

RESEARCH COMMUNICATION

Trends of Prevalent Cancer Incidences in the Aral-Syr Darya Ecological Area of Kazakhstan

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Abstract

The aim of this research was to examine the incidence of major forms of cancer in the Aral-Syr Darya ecological area of Kazakhstan. The present retrospective study of 11 years (1999-2009) was therefore conducted using descriptive and analytical methods. Incidence rates (crude and standardized) of 11 leading cancer sites were calculated and trends determined. The result of analysis demonstrated the most common neoplasms in the study region to be esophageal cancer, carcinoma of lung, stomach cancer, and breast cancer. Trends in incidence of cancers under study were different, the most marked reduction in cancer of esophagus is established ($T=-6.1\%$) and revealed the high increase in breast cancer ($T=+6.7\%$). In the dynamics the trend of malignant disease in general tended to decrease ($T=-0.5\%$).

Keywords: Prevalent cancers - incidence rates - trends - Aral-Syra ecological zone, Kazakhstan

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Introduction

Malignant neoplasms is an important medical and social problem of modern society. According to data of Globocan 2008 the International Agency for Research on Cancer in the world were registered about 12.7 million cases of malignant tumors and 7.6 million cancer deaths (IARC, 2004; Ferlay et al., 2007; IARC, 2010). Quantity growth of malignant tumors cases in the world happens as a consequence of population growth and as a result of its aging. Increase the number of cases with malignant tumors also is a result of spreading the influence of negative environmental factors and lifestyle in the world (Zaridze et al., 2002). At the same time in the most of developed countries incidence standardized by age and mortality rates per 100,000 people from many forms of cancer is getting reduce (Berrino et al., 1995; Antunes et al., 2003; Boyle et al., 2003; Levi et al., 2004a; 2004b; Parkin et al., 2005; Ferlay et al., 2007; American Cancer Society, 2009; MEPS against cancer, 2011; World Health Organization Statistical information System, 2011).

Reducing the incidence of malignant tumors can be achieved first of all by primary prevention. While reducing mortality happens in consequence of decreasing morbidity and increasing survival of patients, which in its turn can be a result of improved methods of diagnosis and treatment. The incidence of malignant tumors in the countries of European Union was reduced for the last

10 years for 15% as a result of implementation of the program "Europe against Cancer", aimed at a primary prevention of cancer. The main elements of it are: anti-smoking campaigns, changing the diet with increasing use of fruits and vegetables and decreasing use of animal products, reducing the negative effects of ultraviolet rays, and recommendations for screening and early diagnosis of malignant tumors.

The epidemiological research of cancer in regions of ecological distress has special scientific interest, particularly the Aral-Syr Darya ecozone, where geographically located Kyzylorda region of Kazakhstan. For epidemiological research aimed at studying the causes and evaluation of the effectiveness of prevention and screening programs it is important to watch the changing from state "healthy" to a state "ill" in connection with environment. In this paper we give a preliminary estimate of morbidity with the major forms of malignant tumors in the Aral-Syr Darya ecological area of Kazakhstan.

Materials and Methods

The sources of research were recording and reporting documents of the Kazakh Research Institute of Oncology and Radiology, Kyzylorda regional oncological center on patients with first-ever diagnosed with cancer. Following localizations of cancer were investigated: esophagus, lung, stomach, breast, skin, cervix, pancreas, tongue,

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oral cavity and pharynx, colon, rectum and thyroid gland. "Cancer Registry" database was used. The research period amounted 11 years (1999-2009). Data on the population were taken from the Agency of statistics of the Republic of Kazakhstan from 1999 to 2009 (Demography Yearbook of Kazakhstan regions, 2007, 2010).

