

Original Article

The Incidence of Prostate Cancer in Iran: Results of a Population-Based Cancer Registry

Alireza Sadjadi MD^{*}, Mehdi Nooraie MD^{*}, Anahita Ghorbani MD^{*},
Masoomeh Alimohammadian MSc^{**}, Mohammad-Javad Zahedi MD^{***},
Sodeif Darvish-Moghadam MD^{***}, Hafez Fakheri MD[†], Masood Babai MD[‡],
Shahriar Semnani MD[§], Fariborz Mansour-Ghanaei MD^{||}, Mohammad-Ali Mohagheghi MD[#]

Background: Little is known about the epidemiology of prostate cancer in Iranian men. We carried out an active prostate cancer surveillance program in five provinces of Iran.

Methods: Data used in this study were obtained from population-based cancer registries between 1996 and 2000.

Results: The age-standardized incidence rate of prostate carcinoma in the five provinces was 5.1 per 100,000 person-years. No significant difference was seen in the age-standardized incidence rate of prostate cancer within the provinces studied. The mean±SD age of patients with prostate cancer was 67±13.5 years.

Conclusion: The incidence of prostate cancer in Iran is very low as compared to the Western countries. This can partly be explained by lack of nationwide screening program, younger age structure and quality of cancer registration system in Iran.

Archives of Iranian Medicine, Volume 10, Number 4, 2007: 481 – 485.

Keywords: Incidence • Iran • cancer • prostate cancer

Introduction

The latest estimates of global cancer incidence show that prostate cancer has become the second most common cancer among men in the world, accounting for almost 11.7% of new cancer cases overall, which constitutes 19% of cancers in developed countries and 5.3% in developing countries.¹ The annual incidence of prostate cancer has grown up in many different countries.¹⁻⁵ In some countries such as in the U.S., prostate surpassed lung as the most

frequent cancer site among men.^{1, 6, 7} Prostate cancer alone accounts for 33% of incident cases in men.²

Epidemiologic studies revealed that there are variations in the geographic and racial distribution of cancer of prostate.⁸⁻¹⁰ The incidence is low in Asia (3 – 8 per 100,000 men per year), intermediate in Africa and Eastern Europe, and high in Western Europe and North America.¹¹

The incidence of prostate cancer grows up with the increase of age⁸ with three-quarters of all cases occurring in men aged 65 years or more.¹

Some previous studies have shown that in contrast to Europe and America, prostate carcinoma is not common in Iran.¹² It has been also shown that the incidence of prostate cancer has increased in Iranian immigrants to Western countries.¹³

Current data on the epidemiology of prostate cancer in Iran are scarce and incomplete. The present paper provides the first population-based report on prostate cancer incidence rate in Iran based on data obtained from cancer registries

Authors' affiliations: *Digestive Disease Research Center, Shariati Hospital, **Faculty of Health, #Cancer Research Center, Medical sciences/University of Tehran, Tehran, ***Kerman University of Medical sciences, Kerman, †Mazandaran University of Medical Sciences, Mazandaran, ‡Ardabil University of Medical Sciences, ‡Ardabil, §Golestan University of Medical Sciences, Golestan, ||Guilan University of Medical Sciences, Guilan, Iran.

•**Corresponding author and reprints:** Alireza Sadjadi MD, Digestive Disease Research Center, Shariati Hospital, Kargar Ave., Tehran 1411713137, Iran.

Tel: +98-218-241-5300, Fax: +98-218-241-5400,

E-mail: sadjadi@ams.ac.ir.

Accepted for publication: 27 December 2006

covering five provinces of Iran.

Patients and Methods

The study design and data collection strategies have been described previously.¹⁴ In summary, incidence data were obtained from population-based cancer registries located in five provinces of Iran, namely Ardabil, Guilan, Golestan, Mazandaran, and Kerman, which consisted of a population of almost 10 million. Data of all patients with prostate cancer in these provinces were collected for a period of five years from 1996 to 2000.

