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Original Article

Cancer Incidence and Mortality in Ardabil: Report of an Ongoing Population-Based Cancer Registry in Iran, 2004-2006

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Abstract

Background: Ardabil cancer registry is the first population-based cancer registry in Iran that was established in 2000. The first report from this registry revealed that Ardabil has one of the highest rate of gastric cardia cancer and the lowest rate of cervical cancer in the world. We aim to update the cancer incidence in this area by the second follow up report from this registry.
Method: Data on all newly diagnosed cancer cases between 2004 and 2006 were actively collected. CanReg4 software was used for data entry and the data of cancer-related death were obtained from the comprehensive death registry system.
Results: More than 4300 new cases were registered during 3 years. Diagnosis of cancer was based on histopathology in 69%, clinical investigation 8%, clinical only 5%, and Death Certificate Only (DCO) in 18% of cases. In terms of age-standardized rate (/100,000), the five leading cancers in men (excluding skin cancer) were stomach (51.8), esophagus (19.5), bladder (13.1), lung and bronchus (10.8), and colorectal (9.6); in women, they were stomach (24.9), esophagus (19.7), breast (11.9), colon and rectum (7.4), and brain tumors (6.9). According to death registration data, upper gastrointestinal cancers constituted more than 43% of cancer-related death in Ardabil.
Conclusions: The ASR for gastric cancer is among the highest rate for this cancer in male and female in the world. Most of the cancers, especially in female, have a significant increase compared to previous report from Ardabil. This is most likely due to the change in the registration practice.

Keywords: *Iran, Cancer, Incidence, Mortality*

Introduction

Cancer is one of the leading causes of death globally (1), according WHO about 7.5 million people have died of cancer in 2007 and close to 85 million will die of cancer in the next 10 yr and in year 2015, the yearly death number is expected to rise to 9 million and increase further to 11.5 million in 2030 (2). According to national death registry report of Iran in 2004 cancer was the second cause of non-accidental death in the country (3). It is estimated that each year more than 51000 cases of cancer are diagnosed and 35,000 deaths due to cancer occur which is the second highest number of cancer death in Eastern Mediterranean Region of WHO (4). This relatively low current incidence rates is at least partly due to incomplete registration and diagnosis (5).We should expect an increase in the incidence of cancer in future because of increasing life expectancy and adoption of western type life style. The first important task for cancer control program is to establish population based cancer registry, which systemically and continuously collect and store information about type, and location of new cancer cases occurring in defined population in a specific geographic area and could periodically analyze and report the results (6). In year 2000, population based cancer registries were established in five provinces of Iran (5, 7, 8) and the first report of these cancer registries were published in subsequent years which permitted a better estimates of cancer incidence and mortality from Iran (4, 9-12). The result of these reports revealed that squamous cancer of esophagus which was very common and among the highest

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rate of cancer ever reported in the world 30 yr ago in Northeast Iranian Turkmen plain has declined sharply (11), while gastric cancer specially the cardia type was found to be very common in Ardabil with the rate highest among all other reported rates in the world.

We aimed to present the second report from Ardabil cancer registry in order to update the incidence and mortality and describe the trend (12).

Materials and Methods

Ardabil cancer registry (ACR) is a population-based cancer registry that has been established in 2000 by Digestive Diseases Research Center (DDRC) of Tehran University of Medical Sciences (TUMS) with collaboration of Ardabil University of Medical Sciences (ARUMS) and International Agency for Research on Cancer (IARC). The population covered by the registry comprises 9 urban districts and their surrounding rural areas, Ardabil province is located in north-west of Iran, an area 50 kilometers inland from the western Caspian Sea shoreline, according to the 2006 census (Fig. 1), is 1,228,155, 1.9% of the total population of Iran. The population of Ardabil is relatively young, with 76% below the age of 40 yr almost all of the population is Shi'a Muslim and more than 98% of them have Azeri ethnicity, which is a branch of Aryan Caucasian ancestry.

