

CANCER INCIDENCE OF DIGESTIVE SYSTEM IN UKRAINE AFTER THE CHERNOBYL ACCIDENT

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Summary. The analysis of incidence level in Ukraine in 1976-2010 showed that digestive cancer incidence of Ukrainian population has steadily increasing tendency with higher growth rates in the contaminated with radiation oblasts. Increment rate of colon cancer incidence in 1986-2010 in all contaminated oblasts, except for Kyivska, was higher than in whole Ukraine, this fact determines priorities of anti-cancer activity in Ukraine

Key words: cancer incidence, malignant neoplasms, cancer epidemiology, personal data.

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Introduction. In order to possible further realization of radiation effect of outcome of Chernobyl accident on the population health, National Cancer Registry permanently monitors oncoepidemiologic situation in Ukraine, including contaminated territories. Whereas there was a derived transfer of radioactive substances through the air and water after the accident, which caused considerable expansion of areal of radiation impact on the population and activated bio-ecologic chains that passes via the air, water and foodstuff, an epidemiologic study of dynamics of digestive system cancer incidence was conducted.

Materials and methods. Analysis of cancer incidence dynamic models of digestive organs (esophagus, stomach, colon and rectum) during 36 years (1976-2011), including 25-year period after the Chernobyl accident, was done for male and female population. Comparative analysis of cancer incidence of digestive tract in whole Ukraine and in the contaminated after the Chernobyl accident territories (Vinnytska, Volynska, Zhytomyrska, Kyivska, Rivnenska, Chernigivska oblasts) was conducted. The study was carried out using personal records about cancer patients accumulated in Ukrainian National Cancer Registry (NCR) database and official statistic tables of Ministry of Public Health (Forms № 61-zh and № 6) verified for completeness and reliability at the time of statistical examinations in the regions. Colon cancer incidence was studied since 1989, when this information became available in the official statistic tables. 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 affection was done, using research of dynamic and structural characteristics of cancer incidence in Ukraine and most contaminated with radiation oblasts. It was detected that 10 most frequently diagnosed cancer sites somewhat different in Ukraine and in the contaminated oblasts. Thus, stomach cancer occupied 2nd place in male population of the contaminated territories and had unit weight 9.4%, and in Ukraine this cancer occupied 4th place and had unit weight 8.4%; esophagus cancer had unit weight 2.0% in Ukraine and 2.8% – in contaminated with radiation oblasts. 5th most frequently diagnosed cancer of stomach had unit weight 5.5% in the contaminated oblasts and 5.1% - in Ukraine; colon cancer occupied 4th place in Ukraine and 6th place in the contaminated oblasts; rectum cancer – 6th and 7th places, respectively (Fig. 1).

Esophagus cancer incidence rates, both general and age-standardized, were lower than average Ukrainian rates in Volynska and Rivnenska oblasts only; this tendency remained in 1986 and 1996. In 2011 esophagus cancer incidence rate of male population in all regions under study was higher than in whole Ukraine. Increment of this rate in 1986-1996 in Ukraine was 18.6%, and in the contaminated territories it was from 19.0% in Chernigivska oblast to 58.8% in Rivnenska oblast; low increase of the rate was in Volynska oblast - 1.6% (Table 1, Fig. 2-3). In 1986-2011 in whole Ukraine increment of this rate was 8.6%, and in the contaminated with radiation oblasts it reached: 76.5% in Rivnenska oblast, 43.5% - in Volynska, 24.2% - in Zhytomyrska, 6.8% - in Kyivska; decrease of the rate was in Chernigivska (-5.0%) and Vinnytska (-3.2%) oblasts.

In female population of Ukraine in 1986-1996 esophagus cancer incidence rate reduced by 14.3%, but it increased in the contaminated with radiation oblasts: in Vinnytska - by 14.3%, in Chernigivska – by 114.3%, in Rivnenska – by 33.3%, decrease of the rate was in Kyivska (-4.5%) and Zhytomyrska (-45.5%) oblasts (Table 2, Fig. 4-5). During the next period 1996-2011 female esophagus cancer incidence declined in all oblasts under study except for Zhytomyrska, where it have grown up by 9.1%.

Stomach cancer was on the 4th place among the most frequent diagnosed cancers in male population of Ukraine, and on the 2nd place in the contaminated territories (Table 3, Fig. 6-7). During all the period of study general incidence rate of stomach cancer only in Volynska and Rivnenska oblasts was lower than average Ukrainian one. In 1976 age-standardized incidence rate

of stomach cancer was higher than in whole Ukraine in Zhytomyrska, Kyivska and Chernigivska oblasts; in 1986 and 1996 it was lower in Volynska and Vinnytska oblasts; in 2011 stomach cancer incidence level was higher than in whole Ukraine in all contaminated territories except for Volynska and Zhytomyrska oblasts.

Decrease of stomach cancer incidence of male population in 1986-2011 was registered both in Ukraine and in all oblasts under study, and all incidence decline rates exceeded average Ukrainian one except for Chernigivska oblast. In 1976-1986 reducing of stomach cancer incidence was in Zhytomyrska and Chernigivska oblasts only, and in 1986-2011 its level intensively went down in all contaminated with radiation oblasts.

Stomach cancer is on the 7th place among the most frequently diagnosed cancers in female population of Ukraine, and on the 5th place – in oblasts under study. The largest incidence decline rates of stomach cancer of female population in 1976-1986 were in Zhytomyrska oblast – 33.6%, Rivnenska – 29.4% and Chernigivska – 30.4% (Table 4, Fig. 8-9). Concerning dynamics of incidence level we have to note that in 1976 stomach cancer incidence rate of female population in whole Ukraine exceeded one in Zhytomyrska, Kyivska, Rivnenska and Chernigivska oblasts; in 1986 this tendency remained in Kyivska and Chernigivska oblasts; in 1996 stomach cancer incidence rate of female population in Vinnytska, Zhytomyrska and Rivnenska oblasts was lower than in whole Ukraine; in 2011 only Vinnytska and Chernigivska oblasts had stomach cancer incidence rate higher than Ukrainian one. In 2011 age-standardized stomach cancer incidence rates exceeded average Ukrainian level in all oblasts under study, except Volynska and Zhytomyrska. It should be also noted that incidence decline rates became slower during last years in Vinnytska, Rivnenska and Chernigivska oblasts; in 1986-1996 stomach cancer incidence rate almost did not reduce and even grew up by 7.9% in Zhytomyrska oblast, but in 1996-2011 sharp decrease of this rate in Zhytomyrska and Kyivska oblasts has occurred.

Dynamics of incidence of colon cancer in male population of the contaminated with radiation regions have certain characteristic properties. Since this rate was included in official statistics only starting from 1989, its values in 1976 and 1986 were estimated with the 2nd order polynomial regression based on the time series of incidence rates in 1989-2011 (Table 5, Fig. 10-11). The results received indicate that colon cancer age-standardized incidence rates of male population of contaminated territories did not exceed one in whole Ukraine, and increment rate in 1986-2011 was higher than average Ukrainian one in Zhytomyrska and Rivnenska oblasts only.