After being confirmed according to the inclusion criteria, the data were then summarized in a data sheets and coded using the ICD-O, 3rd edition. The alphabetically ordered data were checked for repeated cases by manual and computerized linkage. The data were then computerized using the SPSS 10.0 and MS Excel software with Persian fonts for the analysis. We calculated person-years of the population at risk using each year method. The crude (all-ages) and age-specific rates per 100,000 person-years for all provinces were calculated separately. For each province, an average annual age-standardized incidence rates (ASR) per 100,000 person-years were computed by the direct method using the World Standard Population:

$$ASR = \sum_{i=1} a_i w_i / \sum_{i=1} w_i$$

where a_i is age-specific incidence rate of each age group, and w_i is world standard population of each age group.¹⁵ Similarly, the standard error (SE) was calculated as follows:

$$SE = \sqrt{\sum_{i=1} [a_i w_i (100,000 - a_i) / n_i] / \left(\sum_{i=1} w_i \right)^2}$$

where a_i is age-specific incidence rate of each age group, w_i is world standard population of each age

group, and n_i represents person-years in each age group, for each province and for all the provinces as a whole providing a summary comparison statistics. The directly age-standardized rate for each province was compared with that for the rest of the provinces, using standardized rate ratios (according to ASR and SE of each province in comparison with those of the rest). The statistical significance of each ratio was calculated and reported whether each province's ASR was significantly different (higher or lower) at the 5% level from the rate for the rest of provinces.¹⁵

Results

There were 703 new cases of prostate cancer recorded in the five cancer registries during the five-year period of 1996 to 2000. Age-specific, crude and age-standardized incidence rates of prostate cancer in the five provinces are depicted in Table 1. According to these data, the ASR of prostate cancer in the five provinces was calculated to be 5.1 per 100,000 person-years. The mean±SD age of patients with prostate cancer at the time of diagnosis was 67±13.5 years. Half of prostate cancers were observed in patients aged 70 years or over. Figure 1 shows the logarithms of the prostate cancer incidence rates in the five provinces as a whole plotted against the logarithms of the age groups (from 25 – 74 years). There were no statistically significant differences in ASR of prostate cancer among these five provinces ($P>0.05$).

Discussion

Prostate cancer has become an increasingly important health problem worldwide.¹⁶

Considering the incidence of prostate cancer has risen dramatically over the last decades,³ it is currently one of the most common

Table 1. Crude, age-specific, and age-standardized incidence rates (per 100,000 person-years) of prostate cancer in five provinces in Iran between 1996 and 2000

Province	Cases affected	Age-specific rate in age group (yr)							Crude rate	ASR	SE
		0 - 14	15 - 24	25 - 34	35 - 44	45 - 54	55-64	≥65			
Ardabil	58	0	0	0	1	2.5	7.9	34.8	2.2	3.4	0.47
Guilan	182	0	0.3	0.1	0	1.1	9.9	50	3.6	4.4	0.33
Mazandaran	237	0.7	0	0.2	0.9	3.3	12.2	62.5	5.5	6.1	0.46
Golestan	106	0	0.2	0.2	0	2.3	10.1	57.7	3.2	5.2	0.49
Kerman	120	0	0	0.2	0.4	0.8	8.9	32.8	2.4	3.2	0.35
Total	703	0.1	0.2	0.2	0.3	2.2	11.3	55	4.1	5.1	0.37