By conventional methods of sanitary statistics (Merkov et al., 1974; Glantz, 1999) calculated the extensive, crude, standardized and aligned rates. Standardized incidence rates (SIR) were calculated in direct way and were used the world, European and African standard population. Also in the investigation were calculated figures by arithmetic mean (M), the average error (m) and 95% confidence interval (CI) was calculated using the formula:

$$95\% CI = M \pm 1.96 \times m$$

The dynamics of incidence was studied for 11 years, with incidence trends were determined by least squares:

$$y = a + bx$$

Where: y – smoothed indicator; x – Arbitrary series of numbers symmetrically located with respect to zero; a – conditioned medium; b – coefficient alignment

To calculate the average annual growth rate and/or decrease the time series used the geometric mean, which is equal to the root of degree n of the product of annual rates:

$$T = \sqrt[n]{T_1 \times T_2 \times T_3 \times T_n} - 100\%$$

Where T – annual growth rates and/or reduction, n – number of indicators.

Incidence rates of breast cancer and cervical cancer were calculated per 100,000 female population, and the incidences of other forms of cancer were calculated among the entire population. We used the program Biostatics for Windows (Version 4.03 by Stanton Glantz) and Microsoft Excel 2010

Results and Discussion

For 11 years (1999-2009) in Kyzylorda region of Kazakhstan there were registered 10,382 cases of malignant neoplasm. In the structure of malignant tumors in first place esophageal cancer – 1,850 (17.8%), second – lung cancer – 1,323 (12.7%) and in third place – stomach cancer – 1,311 (12.6%) (Table 1). Crude incidence rate of malignant neoplasms in general among the population of Kyzylorda was 154.2 ± 3.1 (95% CI=148.2-160.3). In the dynamics crude incidence rates tended to decrease from 154.8 ± 5.1 (1999) to 144.3 ± 4.7 in 2009. For alignment this indicator was also a decrease, while the average rate of decline was T=-0.5% (Figure 1).

The average annual SIR of malignant neoplasms of the total population of the region were as follows: the world standard – 218.5 ± 5.4 (95% CI=207.8-229.1), European – 310.0 ± 7.9 (95% CI=294.5-325.5) and African – 126.9 ± 3.0 (95% CI=121.0-132.8). But for all that 95% CI do not overlap to one another, that is to say differences were statistically significant (p<0.05) and the figures were influenced by various factors, namely, the age structure of population of the region is different from the world, European and African population structure. In the dynamics aligned indicators also tended to decrease, while the average annual loss of world, European and

Table 1. Distribution of Malignant Neoplasms in the Aral-Syra Darya Region for 1999-2009

Location	Number	%
Cancer of the esophagus	1,850	17.8
Cancer of lung	1,323	12.7
Stomach cancer	1,311	12.6
Breast cancer	652	6.3
Cancroid (skin cancer)	454	4.4
Cervical carcinoma	357	3.4
Cancer of the pancreas	262	2.5
Tongue, oral cavity and pharynx	206	2.0
Colon cancer	185	1.8
Rectal cancer	184	1.8
Thyroid cancer	109	1.0
Other forms	3,489	33.6
Total	10,382	100.0

African standards were T=-1.9%, T=-1.9% и T=-1.8%, respectively. Next, consider the rates of morbidity population of the region from the major cancer sites.

Cancer of esophagus

The average annual crude incidence rate of whole population with esophageal cancer was 27.6 ± 1.9 (95% CI=24.0-31.20). In the dynamics the incidence of esophageal cancer tended to decrease from 36.4 ± 2.5 (1999) to 17.6 ± 1.7 in 2009, and the average annual reduction of aligned rate was T = - 6.1%

Lung cancer

Crude indicator of lung cancer for the entire population of the study period was 19.7 ± 1.2 (95% CI=17.2-22.1). In the dynamics the incidence increased from 16.0 ± 1.6 (1999) till 17.8 ± 1.7 in 2009 and average annual growth rate of aligned index was 0.1% T. Standardized incidence rates of lung cancer were significantly (p<0.05) different from each other: the world – 29.3 ± 1.9 (95% CI=25.7-33.0), European – 42.6 ± 2.7 (95% CI=37.3-47.9) and African – 15.4 ± 1.0 (95% CI=13.5-17.2) and in dynamics of aligned standardized incidence rates of lung cancer tended to decrease, and the average rate amounted to T=-0.4%, T=-0.1% T=-0.2%, respectively.