In female population, colon cancer incidence rate was growing during all time intervals of the study (Table 6, Fig. 12-13). This rate in whole Ukraine increased by 67.6% in 1986-2011, and increment rates in all contaminated oblasts, except Kyivska, were higher than in whole Ukraine.

Changes of age-standardized incidence rate of colon cancer in female population are not so pronounced, but main dynamic tendencies are the same, and this is evidence of true incidence increment, which is not associated with ageing of the population.

Among the three periods of study the highest increment rates of colon incidence level of female population were in 1996-2011 both in Ukraine and in all contaminated with radiation oblasts; this increment rate was lower than in whole Ukraine in Kyivska oblast only.

Incidence level of rectum cancer of male population was persistently growing, but there were different increment rates of it in various contaminated regions (Table 7, Fig. 11-15).

The highest increment level of rectum cancer incidence rate of male population during 1976-1986 was in Volynska, Zhytomyrska and Kyivska oblasts, where it exceeded average Ukrainian value. During 1986-1996 average Ukrainian level of this increment rate was exceeded in all contaminated with radiation oblasts, except Volynska; in 1996-2011 this excess remained in Chernigivska and Vinnytska oblasts. In age-standardized rates these characteristics were the same.

Rectum cancer constantly took one of the 10 leading places among the most frequent cancers in female population of Ukraine and the contaminated oblasts. Stable increase of both

general and age-standardized rates is characteristic for this nosologic form of cancer (Table 8, Fig.16-17).

Female incidence rates of rectum cancer in 1976 were lower than average Ukrainian value in all contaminated oblasts, except Kyivska and Chernigivska; in 1986 this average value was overtopped in Kyivska oblast; in 2011 rectum cancer incidence rates of Kyivska, Rivnenska and Chernigivska oblasts exceeded one of Ukraine. Age-standardized rates had similar dynamic tendency, and in 2011 incidence of female population of Kyivska and Rivnenska oblasts exceeded average Ukrainian value.

The highest increment rates of rectum cancer incidence during 1986-2011 were in female population of Rivnenska (91.9%), Chernigivska (78.4%) and Zhytomyrska (44.3%) oblasts; in Vinnytska, Volynska and Kyivska oblasts in 1996-2011 sharp increase of incidence rate took place after its fall in 1986-1996.

Analysis of cumulative risk of developing cancer of digestive system showed its growth during 1986-2011 in all sites, except stomach, for male population of Ukraine (Table 9). The most valuably increased risk of esophagus cancer (1.75 times); in the contaminated with radiation oblasts it increased 2-10 times, with greatest values in Volynska and Rivnenska oblasts. Risk of developing stomach cancer decreased 1.5-1.9 times in all territories under study. Cumulative risk of developing colon cancer increased in all regions 1.4-1.9 times and most of all - in Zhytomyrska oblast. Cumulative risk to become ill with rectum cancer increased most of all in Vinnytska (2.1 times) and Chernigivska (2.0 times) oblasts, in 2011 value of this risk in Vinnytska oblast exceeded average Ukrainian level.

In female population cumulative risks of developing cancer of digestive system, except for stomach cancer, have grown too. Female risk rates were lower than those in males were for all sites of cancer. In all contaminated regions, except Kyivska oblast, increment of risk of developing colon cancer exceeded average Ukrainian level. Increment of cumulative risk to become ill with rectum cancer was lower than for colon cancer. Risk to become ill with stomach cancer in female population decreased 2 times in Zhytomyrska oblast and less – in other territories under study.

Summary.

1. Cancer incidence of digestive system of population of Ukraine and contaminated with radiation oblasts have grown up, except for stomach.

2. In 1986-2011 esophagus cancer incidence of male population was growing most intensively in Volynska and Rivnenska oblasts with increment value 43.5-76.5%, which is 5-9 times higher than in whole Ukraine. Female population had significantly lower esophagus cancer incidence level than male population; variations of rates in regions under study have been observed.

3. Colon cancer incidence of male population increased in 1986-2011 by 32.0-145.1%, with most valuable increase in Zhytomyrska and Rivnenska oblasts. In female population the highest increments of colon cancer incidence were in Volynska and Chernigivska oblasts – 78.7-85.6%. Increment rate of the incidence in all contaminated oblasts, except for Kyivska, was higher than in whole Ukraine.

4. During 1986-2011 cancer incidence of rectum of male population increased by 76.5% in whole Ukraine; average Ukrainian increment level was overtopped in Vinnytska, Rivnenska and Chernigivska oblasts (97.8-153.3%). In female population in 1986-2011 this increment was 40.9%, and in the contaminated territories it varied from 10.7 % in Volynska oblast to 91.9% - in Rivnenska.

5. Increasing of incidence level entailed growing of cumulative risk of developing cancer, which increased notably for esophagus cancer in males - 2-10 times and for rectum cancer in females 1.3-1.8 times (in age 0-74).

6. Thus, growing of increment rates of cancer incidence of digestive organs have been observed after the Chernobyl accident, with most prominent values in the contaminated with radiation oblasts (up to 153%). This caused neighbouring of cancer incidence rates in whole Ukraine and in the contaminated oblasts.

7. Percent distribution by site of new cancer cases in population of whole Ukraine, contaminated oblasts and victims of Chernobyl accident is almost similar, but in the contaminated oblasts larger share have cancers of stomach, rectum and esophagus - in male population, stomach and rectum - in female population.

8. Results of the study showed necessity of further research of cancer rates, including cancer mortality level in population of Ukraine and oblasts that suffered from contamination with radiation, age-specified rates and involving other cancer sites, which may be responsive for radiation, with use of National Cancer Registry resources.

Table 1 – Dynamics of cancer incidence, esophagus, male population

Administrative territory	Rate per 100,000 of population								Increment rate (%)			
	general				age-standardized				1976-1986	1986-1996	1996-2011	1986-2011
	1976	1986	1996	2011	1976	1986	1996	2011				
Ukraine	4.2	7.0	8.3	7.6	4.1	6.2	6.6	5.3	66.7	18.6	-8.4	8.6
Vinnyska	6.6	9.5	12.0	9.2	5.7	6.6	8.7	6.4	43.9	26.3	-23.3	-3.2
Volynska	3.4	6.2	6.3	8.9	3.3	5.8	5.5	7.2	82.4	1.6	41.3	43.5
Zhytomyrska	4.8	9.5	13.5	11.8	4.6	7.8	10.2	8.4	97.9	42.1	-12.6	24.2
Kyivska	6.1	10.3	12.7	11.0	5.9	8.9	10.0	7.9	68.9	23.3	-13.4	6.8
Rivnenska	2.4	5.1	8.1	9.0	2.2	5.0	7.2	7.6	112.5	58.8	11.1	76.5
Chernigivska	4.3	10.0	11.9	9.5	3.7	7.7	8.2	6.3	132.6	19.0	-20.2	-5.0