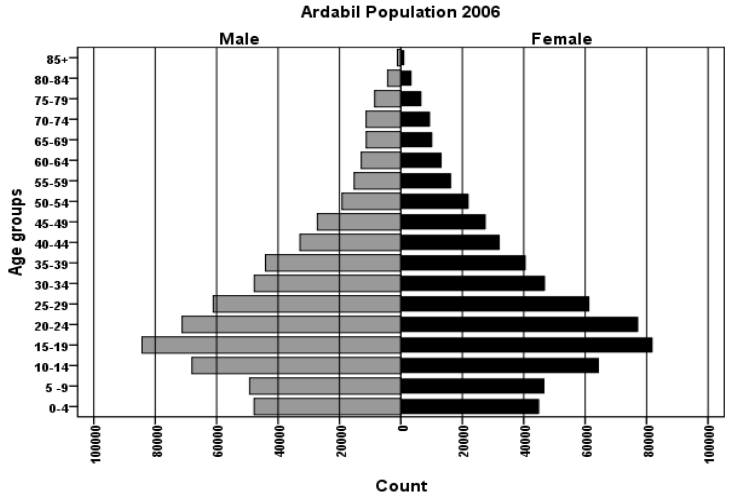

Fig. 1: Ardabil population, 2006 census

Data on all newly diagnosed cancer cases (only permanent residents of Ardabil Province) in 2004 to 2006 were actively collected. The ACR provides data on cancer incidence and stage at diagnosis from hospitals, pathology laboratories, radiology centers, ambulatory surgical centers, chemotherapy facilities, Drugs and Alcohol Investigation Unit, and physicians' offices. There are 14 hospitals with more than 1700 active beds in this province. ACR has appointed one trained personnel in each of 7 main hospitals of the province, to prepare cancer data and send them to ACR monthly.

ARUMS has lunched the family physicians' (FPs') program in almost all the rural areas of Ardabil province since 2004 to provide more effective medical care for people and provide the necessary medical facilities for patients. All the rural population has been covered by medical insurance and all referral should pass through FPs'. All FPs' are suppose to report cancer data to ACR during the referral for cancer patients in FPs' system. There are 4 categories of information collected by the registry: Patient demographics, tumor (cancer) identification, treatment and outcome of patient.

The majority of cancer cases among Ardabil province residents, which were diagnosed in other provinces, were added in the ACR database through sharing of cancer incidence data among provinces specially data from Tabriz and Tehran. Cases reported to ACR initially were checked for duplica-

tion reports and then were defined by the codes included in the third edition of the International Classification of Diseases for Oncology (ICD-O III) before entering to database (13). Persian version of CanReg4 software was used for data entry and data was checked with IARC check program (14).
Incidence rates were age-adjusted to the world's 2000 standard population in 18 age categories of 5 yr each (0-4, 5-9, .., 85+), and expressed per 100,000. Incidence rate and age-standardized rate (ASR) has been calculated according to the years observed, gender, and topography site and adjusted for the cases of unknown age. Correction for unknown age cases was carried out by multiplying the standardized rate, based on cases of known age, by T/K where T is the total number of cases of cancer of the same type in persons of the same sex and K is the number occurring in persons of known age (15).
ASR has been calculated with direct method and indirect method of standardization to compare with the previous studies and the national report of cancer occurrence in Iran. Cumulative risk calculated based on Day's (1987) equation for age periods of 0-64 and 0-74 yr for each gender and cancer sites (16).
The leading causes of death from cancer and cancer mortality rates from 2004 to 2006 were obtained using data from the comprehensive death registry system of Ardabil province and had been compared with cancer registry data to reduce misclassification of causes of death. Death registration program of Ardabil Province is a part of the national program with more than 75% coverage in Iran (17, 18).

Quality of Data

More than 7200 reports of cancer occurrence were submitted in ACR from 2004 to 2006. After omitting duplicate cases there were 4363 new cases registered in ACR during the study period, the notification per case ratio was 1.7 and the number of new cases registered in the study period was, 1442, 1484, and 1437 respectively for 2004, 2005, and 2006. During 3 yr, the cases registered based on Microscopic Verification (MV) has improved from 58.7% to 81.5% and cases registered based on Death Certificate Only (DCO) has been decreased from 22.5% to 9.2% subsequently. In total cases registered during 3 yr, base of the diagnosis was histopathological (MV) in 69%, DCO in 18%, Clinical investigation in 8% and Clinical only in 5% of cases.
Some cancer types with more than 80% evidences of MV were the skin (97.1%), thyroid (92.1%), rectum (91.9%), lymph nodes (82.9%), and ovary (80.7%) (Table 1). The cancer sites that were registered lower than 50% based on MV were the bronchus and lung (32.7%), small intestine (35.5%), pancreas (32.7%) and liver (19.7%). In some cancer sites such as small intestine and liver, more than 50% of cases were registered based on DCO reports. Some cancer cases that were registered mainly based on clinical investigation were pancreas (49.1%) and brain (31.6%).
Some indices about data quality in the 3 yr period are shown in Table 2. Percentage of unknown morphology (code 8000.3-8000.9) decreased from 38% to 17% respectively from 2004 to 2006.