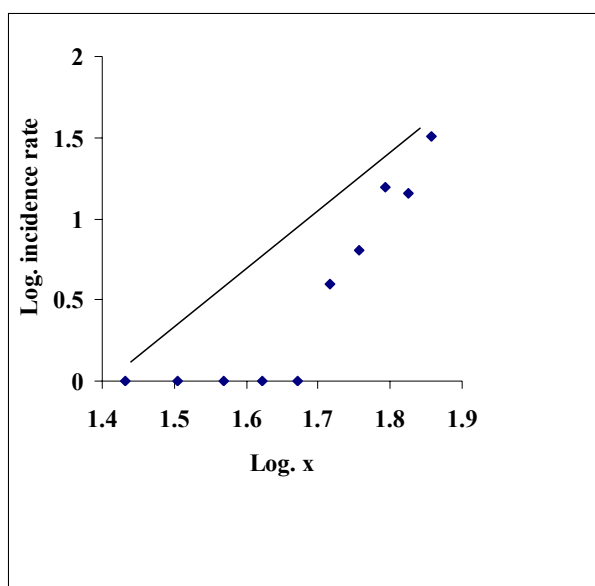


Figure 1. Changes in incidence with age for cancer of prostate.

malignancies around the world.¹⁷ Wide variations in the incidence of clinical prostate cancer have been reported between different ethnic groups and among different populations.⁸ To date, there has been no population-based study on the incidence of prostate cancer in Iran. This paper reveals the first report of an active prostate cancer surveillance program carried out in five provinces of Iran.

Our data indicate no statistically significant variations in the ASR of prostate cancer in these five provinces. This finding can be explicable in terms of similar prevalence of the probable environmental and genetic risk factors promoting prostate cancer in these provinces.¹⁸

As demonstrated in Figure 2,¹⁰ the age

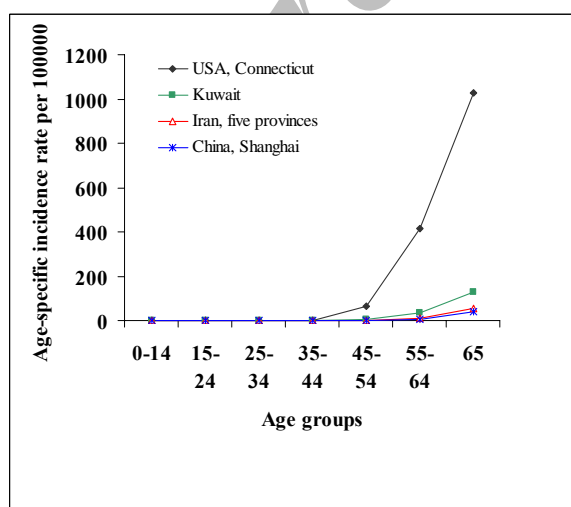


Figure 2. Age-specific incidence rate of prostate cancer in various countries.

incidence curve of prostate cancer in Iran shows a slow rise with increase of age (after 50 years of age). Similar pattern is observed in China and Kuwait. By contrast, the USA curve displays a sharp rise at this age. This sharp pattern may be due to the establishment of a National screening program and consequent detection of even latent prostate cancer in the US.¹⁹

Figure 3 shows the ASR of prostate cancer in Iranian men in comparison with various countries.²⁰ The ASR of prostate cancer in Iran is close to that of Asian countries such as China and Kuwait.⁴ Compared with the Western countries like the US, Iran has a remarkably lower incidence rate of prostate cancer.²¹ This large disparity in the incidence of prostate cancer may be due to a combination of genetic and environmental factors. Increased awareness of the condition and nationwide prostate screening program can explain partly the high incidence rates of prostate cancer reported in Western countries.^{2, 22, 23} Prostate-specific antigen (PSA) testing for prostate cancer screening can signal the presence of impalpable and thus previously undetectable cancer.^{3, 24} Consequently, intensified effort in early detection of prostate cancer through PSA screening has amplified the incidence of prostate cancer by allowing the detection of localized latent cancer lesions,^{9, 25} whereas in our country, data on incidence of prostate cancer only reflect the clinically obvious diseases. This certainly results from shortage in early detecting prostate cancer owing to lack of screening program. As prostate cancer occur mainly in higher ages, high life expectancy of the male population in Western countries resulting in greater proportions of elderly men in their population can also contribute to these differences.^{17, 25, 26} Additionally, other risk factors such as high fat Western diet, socioeconomic status, smoking, infectious agents, sexual behavior, and occupational exposures might play a role.^{6, 18, 27-32} Finally, high quality registration system for prostate cancer in Western world can provide the most accurate data, whereas this is lacking in Iran and we have undoubtedly underestimated the number of people affected.

