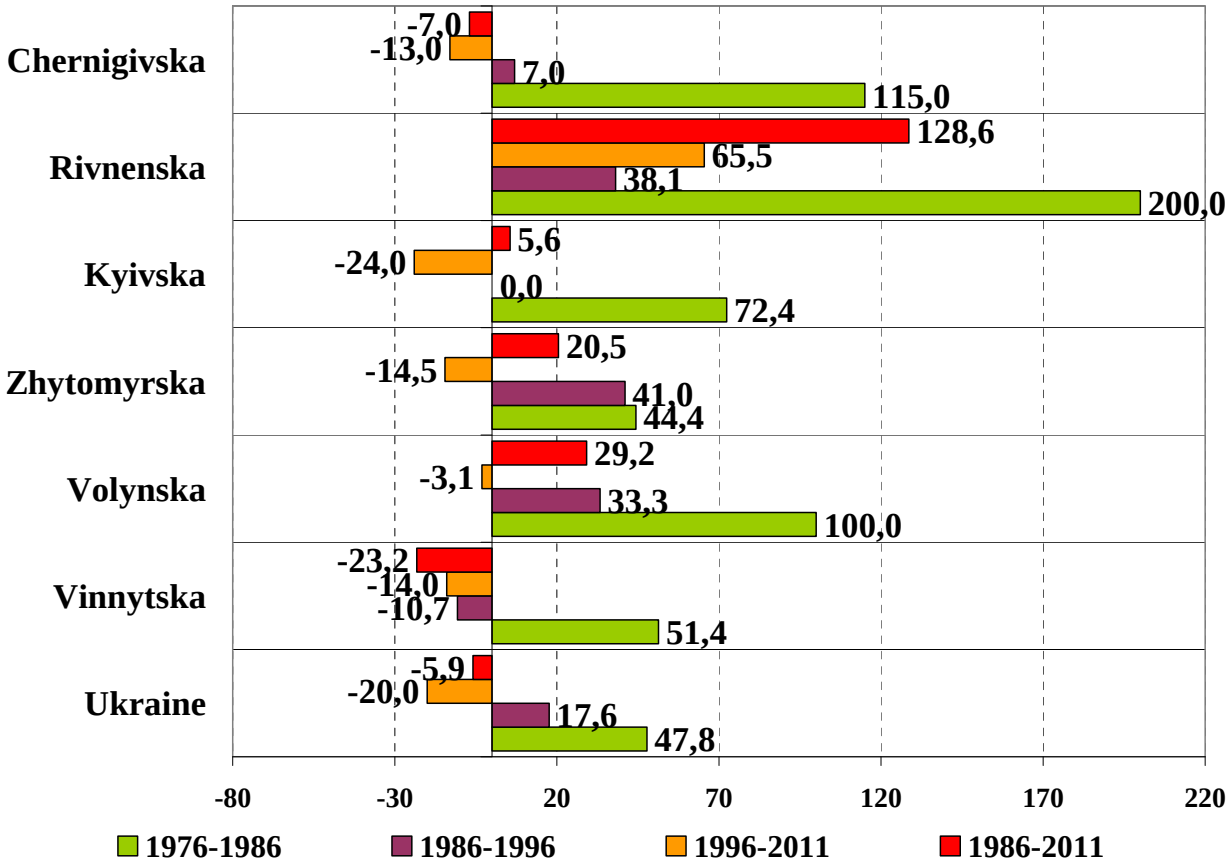

Figure 3. Increment of cancer mortality, esophagus (%)