Table 2 – Dynamics of cancer incidence, esophagus, female population

Administrative territory	Rate per 100,000 of population								Increment rate (%)			
	general				age-standardized				1976-1986	1986-1996	1996-2011	1986-2011
	1976	1986	1996	2011	1976	1986	1996	2011				
Ukraine	1.4	1.4	1.2	1.1	0.8	0.7	0.6	0.5	0.0	-14.3	-8.3	-21.4
Vinnyska	1.5	1.4	1.6	1.1	0.8	0.6	0.8	0.6	-6.7	14.3	-31.3	-21.4
Volynska	0.0	0.2	0.7	0.4	0.0	0.1	0.3	0.1		250.0	-42.9	100.0
Zhytomyrska	1.1	1.1	0.6	1.2	0.7	0.5	0.3	0.6	0.0	-45.5	100.0	9.1
Kyivska	1.6	2.2	2.9	1.2	0.9	1.4	1.3	0.5	37.5	-4.5	-42.9	-45.5
Rivnenska	1.2	0.6	0.8	0.5	0.9	0.1	0.5	0.3	-50.0	33.3	-37.5	-16.7
Chernigivska	1.4	0.7	1.5	1.0	0.8	0.4	0.5	0.5	-50.0	114.3	-33.3	42.9

Table 3 – Dynamics of cancer incidence, stomach, male population

Administrative territory	Rate per 100,000 of population								Increment rate (%)			
	general				age-standardized				1976-1986	1986-1996	1996-2011	1986-2011
	1976	1986	1996	2011	1976	1986	1996	2011				
Ukraine	44.8	45.0	40.8	32.0	43.7	39.8	32.5	21.5	0.4	-9.3	-21.6	-28.9
Vinnyska	48.1	48.6	41.5	33.8	41.7	38.5	30.4	21.5	1.0	-14.6	-18.6	-30.5
Volynska	38.8	41.4	33.1	24.7	36.0	35.6	27.7	20.0	6.7	-20.0	-25.4	-40.3
Zhytomyrska	50.5	50.2	50.9	30.9	49.0	41.6	38.0	20.3	-0.6	1.4	-39.3	-38.4
Kyivska	55.8	59.6	55.2	36.3	53.5	52.1	44.1	24.9	6.8	-7.4	-34.2	-39.1
Rivnenska	42.2	44.7	40.1	30.7	41.1	43.6	35.6	26.6	5.9	-10.3	-23.4	-31.3
Chernigivska	56.7	53.3	52.6	42.4	49.3	40.0	35.1	25.2	-6.0	-1.3	-19.4	-20.5

Table 4 – Dynamics of cancer incidence, stomach, female population

Administrative territory	Rate per 100,000 of population								Increment rate (%)			
	general				age-standardized				1976-1986	1986-1996	1996-2011	1986-2011
	1976	1986	1996	2011	1976	1986	1996	2011				
Ukraine	27.3	27.8	22.5	18.4	19.4	16.2	12.8	8.8	1.8	-19.1	-18.2	-33.8
Vinnyska	25.8	24.1	23.5	21.4	15.4	13.4	12.1	9.2	-6.6	-2.5	-8.9	-11.2
Volynska	22.2	21.4	13.6	13.9	16.2	13.4	8.1	8.6	-3.6	-36.4	2.2	-35.0
Zhytomyrska	34.2	22.7	24.5	16.3	21.7	12.6	13.2	7.9	-33.6	7.9	-33.5	-28.2
Kyivska	44.5	37.0	33.3	18.7	26.7	21.0	17.9	9.6	-16.9	-10.0	-43.8	-49.5
Rivnenska	28.6	20.2	19.4	16.3	21.3	13.7	12.1	9.2	-29.4	-4.0	-16.0	-19.3
Chernigivska	40.8	28.4	28.0	23.3	22.9	14.6	13.1	10.2	-30.4	-1.4	-16.8	-18.0

Table 5 – Dynamics of cancer incidence, colon, male population

Administrative territory	Rate per 100.000 of population								Increment rate (%)			
	general				age-standardized				1976-1986	1986-1996	1996-2011	1986-2011
	1976	1986	1996	2011	1976	1986	1996	2011				
Ukraine	7.6	11.4	16.2	23.5	7.0	9.7	12.4	15.5	50.0	42.1	45.1	106.1
Vinnyska	7.8	12.5	14.2	20.8	8.9	9.3	9.9	13.1	60.3	13.6	46.5	66.4
Volynska	7.9	10.0	11.7	13.2	6.6	8.1	9.7	11.3	26.6	17.0	12.8	32.0
Zhytomyrska	7.3	8.5	11.2	20.3	6.9	7.0	8.1	13.9	16.4	31.8	81.3	138.8
Kyivska	9.8	12.5	17.1	20.9	7.8	10.4	13.6	13.9	27.6	36.8	22.2	67.2
Rivnenska	7.8	7.1	8.8	17.4	6.3	6.8	7.8	14.5	-9.0	23.9	97.7	145.1
Chernigivska	8.5	11.2	17.0	22.9	6.6	7.9	10.3	14.0	31.8	51.8	34.7	104.5

Table 6 – Dynamics of cancer incidence, colon, female population

Administrative territory	Rate per 100,000 of population								Increment rate (%)			
	general				age-standardized				1976-1986	1986-1996	1996-2011	1986-2011
	1976	1986	1996	2011	1976	1986	1996	2011				
Ukraine	9.0	14.2	16.6	23.8	5.6	7.4	9.2	11.3	57.8	16.9	43.4	67.6
Vinnyska	6.6	10.6	11.1	18.7	5.1	5.6	5.8	8.6	60.6	4.7	68.5	76.4
Volynska	7.8	8.9	9.7	15.9	5.6	5.7	6.3	9.6	14.1	9.0	63.9	78.7
Zhytomyrska	6.7	9.4	11.2	16.2	4.6	4.7	5.7	7.9	40.3	19.1	44.6	72.3
Kyivska	11.3	14.8	17.6	22.3	6.5	7.8	9.2	11.1	31.0	18.9	26.7	50.7
Rivnenska	5.8	10.1	12.5	17.8	5.8	6.3	7.6	10.9	74.1	23.8	42.4	76.2
Chernigivska	6.5	10.4	12.5	19.3	5.7	5.5	5.9	7.9	60.0	20.2	54.4	85.6

Table 7 – Dynamics of cancer incidence, rectum, male population

Administrative territory	Rate per 100,000 of population								Increment rate (%)			
	general				age-standardized				1976-1986	1986-1996	1996-2011	1986-2011
	1976	1986	1996	2011	1976	1986	1996	2011				
Ukraine	7.4	13.2	16.3	23.3	7.2	11.8	13.0	15.4	78.4	23.5	42.9	76.5
Vinnyska	8.3	10.3	13.8	24.0	7.1	8.1	9.9	15.5	24.1	34.0	73.9	133.0
Volynska	6.7	14.0	12.2	16.5	6.1	12.3	10.1	12.9	109.0	-12.9	35.2	17.9
Zhytomyrska	6.6	13.4	16.8	17.6	6.5	11.2	12.5	11.6	103.0	25.4	4.8	31.3
Kyivska	8.1	15.5	20.5	25.0	7.7	13.6	16.4	16.7	91.4	32.3	22.0	61.3
Rivnenska	7.6	9.3	13.3	18.4	6.5	8.5	11.6	14.9	22.4	43.0	38.3	97.8
Chernigivska	7.5	10.5	15.7	26.6	6.5	7.7	10.2	14.9	40.0	49.5	69.4	153.3

Table 8 – Dynamics of cancer incidence, rectum, female population.