The mean \pm SD age at diagnosis of prostate cancer in Iranian men is 67 \pm 13.5 years. In fact, half of the cases tend to occur over the age of 70. Hence, the age distribution of prostate cancer in Iran is similar to that of other countries around the world.¹

As it is expected that prostate cancer incidence

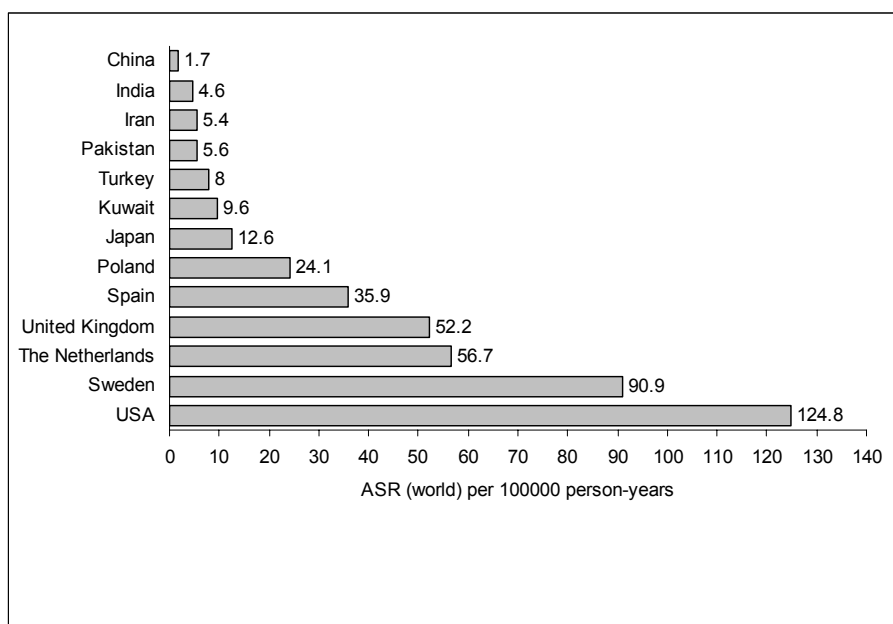


Figure 3. Age-standardized (to world population) incidence rates prostate cancer among men.²⁰

rate goes up with increasing age, the drop in prostate cancer incidence rate in the age group of 65 – 69 years (Figure 1) may be due to an underreporting of cases in elderly Iranian men over 65 years.

Previous studies on the multi-stage theory of carcinogenesis suggest that for cancer of certain organs the mortality increases with the sixth power of the age.³³ They formulate a hypothesis that this relationship is a result of constant strength of the carcinogenic factors within the specified period of life and independent role of hormonal control in growth. Divergence of our observations from the regression line with a gradient of 6 to 1 exhibits the lack of a uniform relationship between incidence rates and the sixth power of the age. This is similar to the findings of those prior studies, which suggest the powers of some of the risk factors, i.e., hormonal risk factors contributing to the development of the disease are variable. Indeed, it is believed that prostate cancer is strongly influenced by endocrine secretions especially sex hormones which vary in each individual throughout the life.^{33, 34}

A limitation of our study arise from its retrospective nature which may lead to an underestimation of the actual number of cases in consequence of poor quality of documenting medical records especially in private medical centers. Strength of this study is that data are based on population-based cancer registries covering a

much larger geographic area than what could be evaluated in the past.

