RESEARCH COMMUNICATION

An Epidemiological Assessment of Increasing Incidence and Trends in Breast Cancer in Mumbai and Other Sites in India, During the Last Two Decades

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Abstract

A great deal is known on the epidemiology of breast cancer. In this paper an attempt has been made to discuss the epidemiology and trends in incidence of breast cancer in various populations of India with special reference to the data available at Mumbai Cancer Registry. For discussing descriptive epidemiology of breast cancer the data collected for most recent year, 1999, by Mumbai Cancer Registry has been utilized. For studying time trends in breast cancer the data collected for the Mumbai Cancer Registry for the years 1982-99 and for Bangalore and Chennai 1982-96 and for Barshi, Bhopal and Delhi for the years 1988-96 has been employed. A linear regression model based on the logarithms of the various incidence rates, a method frequently used for studying time trends, was applied to the entire dataset.

Age specific incidence rates for breast cancer for most of the urban population in India were found to show steep increase till menopause years, after which the curves plateau. Most of the registries data indicate that Christians in India have the greatest risk of breast risk and Muslims have the lowest rate. In all the populations breast cancer was found to be less prevalent at the lower education level and the incidence increased with the education level. The trends for increase in breast cancer incidence over time for most of the populations in India were found to be statistically significant.

Key Words: Epidemiology - Etiology - Breast Cancer - Incidence - Trends - Risk Factors

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Introduction

Epidemiology is the only way to study cancer in humans at the population level. It is a discipline with a well-developed set of principles for study conduct, analysis and interpretation, honed to a fine art over the last several decades. Increasingly epidemiologists are collaborating with basic scientists and applying biological markers of exposure, susceptibility and intermediate effects, both to clarify the multiple steps in carcinogenesis and identify people at high risk of disease. Epidemiology enables us to study gene-environment interactions and to assess the effects of our interventions at the population level.

A great deal is known about the epidemiology of breast cancer. It has been estimated that globally in 2000 there was an incidence of 1,050,300 with 373,000 deaths and 3,860,300 prevalent female breast cancers (Parkin et al., 2001). There are some pointers to an increase in breast cancer incidence globally (Parkin et al., 1999). It has estimated that by 2010 there will be 11.45 million new cancer cases of breast cancer in the world. In this paper an attempt has been made to discuss the epidemiology and trends in incidence of breast cancer in various populations of India, with special reference to the data available at Mumbai Cancer Registry.

Materials and Methods

For discussing descriptive epidemiology of breast cancer the data collected for the most recent year, 1999 by Mumbai Cancer Registry has been utilized. For studying time trends

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in breast cancer the data collected for the Mumbai Cancer Registry for the years 1982-99 and for Bangalore and Chennai 1982-96 and for Barshi, Bhopal and Delhi for the years 1988-96 has been employed. A linear regression model based on the logarithms of the various incidence rates, the method most often used for studying time trends (Trends in Cancer Incidence in Norway, 1982) was applied to the entire dataset.

Results

Globally, with the exception Japan, breast cancer incidence rates are very high in developed countries as compared to the rates seen in developing countries. The highest incidence recorded in cancer incidence in five continents (Parkin et al., 1997) was in the European population living in Zimbabwe- 127.7 per 100,000. In the U.S., non-Hispanics-white had a rates of 86.2 per 100,000. U.S-Blacks have lower rates than in whites, but their mortality from breast cancer was higher.

Populations in Asia have lower rates of breast cancer compared to the west. In Japan the incidence rate in Miyagi was 31.1, in China-Shanghai women had a rate of 26.5 but the rate for Chinese women overall was 39.5. Considerable differences have been observed in breast cancer rates seen various countries and different population groups. The highest rate was more than 15 times the lowest rate noted.

In figure 1 the age-adjusted incidence rates of breast cancer seen in various populations of India are presented. Highest incidence is noted for Mumbai (28.2 per 100,000). Urban areas have rates between 20-30 per 100,000 available rural rates vary between the areas but are lower than urban areas.