Table 1: Methods of diagnostic verification (%) by cancer site, 2004-2006

Topography	Microscopic	Clin. Invest./Ult Sound	Clinical only	DCO	Unknown
Stomach	72.2	4.0	5.6	17.9	0.2
Esophagus	76.9	4.3	4.8	13.8	0.2
Skin	97.1	0.0	0.2	2.7	0.0
Bladder	78.1	10.2	6.5	4.6	0.5
Bronchus & lung	32.7	15.4	7.2	43.7	1.0
Blood	54.1	0.9	5.8	37.2	1.9
Breast	77.4	6.8	7.3	7.3	1.1
Brain	53.8	31.6	4.7	9.4	0.6
Colon	77.9	9.1	6.5	6.5	0.0
Lymph nodes	82.9	7.6	3.8	4.8	0.9
Prostate	67.4	3.4	8.9	17.9	2.2
Liver	19.7	23.5	1.2	54.3	1.2
Kidney	64.9	19.5	6.5	7.8	1.3
Rectum	91.8	4.1	2.7	1.4	0.0

Table 1: Countinued…

Thyroid	92.1	0.0	3.2	4.8	0.0
Ovary	80.7	10.5	7.0	1.7	0.0
Pancreas	32.7	49.1	7.3	10.9	0.0
Small intestine	35.5	6.4	0.0	58.1	0.0

DCO= Death Certificate only, Clin.Invest.= Clinical Investigation, Ult sound= Ultra sound

Table 2: Data quality of cancer registry by year of registration

Data quality index	2004	2005	2006	3 yr
	%	%	%	%
Unknown sex	0.3	0.1	0.3	0.2
Unknown age	2.7	2.5	2.7	1.3
Unknown site of Origin (80.9)	7.1	8.7	3.2	6.4
Unknown Morphology (8000.3-9)	38	33.9	17.2	29.8
Microscopic Verification	58.7	63.1	81.5	67.2
Death Certificate Only	22.5	22.2	9.2	18.0

Results

Cancer Incidence

Of the total of 4363 cases that were registered, 2588 (59.3%) cases were male and 1765 (40.5%) cases were female, with sex ratio of 1.47. The mean (±SD) age at the time of first diagnosis was 62.1 (±16.9) yr for males and 59.8 (±18.4) for females [for both sex mean age was 59.8 (±17.8)]. Fig. 2 shows the age-specific crude rate of all cancer sites by sex rising with age with a little notching in the age group 80-84 in women.

In men, the leading primary cancer sites in terms of ASR (excluding skin cancer) were stomach, esophagus, bladder, lung, and colorectal (Table 3). In women, also stomach was the most common cancer site, followed by esophagus, breast, colorectal, and central nervous system (CNS) (Table 4). Table 5 compares the incidence rates of invasive cancers in this study with the previous cancer survey in Ardabil between 1996 and 1999. This table reveals that approximately all the cancers has increase in the recent cancer data.

Cancer Mortality

More than 13,630 deaths were registered during 2004 to 2006 in comprehensive death registration of Ardabil province. Annual Cancer related deaths ranged between 14 to 16 percent of all deaths during the study period in Ardabil. Death due to cancer was registered for 2111 cases (15.5%) in the study period. Garbage codes in death certificates consist of 20.5% of registered cases. The mean age (±SD) for cancer related death was 63.5 (±16.8) [male 64.4 (±16.4); female 61.6 (±17.5)].

The leading cancer sites in men in terms of crude mortality rate (MR) were stomach, esophagus, and lung (Table 6). In women, the leading killer cancer sites were similar to men.

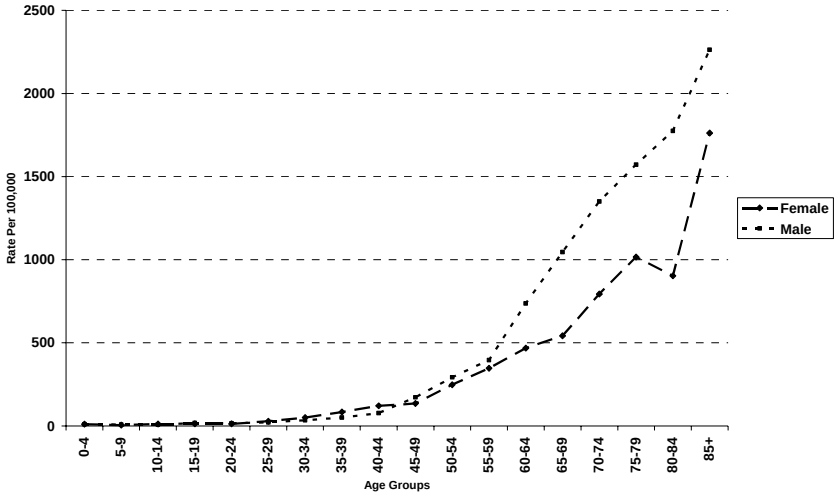

Fig. 2: Age-specific incidence curve by sex, all sites, Ardabil, 2004-6

Table 3: Age specific crud rate, Crud and Age adjusted incidence rates for Male in Ardabil Province_2004-6