Administrative territory	Rate per 100,000 of population								Increment rate (%)			
	general				age-standardized				1976-1986	1986-1996	1996-2011	1986-2011
	1976	1986	1996	2011	1976	1986	1996	2011				
Ukraine	9.1	13.2	13.3	18.6	6.1	7.9	7.6	9.0	45.1	0.8	39.8	40.9
Vinnyska	8.7	12.6	11.2	17.0	5.2	6.5	6.0	8.2	44.8	-11.1	51.8	34.9
Volynska	7.0	12.2	9.4	13.5	5.3	7.7	5.9	8.1	74.3	-23.0	43.6	10.7
Zhytomyrska	7.6	10.6	12.4	15.3	5.1	6.1	6.6	7.6	39.5	17.0	23.4	44.3
Kyivska	10.7	15.2	10.9	18.7	6.6	8.2	5.8	9.4	42.1	-28.3	71.6	23.0
Rivnenska	6.7	9.9	10.6	19.0	4.9	6.9	6.3	11.0	47.8	7.1	79.2	91.9
Chernigivska	9.6	12.5	14.0	22.3	5.5	6.6	6.9	8.9	30.2	12.0	59.3	78.4

Table 9 - Cumulative risk of developing cancer to the age 75 (%)

Tumor site	Ukraine		Vinnytska		Volynska		Zhytomyrska		Kyivska		Rivnenska		Chernigivska	
	1986	2011	1986	2011	1986	2011	1986	2011	1986	2011	1986	2011	1986	2011
	male population													
Esophagus	0.4	0.7	0.4	0.8	0.1	0.9	0.4	1.1	0.5	1.1	0.1	1.0	0.3	0.8
Stomach	4.6	2.7	5.3	2.8	5.2	2.9	5.0	2.7	5.6	3.2	4.7	3.1	5.7	3.2
Colon	1.4	1.9	1.2	1.6	1.0	1.5	0.8	1.5	1.3	1.8	0.9	1.4	1.1	1.1
Rectum, anus	1.5	2.0	1.4	2.9	1.4	1.6	1.4	1.9	1.4	2.0	1.3	1.8	1.0	2.0
	female population													
Esophagus	0.05	0.06	0.05	0.05	0.01	0.01	0.01	0.04	0.07	0.08	0.05	0.03	0.09	0.06
Stomach	1.8	1.1	1.6	1.2	1.7	1.3	1.8	0.9	2.1	1.5	1.9	1.4	2.1	1.5
Colon	1.0	1.4	0.7	1.2	0.8	1.3	0.6	0.9	1.0	1.3	0.8	1.3	0.6	1.1
Rectum, anus	1.0	1.1	0.9	1.0	1.0	1.2	0.8	0.9	0.9	1.2	0.8	1.2	0.9	0.8

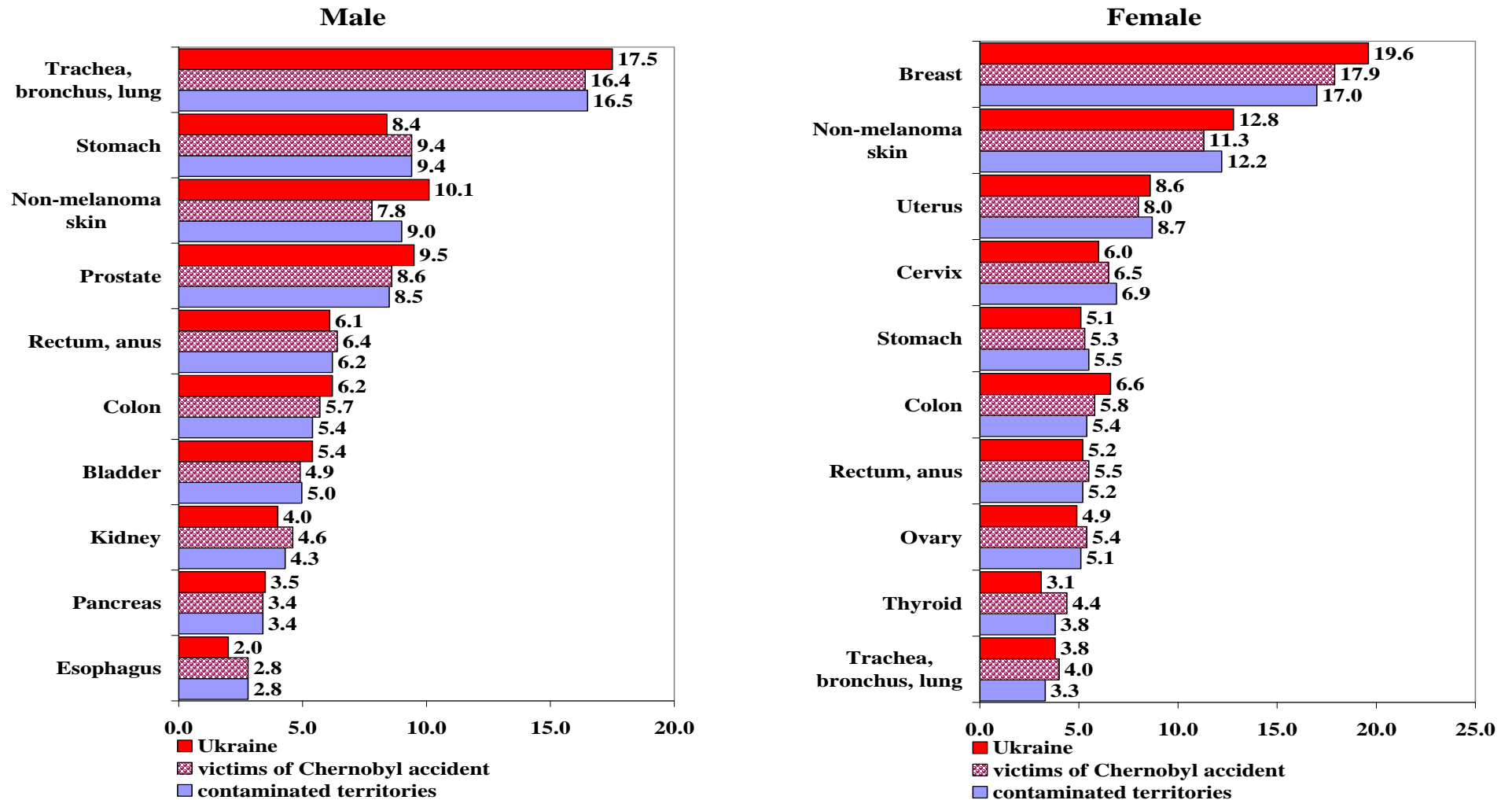


Figure 1 – 10 most frequently diagnosed cancers in Ukraine, contaminated oblasts and victims of Chernobyl accident, 2011 (%)