In view of wide variations reported in the incidence of prostate cancer among various populations even within a given country,¹⁶ expansion of our cancer registration system is necessary to identify the true incidence of prostate cancer and its probable geographic disparities in Iran. Furthermore, a screening program for prostate cancer by PSA testing is highly recommended in order to discover latent asymptomatic prostate cancer cases and help clarify the real burden of the disease. In addition, future investigations are needed to improve our knowledge of risk factors predisposing to and probable protective factors against prostate cancer in Iran and show its trends over the time.

Acknowledgment

This study was funded by Digestive Disease Research Center and the Iranian Society of Gastroenterology and Hepatology. We are deeply indebted to Dr. D.M. Parkin (IARC, Lyon, France) for his support in providing trainings of registry personnel. We also gratefully acknowledge the assistance of Dr. Gooya from the Center for Disease Control in the Ministry of Health of Iran, local health officials, medical students of the survey team, Behvarzes of the health houses and all other colleagues who participated in this study.

References

- 1 Parkin DM, Bray F, Ferlay J, Pisani P. Global cancer statistics, 2002. *CA Cancer J Clin.* 2005; **55**: 74 – 108.
- 2 Jemal A, Siegel R, Ward E, Murray T, Xu J, Smigal C, Thun MJ. Cancer statistics, 2006. *CA Cancer J Clin.* 2006; **56**: 106 – 130.
- 3 Albertsen PC. The prostate cancer conundrum. *J Natl Cancer Inst.* 2003; **95**: 930 – 931.
- 4 Sim HG, Cheng CW. Changing demography of prostate cancer in Asia. *Eur J Cancer.* 2005; **41**: 834 – 845.
- 5 Wakai K. Descriptive epidemiology of prostate cancer in Japan and western countries. *Nippon Rinsho.* 2005; **63**: 207 – 212.
- 6 Dutta Roy S, Philip J, Javle P. Trends in prostate cancer incidence and survival in various socioeconomic classes: a population-based study. *Int J Urol.* 2005; **12**: 644 – 653.
- 7 Druet-Cabanac M, Colombeau P, Preux PM, Paulhac P, Vergnenegre A, Dumas JP. Epidemiology of prostate cancer in the Limousin area. *Prog Urol.* 2002; **12**: 226 – 231.
- 8 Diokno AC. Epidemiology of prostate cancer. *West J Med.* 1998; **169**: 111 – 112.
- 9 Sandblom G, Varenhorst E. Incidence rate and management of prostate carcinoma. *Biomed Pharmacother.* 2001; **55**: 135 – 143.
- 10 Parkin DM, Whelan SL, Ferlay J, Storm H. *Cancer Incidence in Five Continents.* Lyon, France: IARC Cancer Base; 2005.
- 11 Kehinde EO, Mojiminiyi OA, Sheikh M, Al-Awadi KA, Daar AS, Al-Hunayan A, et al. Age-specific reference levels of serum prostate-specific antigen and prostate volume in healthy Arab men. *BJU Int.* 2005; **96**: 308 – 312.
- 12 Habibi A, Manouchehri A, Diba MH, Sadjadi M, Ghavam M. Prostatic tumors in Iran. *Int Surg.* 1975; **60**: 405 – 407.
- 13 Yavari P, Hislop TG, Bajdik C, Sadjadi A, Nouraie M, Babai M, et al. Comparison of cancer incidence in Iran and Iranian immigrants to British Columbia, Canada. *Asian Pac J Cancer Prev.* 2006; **7**: 86 – 90.
- 14 Sadjadi A, Malekzadeh R, Derakhshan MH, Sepehr A, Nouraie M, Sotoudeh M, et al. Cancer occurrence in Ardabil: results of a population-based cancer registry from Iran. *Int J Cancer.* 2003; **107**: 113 – 118.