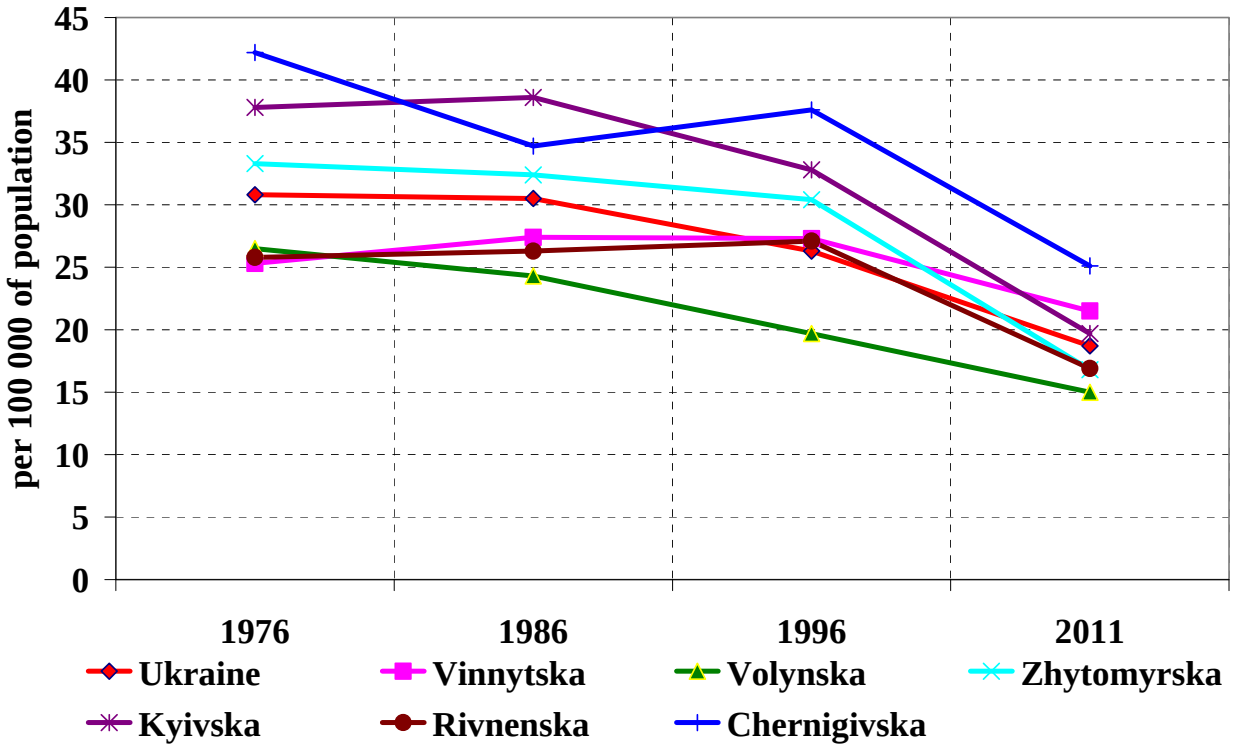

Figure 4. Cancer mortality in 1976-2011, stomach

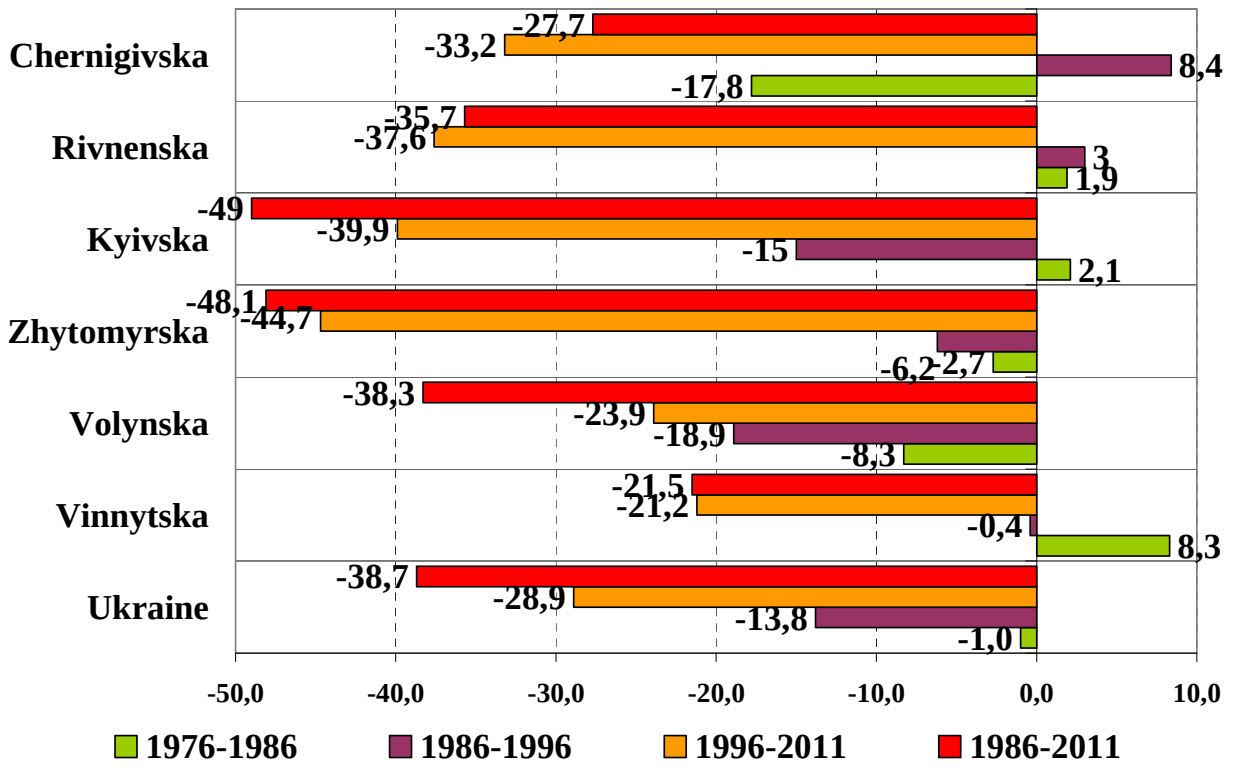

Figure 5. Increment of cancer mortality, stomach (%)