Primary Site	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+	Total Count	Freq %	Crud Rate	ASR /100,000
Stomach	0.0	0.0	0.0	0.8	1.3	1.1	1.4	3.3	11.7	37.8	67.6	107.5	227.7	356.1	484.1	496.2	631.5	538.8	727	27.8	38.3	51.8
Esophagus	0.0	0.0	0.0	0.4	0.4	1.1	0.7	1.6	7.4	13.5	21.9	38.9	99.8	133.5	148.7	206.4	160.4	251.4	269	10.3	14.2	19.5
Other skin	0.7	0.6	0.4	0.4	0.4	1.6	2.7	6.5	3.2	8.1	25.6	38.9	69.1	77.9	128.3	99.2	180.4	610.6	230	8.8	12.1	17.9
Bladder	0.0	0.6	0.0	0.0	0.9	0.5	0.7	6.5	5.3	13.5	18.3	48.0	43.5	61.2	90.4	107.2	140.3	251.4	179	6.8	9.4	13.1
Lung, trachea & bronchus	0.0	0.0	0.0	0.4	0.4	0.0	0.7	3.3	4.2	16.2	25.6	32.0	33.3	61.2	84.6	91.3	110.3	71.8	151	5.8	7.9	10.8
Colorectal	0.0	0.0	0.0	1.5	0.0	3.7	4.7	4.1	11.7	10.8	9.1	20.6	38.4	38.9	72.9	95.3	70.2	107.8	144	5.5	7.6	9.6
Brain, nervous system	1.4	0.0	1.7	0.8	3.1	4.8	2.7	4.9	5.3	18.9	20.1	4.6	30.7	22.3	23.3	31.8	10.0	35.9	104	4.0	5.5	7.0
Luekemia	1.4	3.1	2.2	2.7	1.3	1.6	4.7	4.1	1.1	4.0	14.6	16.0	17.9	11.1	29.2	35.7	30.1	71.8	91	3.5	4.8	5.8
Prostate	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	4.0	1.8	2.3	20.5	41.7	61.2	115.1	80.2	71.8	89	3.4	4.7	5.7
NHL	1.4	0.6	0.4	1.1	0.9	2.1	1.4	1.6	1.1	9.4	7.3	4.6	12.8	22.3	11.7	27.8	30.1	35.9	59	2.3	3.1	4.0
Liver	0.0	0.0	0.0	0.8	0.4	0.0	0.0	0.0	1.1	4.0	11.0	9.1	20.5	25.0	11.7	23.8	30.1	35.9	48	1.8	2.5	3.7
Kidney	2.1	0.0	0.4	0.4	0.0	0.5	0.0	0.8	4.2	2.7	9.1	4.6	5.1	22.3	8.7	23.8	30.1	35.9	43	1.6	2.3	3.1
Larynx	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1	0.0	5.5	6.9	15.4	13.9	2.9	7.9	0.0	0.0	22	0.8	1.2	1.8
Pancreas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	2.7	5.5	4.6	10.2	5.6	8.7	27.8	10.0	0.0	25	1.0	1.3	1.8
Bone	0.0	0.6	0.4	4.2	2.6	0.5	1.4	0.8	1.1	0.0	0.0	4.6	0.0	11.1	5.8	0.0	0.0	35.9	33	1.3	1.7	1.7
Small intestine	0.7	0.6	0.0	0.0	0.0	0.0	1.4	0.8	0.0	1.3	3.7	2.3	5.1	5.6	8.7	23.8	0.0	0.0	22	0.8	1.2	1.4
Hodgkin Lymphoma	0.0	0.6	0.9	0.8	0.0	0.0	0.7	0.0	1.1	4.0	1.8	2.3	5.1	0.0	5.8	4.0	10.0	0.0	18	0.7	0.9	1.1
Testis	0.0	0.0	0.0	0.0	1.8	1.6	2.7	2.5	2.1	1.3	0.0	2.3	0.0	2.8	0.0	0.0	20.0	0.0	21	0.8	1.1	1.1
Multiple Myeloma	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	0.0	0.0	7.7	5.6	8.7	7.9	10.0	0.0	13	0.5	0.7	0.9
Melanoma of skin	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.8	1.1	1.3	5.5	2.3	0.0	5.6	0.0	4.0	20.0	0.0	13	0.5	0.7	0.9
Nasopharynx	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	2.7	0.0	4.6	5.1	2.8	8.7	0.0	0.0	0.0	12	0.5	0.6	0.9
Connective & soft tissue	0.0	0.0	0.4	0.0	0.9	0.0	2.0	0.0	2.1	1.3	0.0	4.6	5.1	0.0	0.0	0.0	0.0	0.0	13	0.5	0.7	0.8
Thyroid	0.0	0.0	0.4	0.0	0.4	0.5	0.7	0.0	0.0	0.0	3.7	0.0	0.0	0.0	11.7	4.0	0.0	0.0	11	0.4	0.6	0.6
Lip	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	1.8	0.0	2.6	2.8	8.7	4.0	0.0	0.0	8	0.3	0.4	0.6
Gallbladder etc.	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.8	0.0	1.3	1.8	0.0	0.0	8.3	0.0	4.0	0.0	0.0	8	0.3	0.4	0.6
Kaposi sarcoma	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	4.6	2.6	0.0	2.9	4.0	0.0	0.0	6	0.2	0.3	0.5
Pharynx unspecified	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	1.8	0.0	0.0	5.6	2.9	0.0	0.0	0.0	5	0.2	0.3	0.4
Breast	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	1.8	2.3	0.0	0.0	0.0	0.0	10.0	0.0	4	0.2	0.2	0.3
Tongue	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	2.8	0.0	7.9	10.0	0.0	5	0.2	0.3	0.3
Other endocrine	0.0	0.0	0.4	0.0	0.0	0.0	0.7	0.8	1.1	0.0	0.0	0.0	0.0	2.8	0.0	0.0	0.0	0.0	5	0.2	0.3	0.3
Ureter	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	5.6	0.0	0.0	0.0	0.0	3	0.1	0.2	0.3