- 15 Jenson OM, Parkin DM, MacLennan R, Muir CS, Sleet RG. Statistical methods for registries. In: Boyle P, Parlin DM, eds. *Cancer Registration Principles and Methods.* Lyon: IARC Scientific Publication; 1991: 126 – 158.
- 16 Quinn M, Babb P. Patterns and trends in prostate cancer incidence, survival, prevalence and mortality. Part II: individual countries. *BJU Int.* 2002; **90**: 174 – 184.
- 17 Dijkman GA, Debruyne FM. Epidemiology of prostate cancer. *Eur Urol.* 1996; **30**: 281 – 295.
- 18 Pienta KJ, Esper PS. Risk factors for prostate cancer. *Ann Intern Med.* 1993; **118**: 793 – 803.
- 19 Sarma AV, Schottenfeld D. Prostate cancer incidence, mortality, and survival trends in the United States: 1981 – 2001. *Semin Urol Oncol.* 2002; **20**: 3 – 9.
- 20 Ferlay J, Bray F, Pisani P, Parkin DM. *GLOBOCAN 2002: Cancer Incidence, Mortality and Prevalence Worldwide.* Lyon, France: IARC Cancer Base; 2004.
- 21 Lee MM, Wang RT, Hsing AW, Gu FL, Wang T, Spitz M. Case-control study of diet and prostate cancer in China. *Cancer Causes Control.* 1998; **9**: 545 – 552.
- 22 Delongchamps NB, Singh A, Haas GP. The role of prevalence in the diagnosis of prostate cancer. *Cancer Control.* 2006; **13**: 158 – 168.
- 23 Slawin KM, Ohori M, Dilliglugil O, Scardino PT. Screening for prostate cancer: an analysis of the early experience. *CA Cancer J Clin.* 1995; **45**: 134 – 147.
- 24 Brewster DH, Fraser LA, Harris V, Black RJ. Rising incidence of prostate cancer in Scotland: increased risk or increased detection? *BJU Int.* 2000; **85**: 463 – 473.
- 25 Caballero-Alcantara J, Marchal-Escalona C, Padilla-Leon M, Rodrigo-Fernandez I. Crude rate increase of prostate cancer incidence in our setting. *Actas Urol Esp.* 2001; **25**: 624 – 627.
- 26 Dvoracek J. Adenocarcinoma of the prostate. *Cas Lek Cesk.* 1998; **137**: 515 – 521.
- 27 Boers D, Zeegers MP, Swaen GM, Kant I, van den Brandt PA. The influence of occupational exposure to pesticides, polycyclic aromatic hydrocarbons, diesel exhaust, metal dust, metal fumes, and mineral oil on prostate cancer: a prospective cohort study. *Occup Environ Med.* 2005; **62**: 531 – 537.
- 28 Steenland K, Rodriguez C, Mondul A, Calle EE, Thun M. Prostate cancer incidence and survival in relation to education (United States). *Cancer Causes Control.* 2004; **15**: 939 – 945.
- 29 Lund-Nilsen TI, Johnsen R, Vatten LJ. Socioeconomic and lifestyle factors associated with the risk of prostate cancer. *Br J Cancer.* 2000; **82**: 1358 – 1363.
- 30 Coley CM, Barry MJ, Fleming C, Mulley AG. Early detection of prostate cancer. Part I: prior probability and effectiveness of tests. The American College of Physicians. *Ann Intern Med.* 1997; **126**: 394 – 406.
- 31 Hsing AW, Deng J, Sesterhenn IA, Mostofi FK, Stanczyk FZ, Benichou J, et al. Body size and prostate cancer: a population-based case-control study in China. *Cancer Epidemiol Biomarkers Prev.* 2000; **9**: 1335 – 1341.
- 32 Du SF, Shi LY, He SP. A case-control study of prostate cancer. *Zhonghua Liu Xing Bing Xue Za Zhi.* 1996; **17**: 343 – 345.
- 33 Armitage P, Doll R. The age distribution of cancer and a multi-stage theory of carcinogenesis. *Br J Cancer.* 2004; **91**: 1983 – 1989.
- 34 Greenwald P. Clinical trials in cancer prevention: current results and perspectives for the future. *J Nutr.* 2004; **134** (suppl 12): 3507S – 3512S.