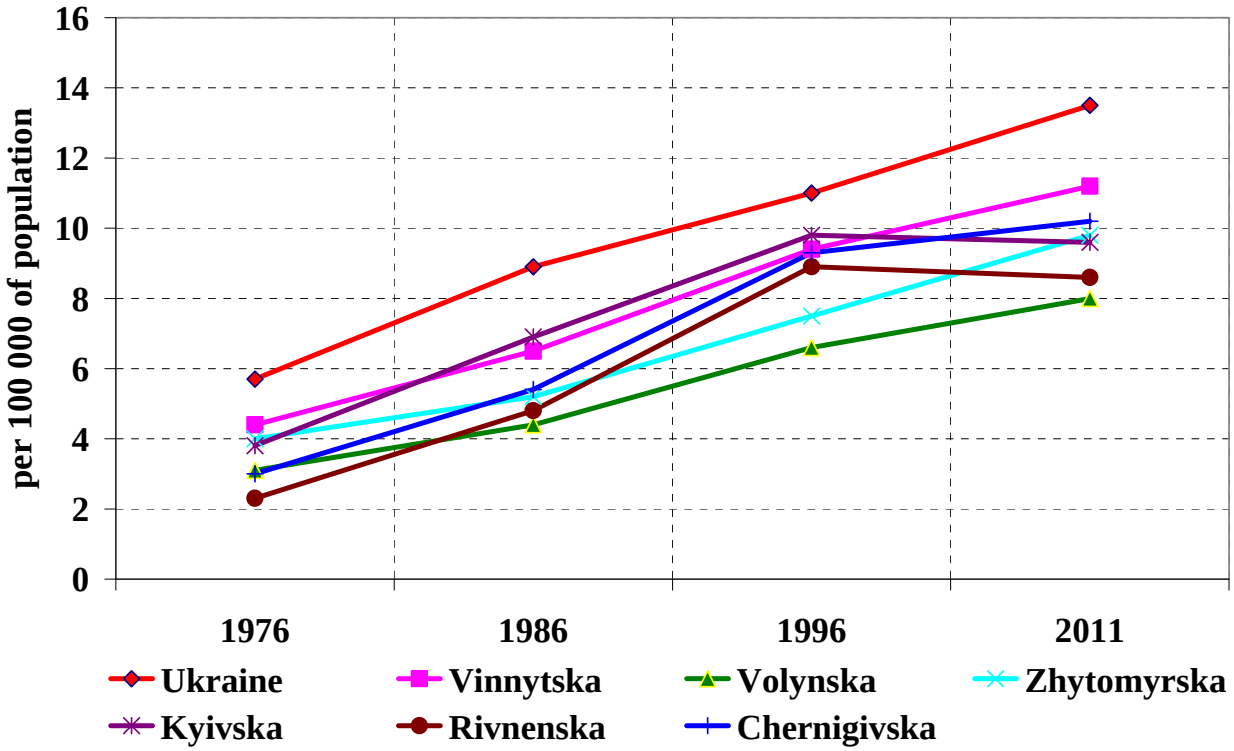

Figure 6. Cancer mortality in 1976-2011, colon

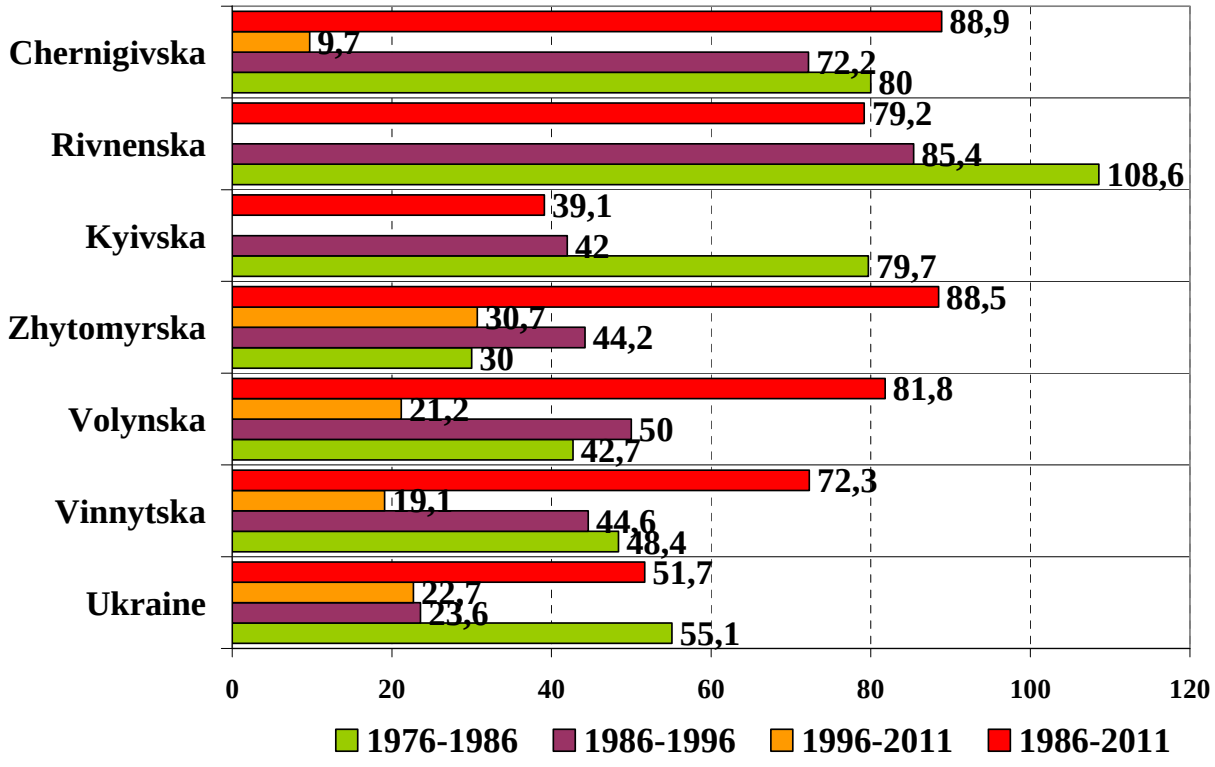

Figure 7. Increment of cancer mortality, colon (%)