Table 3: Continued…

Other thoracic organs	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.8	0.0	0.0	0.0	0.0	2.6	0.0	0.0	0.0	0.0	0.0	3	0.1	0.2	0.2
Other oropharynx	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	2.3	0.0	0.0	0.0	0.0	0.0	0.0	2	0.1	0.1	0.2
Salivary glands	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	1.1	0.0	0.0	0.0	0.0	0.0	2.9	0.0	0.0	0.0	3	0.1	0.2	0.2
Nose, sinuses etc.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2	0.1	0.1	0.1
Mesothelioma	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	0.0	0.0	0.0	0.0	0.0	1	0.0	0.1	0.1
Eye	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	10.0	0.0	2	0.1	0.1	0.1
Other and unspecified	2.1	1.2	0.9	2.3	0.4	0.0	0.0	0.0	0.0	0.0	14.6	6.9	12.8	52.9	40.8	23.8	100.2	0.0	80	3.1	4.2	5.4
All sites	9.7	8.0	8.7	17.9	16.2	23.8	35.8	51.5	81.8	176.7	292.2	395.5	737.0	1046.1	1350.3	1572.1	1774.3	2262.9	2619	100.0	137.9	184.1
All sites but Skin	9.0	7.4	8.3	17.5	15.8	22.3	33.1	45.0	78.6	168.6	266.6	356.7	667.9	968.2	1222.0	1472.8	1593.8	1652.3	2400	91.6	126.3	167.1

Table 4: Age specific crud rate, Crud and Age adjusted incidence rates for Female in Ardabil Province_2004-6