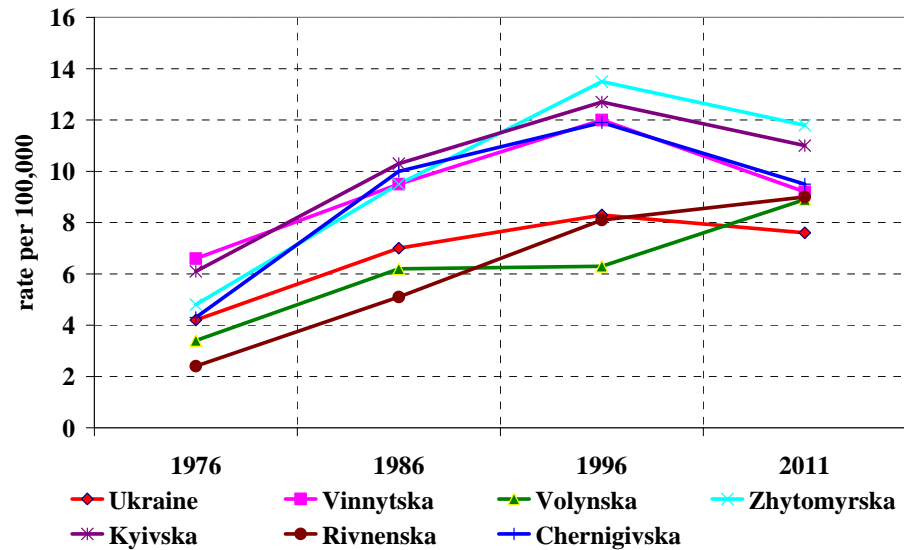


Figure 2 – Cancer incidence in 1976-2011, esophagus, male population

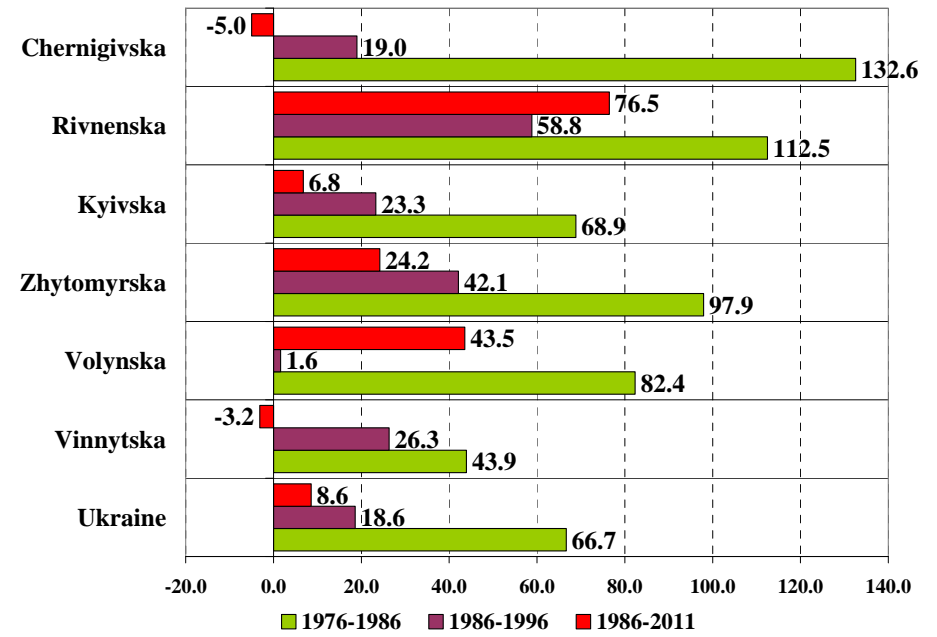


Figure 3 – Increment of cancer incidence, esophagus, male population (%)

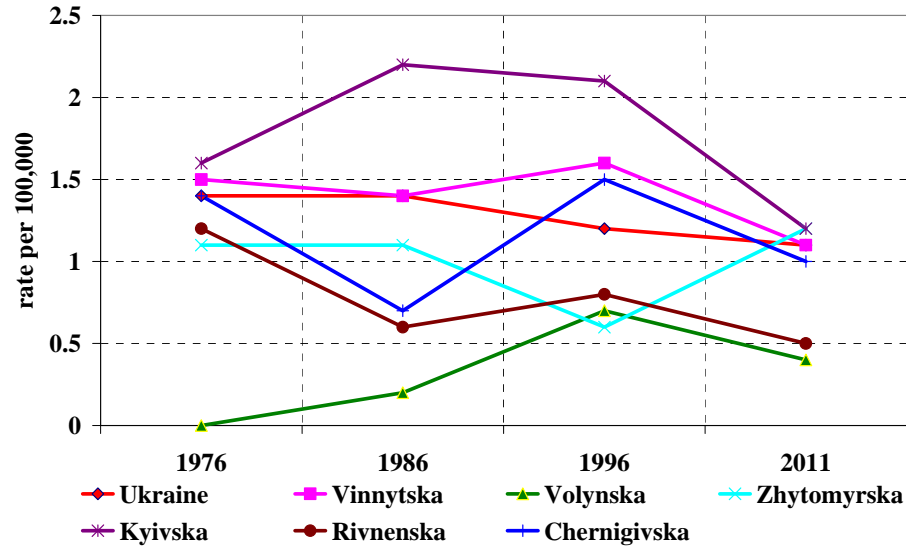


Figure 4 – Cancer incidence in 1976-2011, esophagus, female population

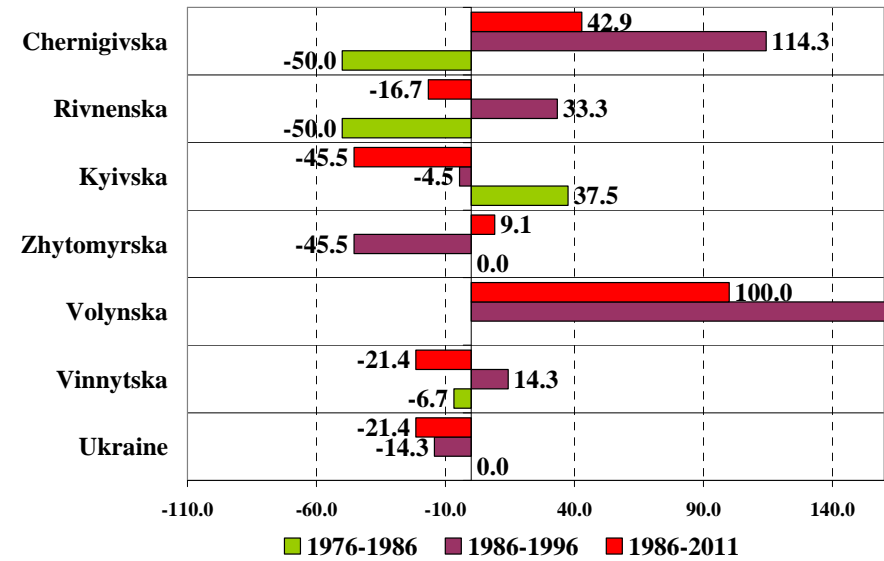


Figure 5 – Increment of cancer incidence, esophagus, female population (%)

