RESEARCH COMMUNICATION

Trends in the Prostate Cancer Incidence in India

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Abstract

Trends in prostate cancer in five population-based cancer Registries (Mumbai, Chennai, Bangalore, Delhi & Bhopal) in India were studied over a period of two decades using a model that fitting the data as the logarithm of Y=ABx which represents a Linear Regression model. This approach showed increasing trends in the age adjusted incidence rates throughout the entire period of observation for most of the registries, especially in Chennai and Bhopal and to the least extent in Mumbai. Particularly in Asia we face a future major increase in the rates of prostate cancer. Collaborative action now is a high priority to allow the preparations necessary for effective control of prostate cancer.

Key Words: Trends - prostate cancer - incidence

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Introduction

Prostate cancer has become a major public health burden worldwide with an estimated number of 679,000 new cases in the year 2002 (Ferlay et al., 2004). In the countries of Asia, prostate cancer incidence rates varied from a low of 2.0/100,000 in Iran to high of 20.3-100,000 in the Philippines in the year 2002 (Parkin and Vatanaspt V, 2001). There has been consistent increase in most countries of Asia over the last 25 years, particularly in Singapore Chinese and Malays and in Japanese, presumably reflecting shifts in diet and other life style factors (Sim and Chang, 2005).

In this paper an attempt has been made to study the trends in prostate cancer in five populations based cancer Registries (Mumbai, Chennai, Bangalore, Delhi & Bhopal) in India, over a period of last two decades. All these Registries are under the network of National Cancer Registry Programme (NCRP) of Indian Council of Medical Research (ICMR), New Delhi. The clean data is available for 22 years of period (1982-2003) for Mumbai, Chennai & Bangalore Registries and for 16 years of period (1988-2003) for Delhi & Bhopal Registries. The data used for trend analysis from these five Registries has been coded in one format i.e. for topography ICD-10 (WHO, 1992) for morphology ICD-O3 (Cancer Incidence in Five Continents, 1982) has been used. For calculating various rates, population by age, sex and year has been estimated by using "Distribution method" (National Cancer Registry Programme, 2006), based on 1981-1991 and 2001 census figure for all these Registries. For calculating age adjusted incidence rates, world standard population (WHO, 2000) has been used.

Materials and Methods

In India first population based cancer registry was established in Mumbai (Bombay), by Indian Cancer Society in 1964 covering the urban population of Greater Mumbai. NCRP was launched by ICMR in 1981, establishing another two population based cancer Registries at Chennai and Bangalore. Subsequently new population based cancer Registries were commissioned by ICMR under the network of NCRP at Bhopal and New Delhi in 1986.

Various analytic approaches and measures of trends including geographical display and the overall mean annual percentage rate of change in age adjusted incidence rates or age specific rates as well as modeling by age, period and cohort have been used to study the trends in caner incidence.

For studying trends we have used a model that fits this data is the logarithm of Y=ABx which represents a Linear Regression Model Where 'Y' is the estimated incidence rates per 100,000 population and 'x' is the calendar year minus initial year for the current date. Capital 'A' therefore represents the estimated rate of initial year and (B-1)*100 gives the average annual percentages change in the incidence rates during the period (Cancer Incidence & Mortality in Greater Mumbai, 2005). The observed and estimated age adjusted incidence rates (based on model fitting) for prostate cancer for all registries are shown diagrammatically. The estimates of the average annual percentage rates in incidence rates of various cancers by sex are given in tabular form.

Age - Period - Cohort models have been not used because the data required for carrying out analysis is not available for longer period except for the Mumbai registry.

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Table 1. Age-Adjusted Incidence Rates/100,000 for Prostate Cancer for Various Registries by Year

Year	Mumbai	Bangalore	Chennai	Delhi	Bhopal
1982	6.0	3.3	1.7		
1983	6.0	3.6	1.8		
1984	6.1	3.8	1.9		
1985	6.1	4.1	2.1		
1986	6.2	4.4	2.2		
1987	6.2	4.8	2.4		
1988	6.3	5.1	2.5	5.8	2.2
1989	6.3	5.5	2.7	5.9	3.5
1990	6.4	5.1	2.9	6.0	5.4
1991	6.4	4.7	3.1	6.2	5.5
1992	6.5	4.4	3.4	6.3	5.5
1993	6.6	4.0	3.6	6.5	5.6
1994	6.6	3.7	3.9	6.6	5.6
1995	6.7	4.0	4.1	6.8	5.6
1996	6.7	4.3	4.4	7.0	5.7
1997	6.8	4.6	4.8	7.1	5.7
1998	6.9	4.9	4.6	7.3	5.8
1999	6.9	5.2	4.5	7.5	5.8
2000	7.0	5.5	4.3	7.7	5.8
2001	7.0	5.9	4.2	7.8	5.9
2002	7.1	6.3	4.0	8.0	5.9
2003	7.2	6.8	3.9	8.2	5.9

Results

Age adjusted incidence rates for prostate cancer by year for various registries are presented in Table 1. The average age adjusted incidence rates along with its annual percentage change for prostate cancer for various registries are presented in Table 2.