Primary Site	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+	Total Count	Freq %	Crud Rate	ASR /100,000
Stomach	0.0	0.0	0.0	0.4	0.0	1.7	5.0	4.4	5.4	13.0	45.6	63.9	121.7	124.4	225.7	215.9	216.6	326.3	311	17.3	17.0	24.9
Esophagus	0.0	0.0	0.0	0.4	0.0	2.8	2.2	1.8	8.6	14.3	34.2	70.3	77.7	95.7	123.5	221.2	156.4	293.6	248	13.8	13.6	19.7
Skin But Melanoma	0.0	0.0	0.0	0.4	0.4	0.6	1.4	3.5	7.5	13.0	14.7	29.8	54.4	54.2	116.4	121.1	108.3	228.4	165	9.2	9.0	13.1
Breast	0.0	0.0	0.0	0.4	0.9	6.1	13.6	26.3	35.4	20.8	40.7	19.2	15.5	19.1	14.1	21.1	24.1	163.1	176	9.8	9.6	12.0
colorectal	0.0	0.0	0.0	0.0	0.4	0.5	2.1	4.4	7.5	5.2	19.6	23.4	28.5	44.7	38.8	68.5	36.1	32.6	97	5.4	5.3	7.4
Brain, nervous system	1.5	1.9	1.4	1.6	1.3	1.7	4.3	5.3	7.5	15.6	16.3	10.6	23.3	28.7	35.3	10.5	12.0	32.6	96	5.4	5.2	6.9
Lung, trachea & bronchus	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.9	2.1	5.2	9.8	25.6	18.1	22.3	38.8	21.1	36.1	32.6	60	3.3	3.3	4.8
Ovary	0.0	0.0	0.9	0.4	1.8	3.9	2.2	3.5	7.5	10.4	13.0	8.5	0.0	16.0	3.5	10.5	0.0	32.6	58	3.2	3.2	3.9
Thyroid	0.0	0.0	0.9	0.8	1.8	0.6	7.9	7.9	3.2	1.3	9.8	0.0	2.6	12.8	3.5	10.5	36.1	65.3	54	3.0	2.9	3.3
Luekemia	1.5	0.0	3.2	1.2	0.4	1.7	2.2	1.8	4.3	2.6	6.5	6.4	15.5	6.4	14.1	21.1	12.0	0.0	51	2.8	2.8	3.3
Kidney	2.2	0.0	0.0	0.0	0.0	1.1	0.7	2.6	2.1	6.5	1.6	4.3	10.4	12.8	7.1	10.5	0.0	65.3	35	2.0	1.9	2.9
Liver	0.0	0.0	0.5	0.0	0.4	0.0	0.0	0.9	2.1	0.0	3.3	4.3	5.2	9.6	31.7	36.9	12.0	65.3	34	1.9	1.9	2.6
Bladder	0.0	0.0	0.0	0.8	0.9	0.6	0.7	2.6	1.1	1.3	3.3	8.5	2.6	6.4	10.6	68.5	48.1	0.0	40	2.2	2.2	2.5
Pancreas	0.0	0.0	0.0	0.0	0.4	0.6	0.0	0.0	1.1	2.6	0.0	10.6	7.8	9.6	24.7	15.8	24.1	32.6	29	1.6	1.6	2.3
NHL	0.7	0.6	0.0	0.4	0.0	2.2	0.7	2.6	2.1	3.9	1.6	2.1	7.8	6.4	0.0	10.5	0.0	32.6	26	1.4	1.4	1.9
Gallbladder etc.	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	1.1	1.3	3.3	0.0	10.4	16.0	10.6	10.5	12.0	0.0	21	1.2	1.1	1.7
Cervix uteri	0.0	0.0	0.0	0.0	0.4	0.0	0.7	2.6	3.2	2.6	0.0	2.1	7.8	0.0	0.0	5.3	0.0	65.3	17	0.9	0.9	1.4
Corpus uteri	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	2.1	0.0	4.9	6.4	5.2	9.6	0.0	0.0	12.0	0.0	17	0.9	0.9	1.3
Multiple Myeloma	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	3.2	3.9	0.0	4.3	7.8	0.0	3.5	0.0	12.0	0.0	14	0.8	0.8	1.1
Bone	0.7	1.3	2.8	1.2	0.9	0.0	0.7	0.9	0.0	0.0	0.0	2.1	2.6	3.2	0.0	5.3	0.0	0.0	20	1.1	1.1	1.1
Uterus unspecified	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.9	1.1	5.2	0.0	2.1	2.6	3.2	7.1	0.0	0.0	0.0	12	0.7	0.7	0.9