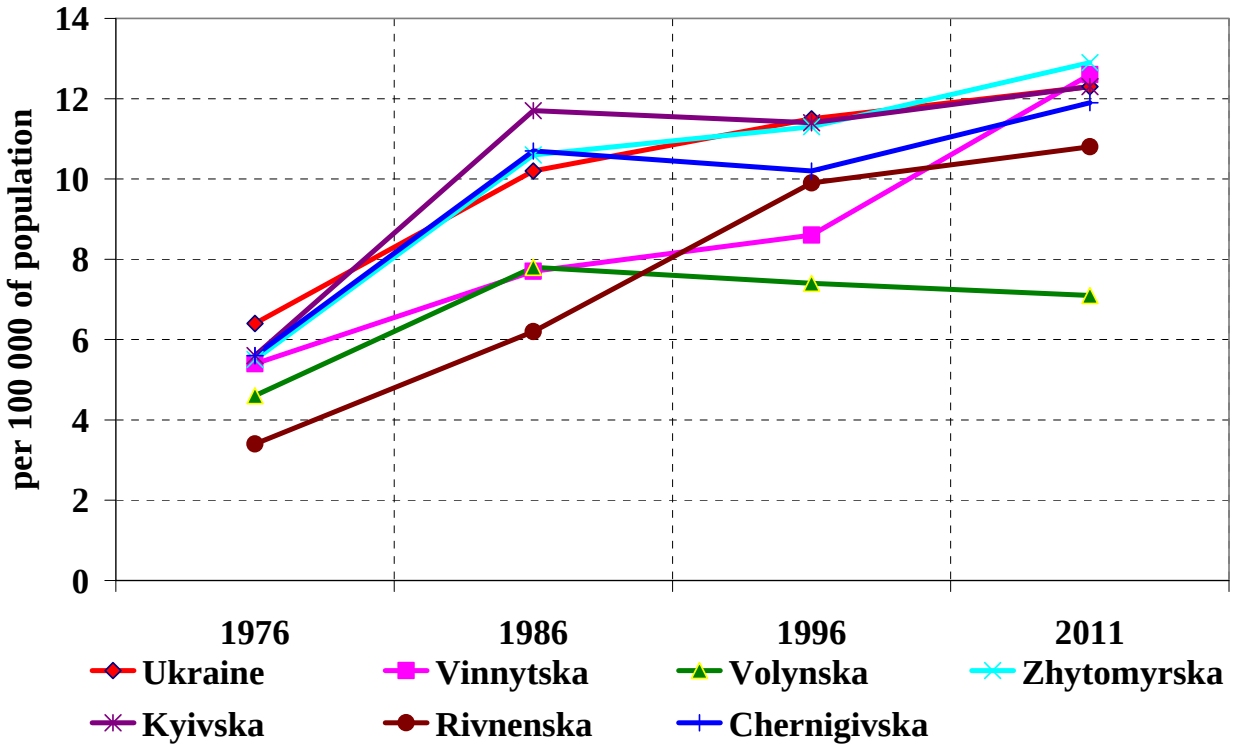

Figure 8. Cancer mortality in 1976-2011, rectum and anus