The lifetime risk (0-74 years) of breast cancer in Mumbai was 3.3% (1 in 30), Chennai 2.4% (1 in 42) and in Trivendrum it was 2.05% (1 in 50). In the US woman the risk of developing breast cancer during entire span of life is 1 in 8 i.e. 12.5%

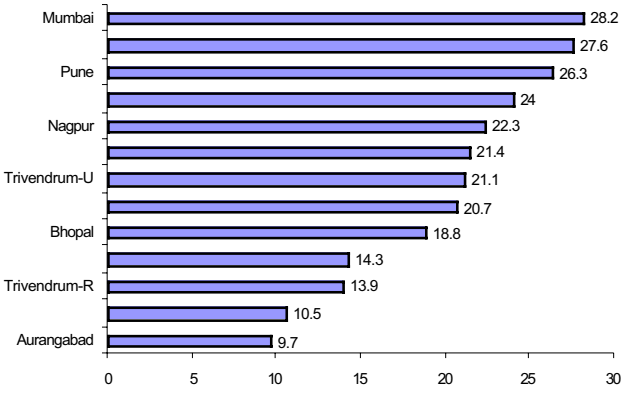

Figure 1. AAR Incidence Rates for Breast Cancers in Indian Populations

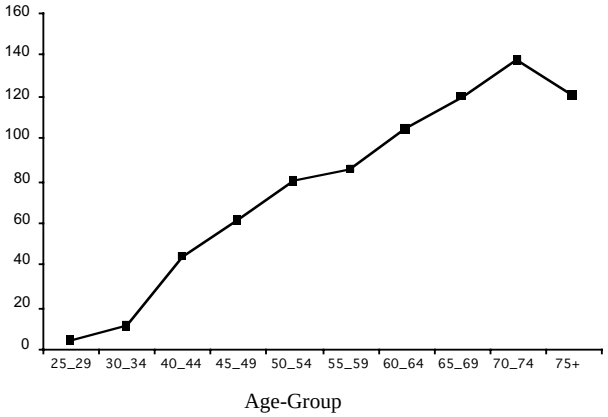

Figure 2. Age Curve for Breast Cancers in Greater Mumbai, 1982-1999

In figure 2, the age specific incidence rates are shown for Mumbai for the year 1999. When the age specific incidence curves are compared for most of the urban populations, it is observed that there is steep increase till menopause years, there after the curves had a slope much less than the menopausal years.

Religious groups in India have some characteristic life style differences, which may influence the occurrence of cancer. The crude incidence rates of breast cancer seen in major religious groups for some populations are given in Table 1. These registry data indicates that Christians are having higher risk of breast cancer and Muslims have the lowest rate. In Mumbai the crude incidence for breast cancer among Parsi's was 75.9. The high incidence in Parsi's is partly attributable to an age population, but the Parsi rate is almost twice values for other communities, even after adjusting for age. Higher age at marriage and first delivery, less number of children, westernized life style are often mentioned as risk factors for high breast cancer incidence in Parsi's.

Table 1. Crude Incidence Rate of Breast Cancer among Religious Groups in Mumbai, Chennai and Karunagappally (/100,000).

Religion	Mumbai*	Chennai**	Karunagappally***
Hindu	21.0	17.2	15.0
Muslim	19.8	11.5	7.8
Christian	32.3	24.8	17.7

*Cancer Morbidity and Mortality in Greater Mumbai 1996
**Madras Metropolitan Cancer Registry 1996
***Cancer Incidence in Karunagappally, Karunagappally 1996

Table 2: Percentage Distribution by Education for Breast Cancer, Greater Mumbai, 1993-97

Site	Illiterate+Lite	Prim+Middle	Sec+Tech	College
Breast	16.2	25.2	40.2	44.4

Percentage distribution for breast cancer for each educational level shows a very interesting with respect to occurrence in women. The breast cancer was found to be less prevalent at the lower education level and the incidence starts to increase as the education level increases. (Table 2)

Life style changes as a consequence of migration and are believe to cause changes is cancer incidence. Cancer incidence in the five continent Vol.VII provides the opportunity to study the changes that occur in breast cancer (Table 3). The increase in breast cancer incidence rates seen woman populations migrating from China, Philippines and Japan to U.S. However, the Indians migrated to Singapore exhibit only marginal changes, because there are no marked changes in dietary and other factors.

Number of new cases and the crude rates (CR), age adjusted rates (AAR) and truncated incidence rates (TR) for breast cancer in Greater Mumbai for the period 1982-1999 are presented in (Table 4). A linear regression model based on the logarithm of all incidence rates was applied to the entire data. Trends to the various incidence rates are shown in figure 3.