The average age adjusted incidence rates for prostate cancer in Indian registries are ranged from 3.38/100,000 for Chennai registry to 6.98/100,000 for Delhi registry. For studying trends and its predominance in total cancers and it's ranking at initial period (1982-83) and at the end of the study period (2002-03) were compared for each registry. At Mumbai registry the age adjusted incidence rate was 5.2/100,000 and it ranked 8th in initial period, while at the end of study period there was an 20% increase in age adjusted incidence rate (6.3/100,000) and occupied 4th rank in leading site. At Bangalore registry the incidence is increased from 3.3/100,000 (10th rank) to 5.6/100,000 (4th rank) from 1982-83 to 2002-03. At Chennai registry prostate cancer was not among the list of 10 leading sites in 1982-83, but it occupied 9th rank (4.1/100,000) in 2002-03. At Delhi registry the incidence for prostate cancer is increased from 6.0/100,000 (8th rank) in 1988-89 to 8.1/100,000 (4th rank) in 2002-03. At Bhopal registry the incidence of prostate cancer has been increased from 3.5/100,000 (9th rank) 1988-89 to 5.5/100,000 (7th rank) in 2002-03.

Table 2. Average Age-Adjusted Incidence Rates and Annual Percentage Change in Age Adjusted Rates for Prostate Cancer for Various Registries

Registry	Average Adjusted Incidence Rates	Annual Percentage Change
Mumbai	6.58	0.89*
Bangalore	4.79	2.02**
Chennai	3.38	4.95**
Delhi	6.96	2.40**
Bhopal	5.39	3.46*

* - Significant at 0.05 level , ** - Significant at 0.01 level.

The observed and expected values of age adjusted incidence rates over a period of time for prostate cancer for various registries are presented by line graphs in fig. 1. There has been statistically significant increased in the incidence of prostate cancer in all the registries. The maximum increase in age adjusted incidence rate over a entire period of observation was noted for Chennai registry (4.95%), followed by Bhopal registry (3.45%), Delhi registry (2.40%), Bangalore registry (2.02%) and Mumbai registry (0.89%).

Linear regression method showed an increasing trend in age adjusted incidence rate throughout the entire period of observation for Delhi & Mumbai registries. For Chennai registry there was increase for period 1982-97 followed by decrease in the incidence for the period 1998-2003. For Bhopal registry there was a sharp increase in incidence for the initial period (1988-91) then it stabilized for the period 1992-2003. For Bangalore registry there has been increase in incidence for the periods 1982-89 and 1995-2003.

Discussion

Data utilized in this study from various registries have maintained the strict definition for inclusion or exclusion of cancer cases throughout entire period of study. This data has been coded using ICD-10 for topography and ICD-O-3 for morphology. There has been no change in coverage of areas of each registry during the entire study period.

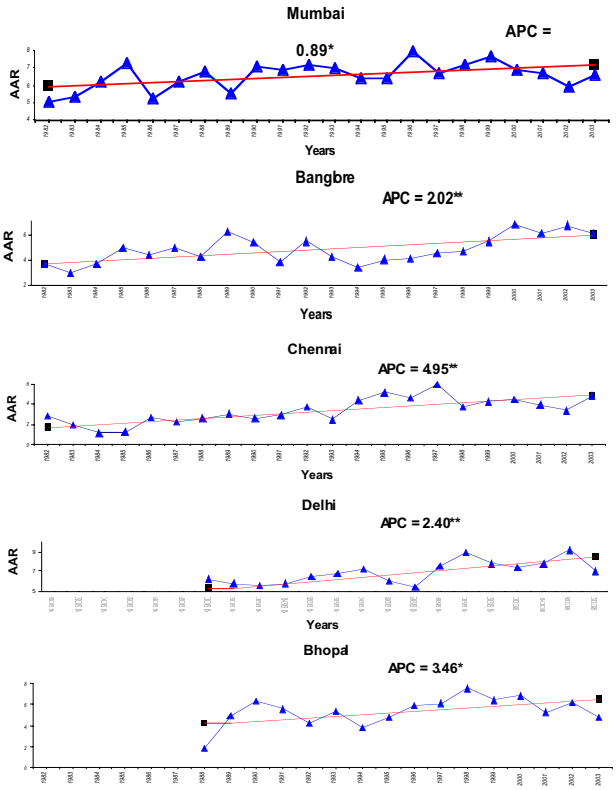

Figure 1. Trends in Prostate Cancer Incidence in India

Before attempting an interpretation of trends it is of the importance to evaluate the reliability of the incidence data. Various indices of reliability have been proposed for e.g., proportion with microscopic verification (MV), proportion registered by death certification alone (DCO), and percentage of deaths in relation to incidence. The percentage of MV between these registries is ranged 77 to 87% in males and 75 to 89% in female; the percentage of DCO is ranged from 3 to 8% while incidence mortality ratio ranged in between 25 to 50% (National Cancer Registry Programme, 2006). The data from these five registries have been accepted for publications in the VI, VII, VIII Volumes of cancer, Lyon, France (Cancer Incidence in Five Continents, 1992; Cancer Incidence in Five Continents, 1997; Cancer Incidence in Five continents, 2002). It appears that cancer registration within these registries is of acceptable standard and interpretation of the observed trends can be attempted.