Table 4: Continued…

Hodgkin Lymphoma	0.0	0.0	1.4	2.4	0.9	1.1	0.0	0.9	0.0	0.0	1.6	2.1	0.0	0.0	3.5	5.3	0.0	0.0	18	1.0	0.9	0.8
Connective & soft tissue	0.7	0.0	0.5	0.0	0.0	0.0	0.0	0.9	1.1	0.0	0.0	0.0	0.0	3.2	7.1	0.0	0.0	65.3	9	0.5	0.5	0.8
Small intestine	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.9	0.0	0.0	0.0	0.0	2.6	3.2	3.5	15.8	12.0	0.0	9	0.5	0.5	0.6
Tongue	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1	2.6	0.0	0.0	0.0	0.0	32.6	3	0.2	0.2	0.4
Melanoma of skin	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	2.1	0.0	0.0	0.0	2.6	0.0	0.0	5.3	0.0	0.0	5	0.3	0.3	0.3
Nasopharynx	0.0	0.0	0.0	0.4	0.0	0.6	0.7	0.0	0.0	0.0	0.0	2.1	0.0	3.2	0.0	0.0	0.0	0.0	5	0.3	0.3	0.3
Larynx	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0	0.0	0.0	2.6	0.0	0.0	0.0	12.0	0.0	4	0.2	0.2	0.3
Tonsil	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	1.6	2.1	0.0	0.0	0.0	0.0	0.0	0.0	3	0.2	0.2	0.2
Other thoracic organs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	3.2	0.0	0.0	0.0	0.0	2	0.1	0.1	0.2
Lip	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	2.1	0.0	0.0	0.0	0.0	0.0	0.0	2	0.1	0.1	0.2
Pharynx unspecified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.5	0.0	0.0	3	0.2	0.2	0.2
Kaposi sarcoma	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0	3.5	0.0	0.0	0.0	2	0.1	0.1	0.2
Mouth	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0	0.0	2	0.1	0.1	0.1
Other oropharynx	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.0	0.0	0.0	0.0	1	0.1	0.1	0.1
Nose, sinuses etc	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0	0.0	1	0.1	0.1	0.1
Ureter	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	0.1	0.1	0.1
Other and unspecified	3.6	1.3	0.5	1.6	0.0	1.1	1.4	0.0	0.0	0.0	0.0	10.6	2.6	0.0	24.7	31.6	84.2	163.1	50	2.8	2.7	3.7
All sites	10.9	5.2	12.1	12.7	12.4	28.7	50.2	85.9	121.1	135.3	251.0	347.1	468.6	561.6	793.6	1016.4	902.5	1761.8	1794	164.7	98.1	134.3
All sites but Skin	10.9	5.2	12.1	12.3	11.9	28.1	48.8	82.4	113.6	122.3	236.3	317.3	414.3	507.3	677.2	895.3	794.2	1533.4	1635	150.1	89.4	121.7

Table 5: Comparison of 10 leading cancers in Ardabil in two periods of time (1996-9 and 2004-6)

Female			**Male**		
Cancer	**Age-standardized rate**		**Cancer**	**Age-standardized rate**	
	1996-9	**2004-6**		**1996-9**	**2004-6**
Stomach	25.4	24.7	Stomach	49.1	51.8
Esophagus	14.4	19.9	Esophagus	15,4	20.0
Breast	7.6	11.9	Bladder	7.6	13.1
Colorectal	5.9	7.4	Lung	7.9	10.8
CNS	3.1	6.8	Colorectal	7.9	9.6
Lung	3.6	4.8	CNS	4.4	7.0
Gallbladder	2.3	1.7	Leukemia	--	5.8
Ovary	0.8	3.9	Prostate	3.4	5.7
Leukemia	--	3.3	Non-Hodgkin Lymp.NOS	2.8	4
Thyroid	1.0	3.3	Liver	1.8	3.7

Table 6: Mortality rates by cancer site and sex, Ardabil, 2004-6

Female							Male						
Cancer	**Total**	**Freq**	**Crude Mortality Rate**	**ASMR**	**95% CI**		**Cancer**	**Total**	**Freq**	**Crude Mortality Rate**	**ASMR**	**95% CI**	
	n	**%**						**n**	**%**				
Stomach	206	28.5	11.3	16.3	13.9	18.6	Stomach	465	33.6	24.5	32.2	29.1	35.3
Esophagus	102	14.1	5.6	7.7	6.1	9.2	Esophagus	179	12.9	9.4	12.9	10.9	14.9
Lung	55	7.6	3.0	4.3	3.1	5.4	Lung	128	9.2	6.7	9.1	7.4	10.8
Hematologic neoplasms	57	7.9	3.1	3.9	2.8	4.9	Hematologic neoplasms	107	7.7	5.6	6.7	5.3	8.1
Breast	36	4.9	1.9	2.6	1.7	3.5	Liver	46	3.3	2.4	3.3	2.3	4.4
Liver	32	4.4	1.7	2.4	1.5	3.2	Colorectal	52	3.7	2.7	3.3	2.4	4.3
Colorectal	21	2.9	1.1	1.6	0.9	2.3	CNS	47	3.4	2.5	3.1	2.1	3.9
CNS	21	2.9	1.1	1.5	0.8	2.1	Prostate	45	3.2	2.4	2.9	1.9	3.8
Small intestine	13	1.8	0.7	0.8	0.4	1.3	Bladder	22	1.6	1.2	1.4	0.8	2.8
Pancreas	9	1.2	0.5	0.7	0.2	1.2	Pancreas	15	1.1	0.8	1.1	0.5	1.6
Kidney	9	1.3	0.5	0.6	0.2	1.1	Bone	15	1.1	0.8	1.0	0.4	1.6
Gallbladder etc.	7	1.0	0.4	0.6	0.2	1.1	Small intestine	16	1.2	0.8	1.0	0.5	1.5
Corpus uteri	8	1.1	0.4	0.5	0.2	0.9	Pharynx unspecified	8	0.6	0.4	0.6	0.2	1.0
Bladder	6	0.8	0.3	0.5	0.1	0.9	Mouth	5	0.4	0.3	0.3	0.0	0.5
Ovary	6	0.8	0.3	0.4	0.1	0.8	Nasopharynx	3	0.2	0.2	0.3	0.0	0.6
Thyroid	4	0.6	0.2	0.3	0.0	0.7	Connective & soft tissue	4	0.3	0.2	0.2	0.0	0.5
Unknown	97	13.4	5.3	6.7	5.3	8.1	Unknown	163	11.8	8.6	11.0	9.2	12.8
All sites	722	100.0	39.5	54.2	50.0	58.3	All sites	1385	100.0	72.9	94.5	89.2	99.9

ASMR=Age-standardized mortality rate per 100,000.