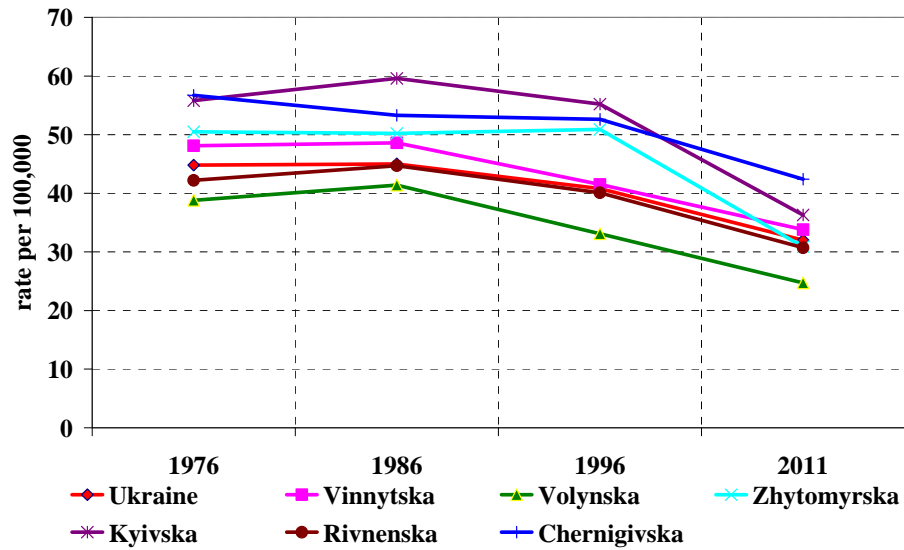


Figure 6 – Cancer incidence in 1976-2011, stomach, male population

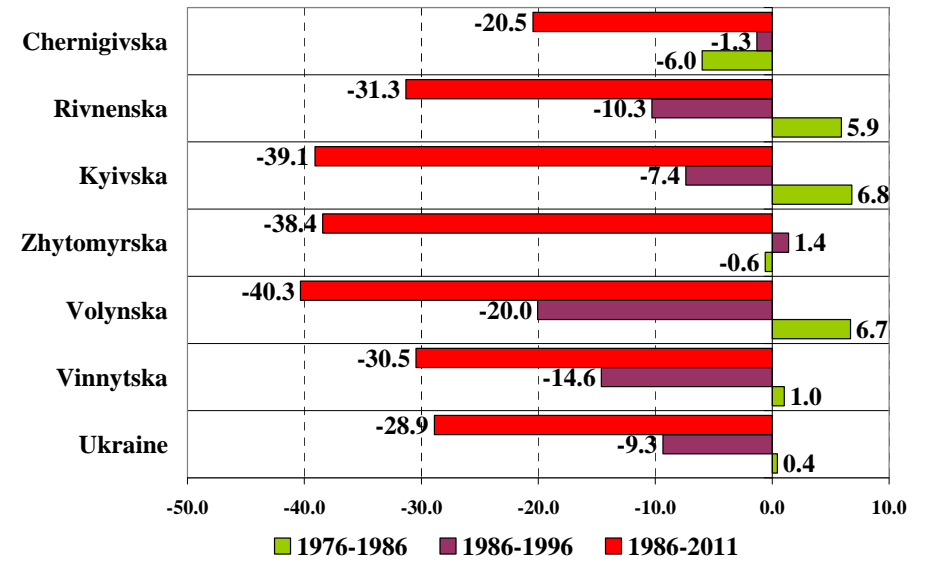


Figure 7– Increment of cancer incidence, stomach, male population (%)

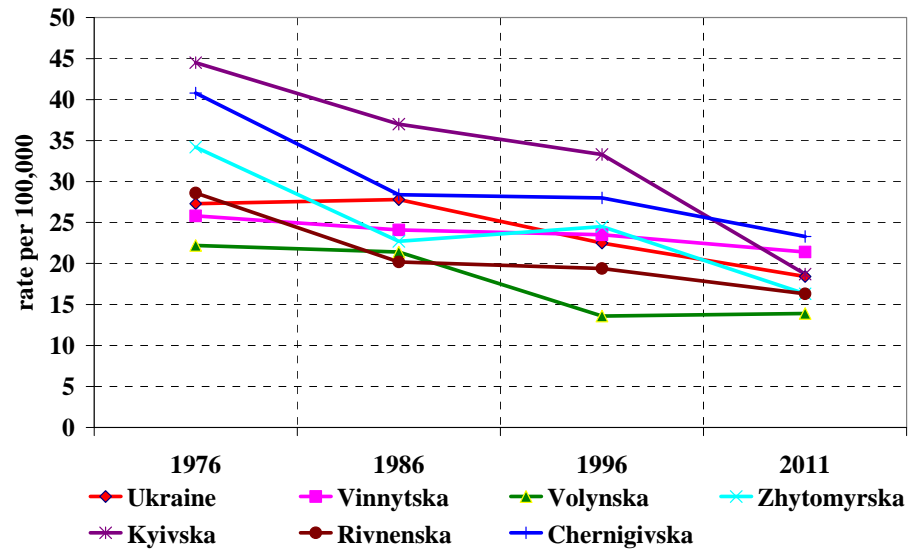


Figure 8 – Cancer incidence in 1976-2011, stomach, female population

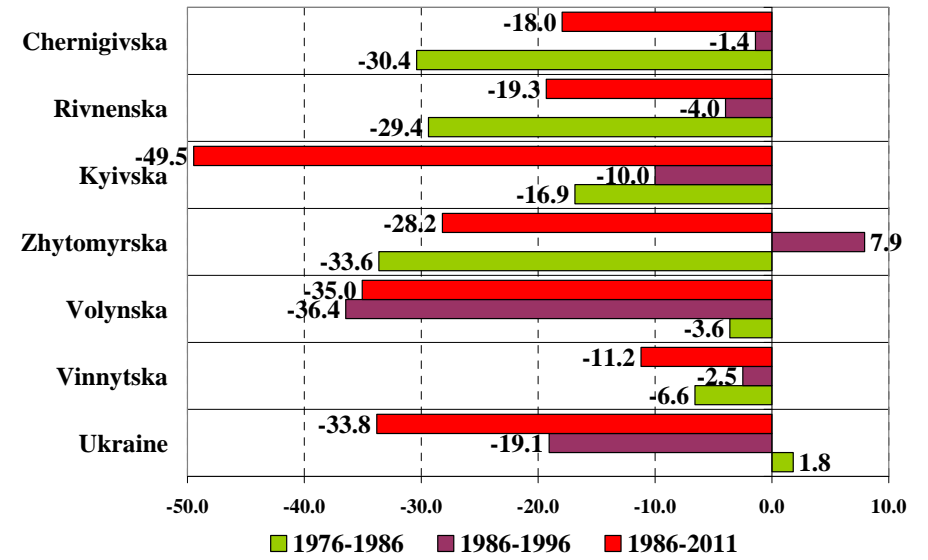


Figure 9 – Increment of cancer incidence, stomach, female population (%)