Stomach cancer

The average annual crude incidence rate of stomach cancer was 19.5 ± 0.7 (95% CI=18.1-20.9). In the dynamics indices decreased from 18.3 ± 1.8 (1999) to 18.1 ± 1.7 in 2009 and the rate of decline of aligned index was T=-1.5%. In the dynamics aligned standard indicators also tended to decrease, while the average annual loss of world, European and African standards were T=-1.0%, T=-1.2% and T=-1.5%, respectively. The average annual standardized incidence rates of gastric cancer were following: World – 29.2 ± 1.2 (95% CI=26.9-31.5), European – 42.7 ± 1.9 (95% CI=39.1-46.3) and African – 15.4 ± 0.7 (95% CI=14.1-16.7). The differences were statistically significant (p<0.05).

Breast cancer

Crude indicator of incidence with breast cancer among the female population in 1999-2009 amounted to 19.2 ± 1.4

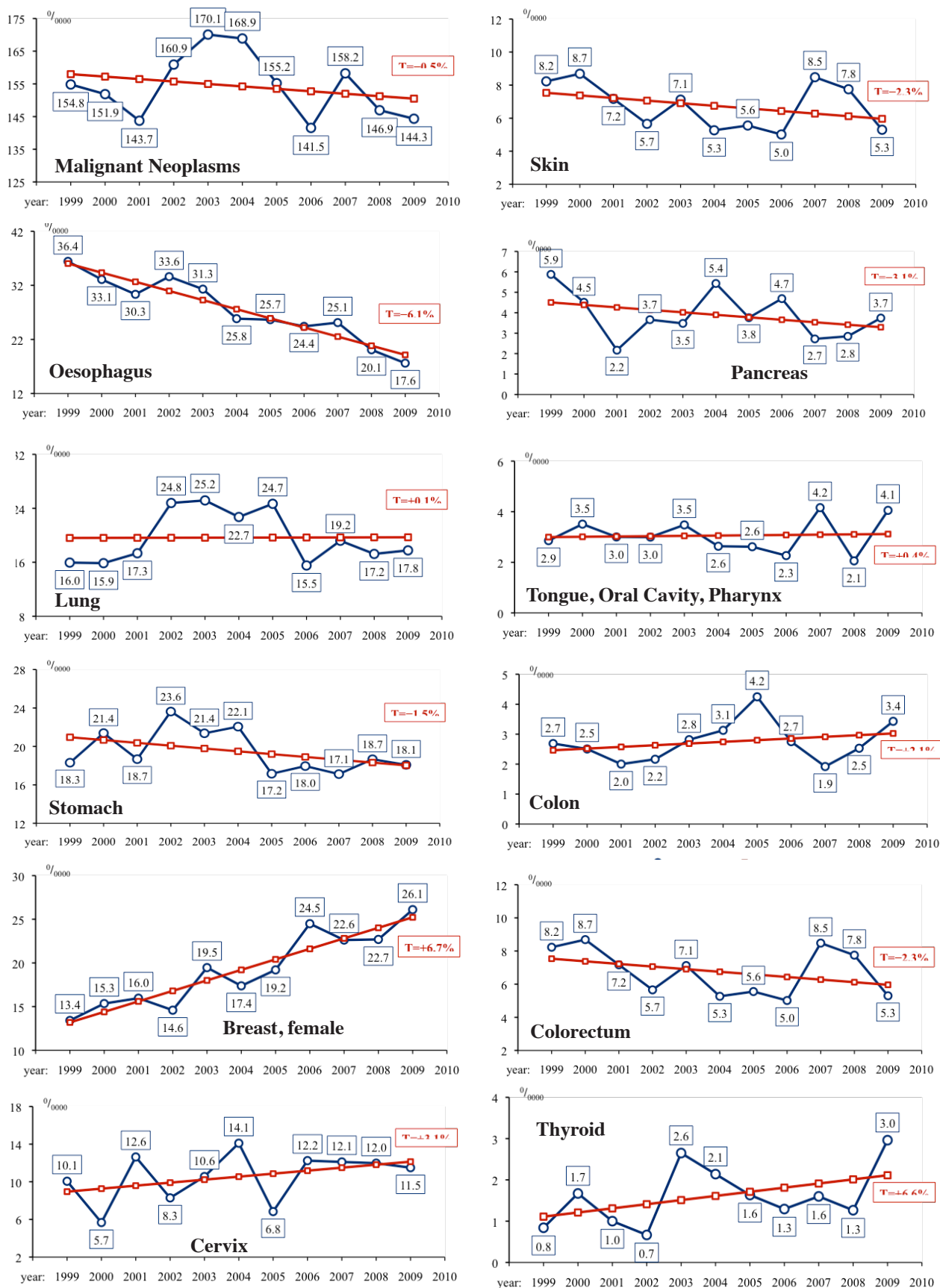


Figure 1. Dynamics of Crude Cancer Incidence Rates in the Aral-Syra Darya Region of Kazakhstan for 11 Years (1999-2009) —●— crude rate —□— trend

(95%CI=16.6-21.9). In dynamics incidents rates increase from 13.4 ± 2.1 (1999) till 26.1 ± 2.8 in 2009 and the average annual growth rate of aligned index was $T=+6.7\%$

Skin cancer

In the dynamics crude incidence rate of skin cancer among total population decreased from $8.2 \pm 1.20/0000$

(1999) to 5.3 ± 0.9 in 2009 and the average annual attrition of aligned rate was $T = -2.3\%$, while the average annual incidence rate was 6.7 ± 0.4 (95% CI=5.9-7.6). Standardized incidence rates of skin cancer were following: world – 9.5 ± 0.6 (95% CI=8.2-10.7), European – 13.3 ± 0.9 (95% CI=11.6-15.0) and African – 5.6 ± 0.4 (95% CI=4.8-6.4). The differences were statistically significant ($p < 0.05$). In dynamics trends of aligned standardized indicators also declined: $T = -5.2\%$, $T = -5.0\%$ and $T = -6.2\%$ respectively the world, European and African standards.

Cancer of the cervix