Prostate cancer has become a major health problem in industrialized world during the last decades of the 20th century. It is now the most common male cancer in the USA (Cancer Incidence in Five Continents, 1997) and in the European Union it is the second most common malignancy in men (Ferlay et al., 1999).

During the last 20 years, prostate cancer incidence has undergone some of the most dramatic swings observed in cancer statistics. In the USA the incidence of prostate cancer increased by 30% from 80 to 105 per 100,000 men between 1980 and 1988, with a 2.5% rise in the mortality from the disease (Ries et al., 1999). From 1989 to 1992, the incidence of prostate cancer increased, on average, 20% per year, reaching the peak incidence of 179 per 100,000 men in whites in 1992 and 250 per 100,000 in blacks in 1993 (Hankey et al., 1999). Since 1993, a decreasing incidence trend, at a rate of 10.8% per year, has been observed and in 1997, the average incidence of prostate cancer in the USA was 149.7 per 100,000 men (Hankey et al., 1999; Ries et al., 2000).

Similar trends have been reported in Canada (Mercer et al., 1997), the UK (Chamberlain et al., 1997), France (Grosclaude et al., 1997), Australia (Threlfall et al., 1998), and the Netherland (Post et al., 1998), although, in general, they are less marked, or occured later, than in the USA. Until 1992 there was a steady increase in the risk of prostate cancer in all the Nordic countries, while the risk in the last observed fire-year period has a steeper increase, probably related to PSA-testing. In the Nordic countries incidence rates increased in 1993-1997, except in Denmark. In Denmark the incidence rates dropped in 1993-1997, probably as a result of general recommendations not to carry out PSA-testing on health men. A similar recommendation was proposed in Norway also. The increase in incidence was most pronounced in Finland, which indicates extensive PSA-testing there. In Finland, the incidence of prostate cancer increased slowly from the 1960s to the beginning of 1990s with age-adjusted incidence per 100,000 men increasing from 22.8 to 39.1. A rapid increase in prostate cancer incidence has been observed since 1991 with age-adjusted incidence per 100,0000 men increasing from 43.2 in 1991 to 72.1 in 1997 (Finnish Cancer Registry, 2000). The annual number of prostate cancer cases is still increasing in Finland. The overall incidence of prostate cancer in the Nordic countries is estimated to double from 1995 to 2020, from about 12000 to almost 24000 new cases, of which half can be attributed to a general ageing in the population (Moller et al., 2002).

Hsing and colleagues (Hsing AW et al., 2000) have reviewed recent data on international trends in prostate cancer incidence and mortality. There were large increases too in low-risk countries where there is no screening programmed for prostate cancer; 104% in Singapore Chinese, 84%, in Miyagi, Japan, 55% in Hong Kong and 44% in Shanghai, China, between 1975 and 1990. (Michel et al., 1993).

A strong correlation between the increase in localized prostatic carcinoma and the increase in trans-urethral resection of the prostate for benign prostatic hypertrophy has been documented in the USA (Potosky et al., 1990). Improvement in diagnostic techniques have also led to increases in diagnosis in younger age groups, as seen in these analyses, where the trends are mostly better described by age-period models. There is a systematic difference between the trends in incidence and mortality, but the modest improvements in survival observed in some countries are difficult to assess, due to the more frequent diagnosis of relatively benign lesions (Potosky et al., 1990; Ponten et al., 1991; Black et al., 1993).

The problem of examining trends in survi9val and mortality in very elderly patients is further complicated by the difficulty of adjusting for competing risks of death, given that many elderly males with localized prostate cancer will die of other causes even if they are not treated (Carr, 1993). Taking this difficulty into consideration, most investigators have concluded that while improvement in diagnostic practice is the main explanation for the observed increase in prostate cancer incidence, a real increase in risk cannot be excluded on the basis of the available data (Alfonso et al., 1988; Cayuela et al., 1989; McLaughlin et al., 1991; Muir and Malhotra, 1987; Potosky et al., 1990; Severson). There is some interesting evidence on this point. There has been an increase in latent invasive carcinoma of the prostate discovered at autopsy in Japan (Yatani et al., 1988), and the frequency among Japanese men aged 50 or more during the period 1982-86 (34%) was similar to that in US white men, in sharp contrast to the difference in the incidence of clinical carcinoma between the two countries. The increase in latent carcinoma in Japan was interpreted as being due to a change in risk factors, and presaging a large increase in incidence for men in Japan, who are currently at low risk.

To conclude, particularly in Asia we face with a future major increase in the rates of prostate cancer. Collaborative action now is a high priority to allow the preparations necessary for effective control of prostate cancer.

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