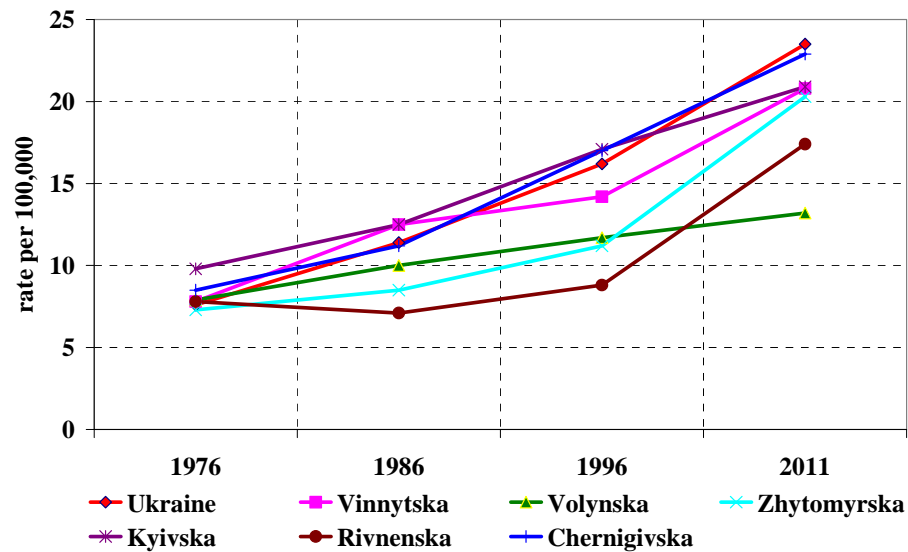


Figure 10 – Cancer incidence in 1976-2011, colon, male population

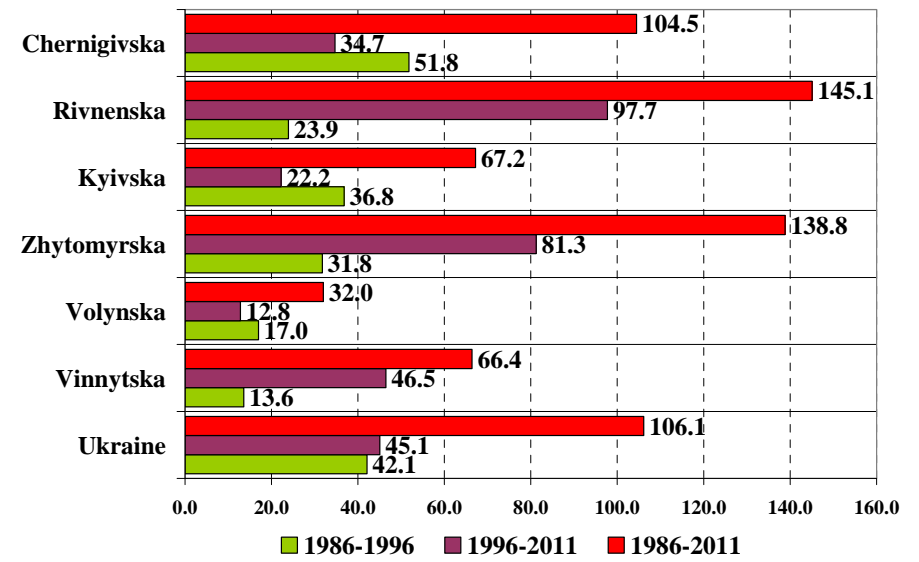


Figure 11 – Increment of cancer incidence, colon, male population (%)

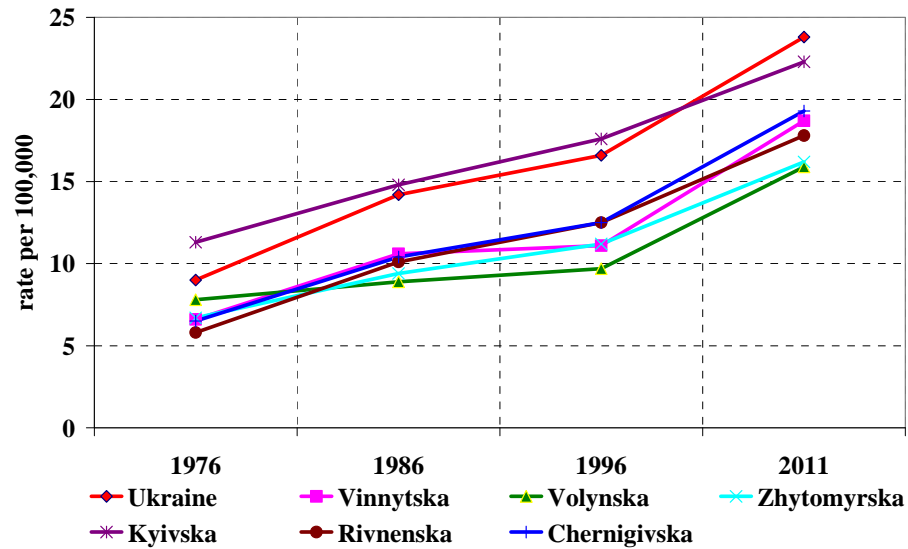


Figure 12 – Cancer incidence in 1976-2011, colon, female population

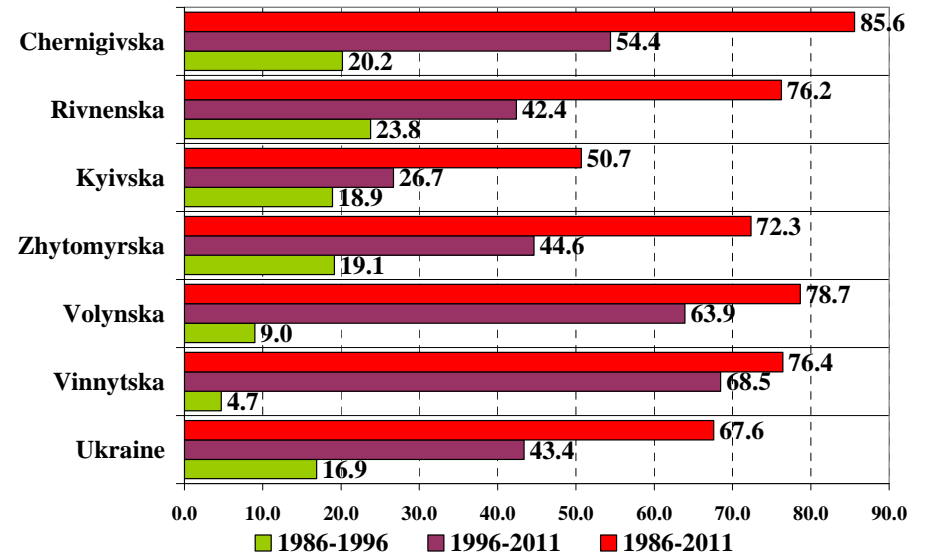


Figure 13 – Increment of cancer incidence, colon, female population (%)