The average annual crude incidence rate of servical cancer among the female population of the region amounted to 10.5 ± 0.8 (95% CI=8.9-12.2). In dynamics indicators increased from 10.1 ± 1.8 (1999) to 11.5 ± 1.9 in 2009 and the growth rate of aligned index was 3.1%. In the dynamics aligned standardized indicators had different trend. Thus, the European standard has been reduced and the average annual loss amounted $T = -0.1\%$. Trends of world and African $T = +0.2\%$ and $T = +0.1\%$, respectively. The average annual standardized incidence rates of cervical cancer were as follows: World – 12.2 ± 0.9 (95% CI=10.4-14.0), European – 16.1 ± 1.2 (95% CI=13.8-18.4) and African – 9.2 ± 0.8 (95% CI=7.7-10.7). The differences were statistically significant between European and African standards ($p < 0.05$).

Cancer of the pancreas

The average annual crude incidence rate of pancreatic cancer among the entire population was 3.9 ± 0.4 (95% CI=3.2-4.6). In dynamics the incidence rates tended to decrease from 5.9 ± 1.0 (1999) to 3.7 ± 0.8 in 2009 and the average annual reduction of aligned rate was $T = -3.1\%$. Standardized incidence rates of the pancreatic cancer were following: World – 5.7 ± 0.6 (95% CI=4.6-6.8), European – 8.3 ± 0.8 (95% CI=6.7-9.8) and African – 3.1 ± 0.3 (95% CI=2.5-3.7). In the dynamics aligned SIR of pancreatic cancer tended to decrease and the average annual loss of World, European and African standards were $T = -6.0\%$, $T = -6.6\%$ and $T = -6.0\%$, respectively.

Tongue, oral cavity and pharynx cancer

In the dynamics crude incidence rate of malignant neoplasms of tongue, oral cavity and pharynx among the total population tended to increase from 2.9 ± 0.7 (1999) to 4.1 ± 0.8 in 2009 and the average annual growth of aligned index was $T = +0.4\%$, while the average annual incidence rate was 3.1 ± 0.2 (95% CI=2.6-3.5). Standardized incidence rates of malignant neoplasms of tongue, oral cavity and pharynx were following: World – 4.2 ± 0.3 (95% CI=3.5-4.8), European – 5.8 ± 0.5 (95% CI=4.9-6.7) and African – 2.5 ± 0.2 (95% CI=2.2-2.8). The differences were statistically significant ($p < 0.05$), with dynamics trends of aligned standardized indicators of $T = +3.1\%$, $T = +3.4\%$ and $T = +0.8\%$ respectively.