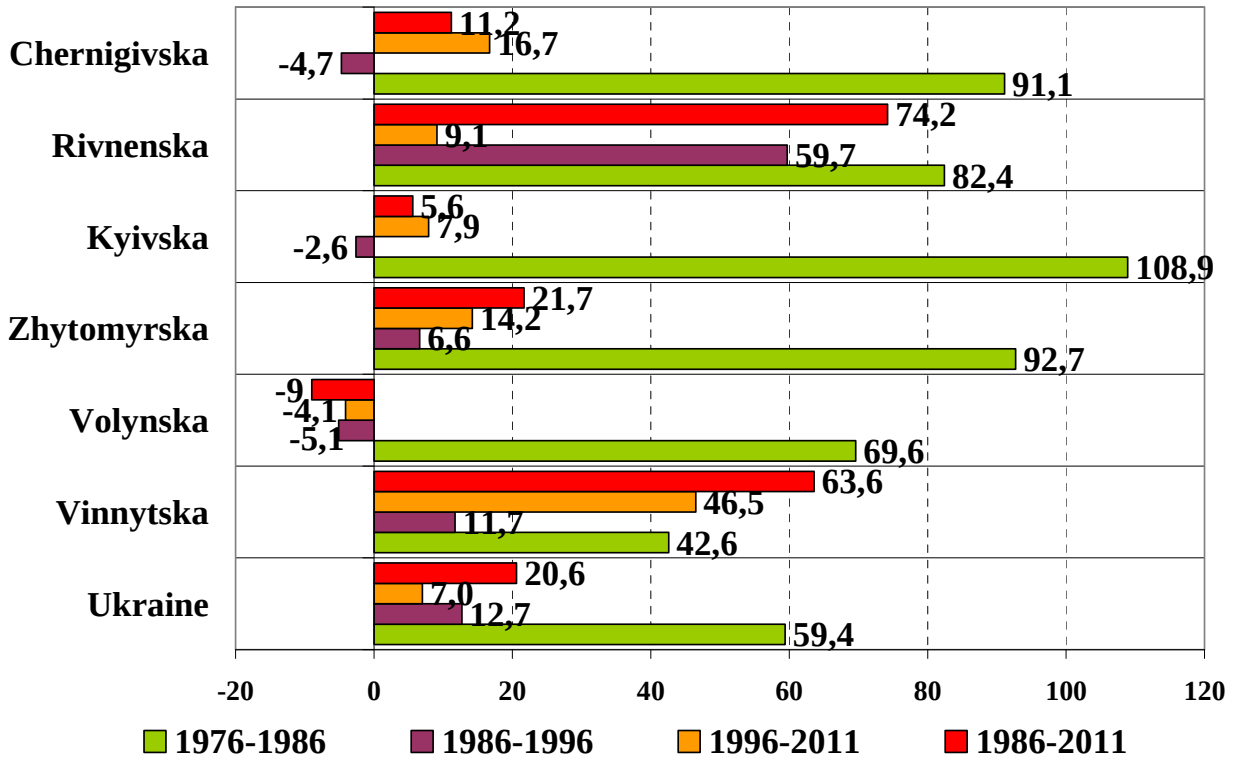

Figure 9. Increment of cancer mortality, rectum and anus (%)