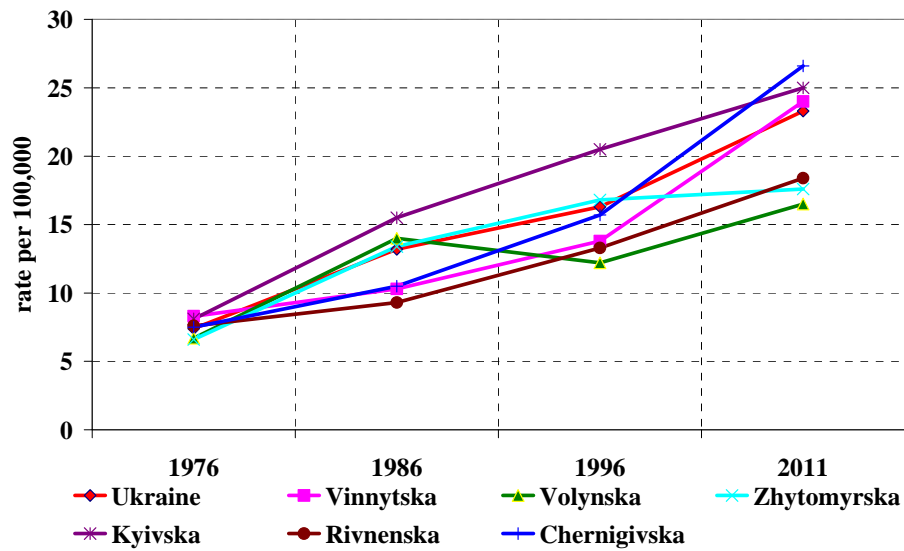


Figure 14 – Cancer incidence in 1976-2011, rectum, male population

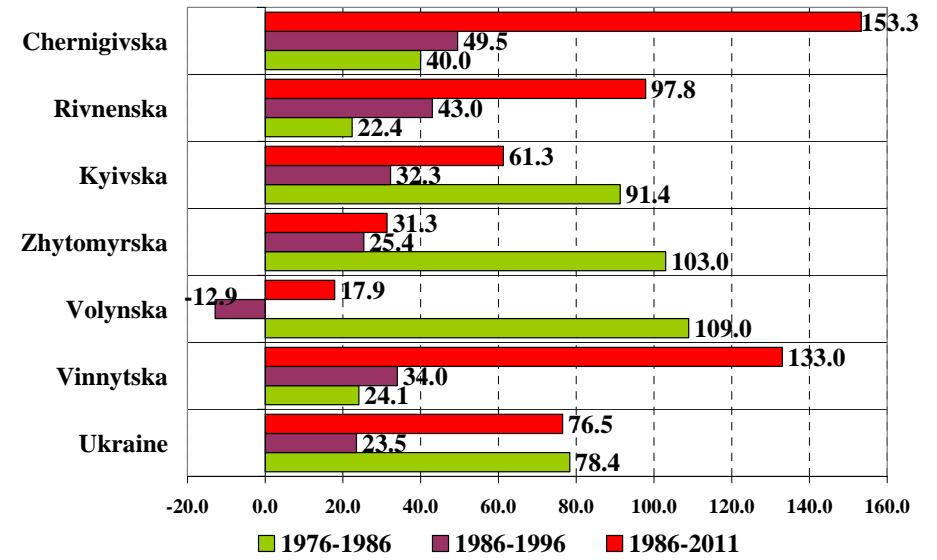


Figure 15 – Increment of cancer incidence, rectum, male population (%)

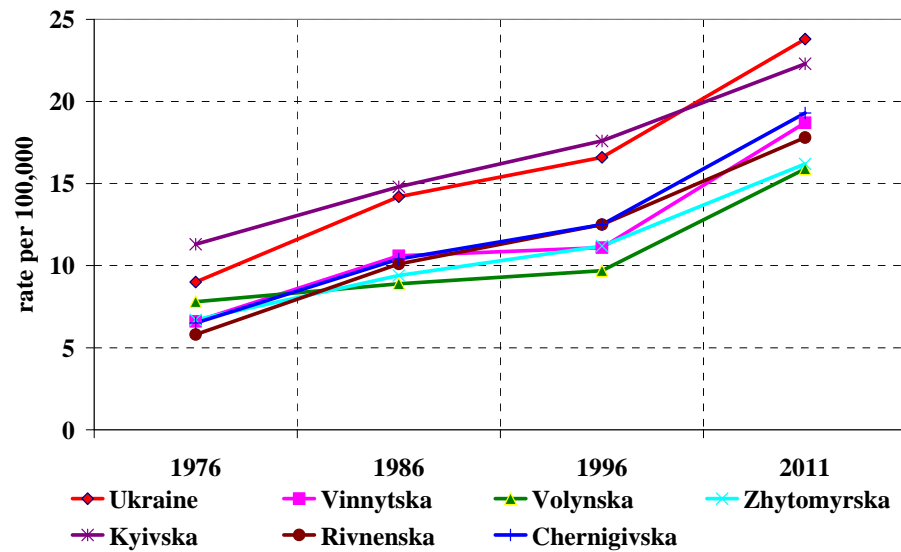


Figure 16 – Cancer incidence in 1976-2011, rectum, female population

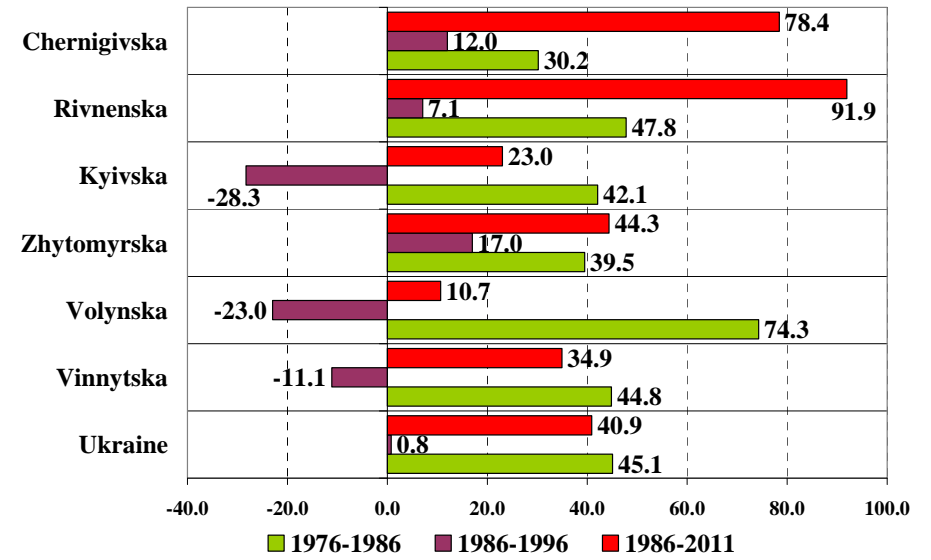


Figure 17 – Increment of cancer incidence, rectum, female population (%)