Cancer of the colon

Crude indicator of incidence of colon cancer among the total population of the region for 1999-2009 was

2.7 ± 0.2 (95% CI=2.3-3.2). In dynamics the incidence rates are increase from 2.7 ± 0.7 (1999) to 3.4 ± 0.7 in 2009 and the average annual growth rate of aligned index was $T = +2.1\%$. Standardized incidence rates of colon cancer were significantly different from each other ($p < 0.05$): World – 4.0 ± 0.3 (95% CI=3.4-4.5), European – 5.7 ± 0.4 (95% CI=4.9-6.5) and African – 2.2 ± 0.2 (95% CI=1.9-2.6). In dynamics the aligned standardized incidence rates also tended to increase. Thus, the average annual growth rates of world, European and African standards were $T = +2.0\%$, $T = +2.6\%$ and $T = +1.7\%$, respectively.

Cancer of the rectum

In the dynamics crude incidence rate of colorectal cancer among total population decreased from 4.0 ± 0.8 (1999) to 3.1 ± 0.7 in 2009 and the average annual attrition of aligned rate was $T = -1.8\%$, while the average annual incidence rate was 6.7 ± 0.4 (95% CI=5.9-7.6). SIR of cancer of the rectum were: world – 3.9 ± 0.3 (95% CI=3.4-4.4), European – 5.6 ± 0.4 (95% CI=4.8-6.3) and African – 2.2 ± 0.2 (95% CI=1.8-2.6). The differences were statistically significant ($p < 0.05$). In the dynamics trends of aligned standardized incidence rates of rectal cancer are also declining: $T = -3.3\%$, $T = -3.3\%$ and $T = -4.0\%$, respectively world, European and African standards.

Thyroid cancer

The average annual crude incidence rate of thyroid cancer among the entire population was 1.6 ± 0.2 (95% CI=1.2-2.1). In the dynamics the incidence rates tended to increase from 0.8 ± 0.4 (1999) to 3.0 ± 0.7 in 2009 and the average annual growth rate of aligned index was $T = +6.6\%$. SIR were as follows: world – 2.1 ± 0.3 (95% CI=1.5-2.7), European – 2.8 ± 0.4 (95% CI=2.0-3.6) and African – 1.4 ± 0.2 (95% CI=1.0-1.8). In the dynamics the aligned SIR have a trend to increase and average annual growth rate of world, European and African standards were $T = +13.4\%$, $T = +14.1\%$ and $T = +12.9\%$, respectively.

Overall

Conclusions

Analysis of morbidity of malignancies among the population of the Aral-Syr Darya in general have showed that in the structure of incidence in the first place was esophageal cancer, the second – lung cancer and the third – gastric cancer. In the dynamics the total incidence of malignant neoplasms tended to decrease ($T = -0.5\%$). Incidence rates of studied forms of cancer in the dynamics had different trends. For all that the most pronounced trends to decrease were detected in pancreatic cancer ($T = -4.6\%$) and cancer of the esophagus ($T = -6.1\%$). Growth of incidence rates was highest in cancer of the thyroid gland ($T = +6.6\%$) and breast cancer ($T = +6.7\%$).

Such standardized rates as world and European were higher than crude indicator and vice versa African below. Almost in all cases in the dynamics the standardized incidents rates tended to repeat a crude indicator (crude incidence rate). Except for the incidence of lung cancer, when crude rates had insignificant tendency to increase, and standardized indicators had the opposite picture

– observed an increase. Cervical cancer trends in the European standard tended to decrease and other indicators have been risen.

Thus, the identified features of the major cancer localizations in the Aral-Syr Darya ecological area of Kazakhstan will help to local health authorities in the organization of targeted anti-cancer activities and develop ways of primary prevention. Further study of the characteristics of cancer of major locations in the ecological area with age, sex, ethnic composition and other factors will be a priority of our future research.

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