Discussion

Ardabil cancer registry is the first population based cancer registry in Iran and as expected the percentage of DCO cases has decline from (22.5%) in the first year of activity to below 10% and the MV% has increased from 58.7% in 2004 to more than 81% in 2006 (Table 2). Overall incidence of all cancers sites in terms of age-standardized rate in Ardabil was 184.1 in men and 134.3 in women (Tables 3 & 4); this is the highest allover cancer rate among all reported rates from other provinces of Iran (12, 19, 20).

The result of this study confirms our first report of cancer occurrence in Ardabil (9). Upper GI cancers alone account for 35.4% of all cancers in this region and Gastrointestinal tract cancers constitutes 43% of all cancers in Ardabil. Stomach cancer which constitute close to one fourth (23.7%) of all malignancies in the province is the most common cancer. We have already shown that at least one third of all stomach cancer in Ardabil occurs in the cardia subsite with a surface area of only 5-10% of the entire stomach. Therefore, the cancer incidence expressed as per unit of epithelial surface area is extremely high. As a matter of fact the incidence of cardia cancer in Ardabil province of Iran is the highest recorded anywhere in the world and it provides an excellent opportunity to study the etiology of this cancer which has a rising incidence throughout the world (10, 21). In Ardabil more than 80% of population has H pylori (HP) infection and Gastroesophageal reflux disease (GERD) (22). We have recently shown that both GERD and HP related atrophic gastritis contribute to etiology of gastric cardia cancer in Ardabil (23, 24). Therefore, any gastric cancer control program in Ardabil should be planned with the understanding that contrary to other high incidence area of gastric cancer like Japan and Korea with the non-cardia cancer as the most common type of stomach cancer; gastric cardia is the predominant type of gastric cancer in Ardabil Iran.

Comparing the GI cancer rate from our first report to the present study there is a significant increase in GI tract cancers rates in Ardabil province (Table 5), this is probably due to improvement in the death and cancer registration practices and increasing availability of gastroenterologist and diagnostic endoscopy in the province; but it may at least partly be a real increase due to changes in dietary habits and lifestyle. There is now some evidence that the incidence of esophageal adenocarcinoma (25), gastric cardia adenocarcinoma (9, 19), adenocarcinoma of colon (26) are increasing in Iran.

The incidence of several other cancers (Table 5) is also on the rise; the most important one are Breast and ovarian cancers in female and male lung and prostate cancers have increased. In addition to better diagnosis and registration of these types of cancer in Ardabil during last 10 years an increasing trend for breast and prostate cancer also has been reported from Iran (5).

Another very interesting finding of our first cancer registry (9) report from Ardabil was the surprisingly very low incidence of cervical cancer in female, a rate lower than any reported in the world. In this second report, although the incidence of this cancer has increased to more than tippled (ASR from 0.4 to 1.4), but it is still not among the first 15 cancers in female. The reason for this finding was thought to be due to the facts that Ardabil is one of the most religious cities in Iran, with >99% of residents being Shi'a Muslims with very strong dependence on family-based traditions and almost no extramarital sexual relations.

Cancer mortality in Ardabil is much higher than mortality in developed countries. For example during 2004 the one-year age-adjusted relative survival of patients with esophageal cancer were 32% for men and 34% for women in British Columbia (BC) in Canada, and 18% for men and 16% for women in Ardabil and the one-year age-adjusted relative survival rates for patients with gastric cancer was 48% for men and 46% for women in BC, and 15% for men and 21% for women in Ardabil (27). The higher mortality in Ardabil seems to be due to differences in cancer control systems in the two regions for example in Ardabil majority of cancers are in advance stages at the time of diagnosis.

Another reason for this difference in mortality may be due to differences in disease etiology, patient factors. The outcomes of upper GI cancers are poor for especially in Ardabil populations, and improvements in diagnosis and management are urgently needed.

A screening program should be considered to reduce the burden of cancer in Ardabil. For upper GI endoscopy, though difficult and expensive to implement, may be the best current possible method.

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