Table 3. Breast Cancer Incidence (AAR) and Migrant Status

Population	Migrant Status	AAR
Chinese	US-San Francisco	55.2
	US-Las Angeles	36.8
	US-Hawai	57.6
	Singapore	39.5
	Quidong	11.2
	Shenghai	26.5
	Tiangen	26.4
Philippinos	US-San Francisco	65.3
	US-Las Angeles	69.3
	US-Hawai	57.4
	Manila	47.7
Japanese	US-San Francisco	68.4
	US-Las Angeles	63.0
	US-Hawai	72.9
	Japan	19.1-33.4
Indians	Singapore	31.9
	Mumbai	28.2
	Chennai	24.0
	Bangalore	20.7

Source: Cancer Incidence in 5 Continents Vol.VII IARC, Lyon, France.

Table 4. Numbers of New Cases and the Crude (CR), Age Adjusted (AAR) and Truncated (TR) Incidence Rates for Breast Cancer, Greater Mumbai, 1982-1999

Year	No. of Cases	CR	AAR	TR
1982	483	13.6	22.8	52.3
1983	529	13.4	23.1	53.0
1984	595	14.4	23.7	54.0
1985	656	15.2	25.6	57.0
1986	674	15.5	22.9	50.9
1987	630	14.0	20.1	44.0
1988	654	14.0	19.8	42.9
1989	692	14.2	20.2	44.9
1990	857	19.5	27.9	63.3
1991	971	21.6	30.8	67.3
1992	963	20.9	29.1	64.7
1993	938	19.9	28.3	61.6
1994	962	20.0	28.5	60.2
1995	974	19.8	27.4	61.1
1996	1023	20.3	28.5	60.8
1997	1055	20.7	28.1	58.8
1998	1063	20.4	27.6	57.0
1999	1127	21.2	28.3	57.6

Source: Cancer Incidence in 5 Continents Vol.VII IARC, Lyon, France.

It is observed that all the three, crude, age-adjusted and truncated incidence rates present a increasing trend. Estimates for the average percentage change (APC) in CR, AAR and TR obtained from regression analysis are given in Table 5. Crude rates seemed to have increase maximally i.e. an average by 3.1% over the study period. However, the AAR increases by 1.10%. The truncated rates which are supposed to be more reliable increased by 1.2%. The average percentage increase seen in each of estimated rates is highly statistically significant.

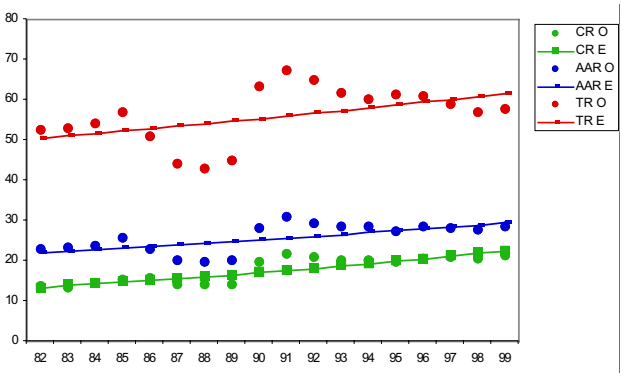

Figure 3. Trends in Various Incidence Rates per 100,000 Population, Breast Cancer in Greater Mumbai 1982-99

Table 5. Estimates from Regression Analysis of Various Rates for 1982-1999 and the Average Percentage Change for Breast Cancer in Greater Mumbai

Rate	Estimated Rate		Average % Change	T-test
	1982	1999		
Crude	13.4	22.6	3.09	6.19***
Age Adjusted	22.0	29.5	1.75	3.43***
Truncated	50.5	61.6	1.80	2.14*

*** Significant at t less than 0.001 level
* Significant at t less than 0.01 level

The trends observed in age adjusted incidence rates for Mumbai, Chennai and Bangalore for the period 1982 to 1996 and Bhopal, Barshi and Delhi registries for the period 1988-1996 are shown in figure 4. The trends in breast cancer incidence for Mumbai, Bangalore, Chennai and Delhi was found to be increasing and statistically significant while the rates for Barshi and Bhopal populations are constant. The average percentage increase is 1.8% for Mumbai, 2.1% for Bangalore, 1.2% for Chennai and 0.9% for Delhi (Table 6).

Discussion

The epidemiology of breast cancer has been reviewed by many investigators (Kelsay et al, 1993; Adami et al 1998). Breast cancer is about hundred times more common among woman than among man. The incidence of breast cancer increases with age with a characteristic inflection around the age of menopause. An earlier age at menarche is associated with increased breast cancer risk while an earlier age at menopause is associated with reduced breast cancer risk. For a given menopause, a surgically induced one conveys more protection than a naturally occurring one. The earlier age of the first full – term pregnancy the lower the risk of breast cancer. Subsequent full-term pregnancies have similar but quantitatively much wicker effect. After the age

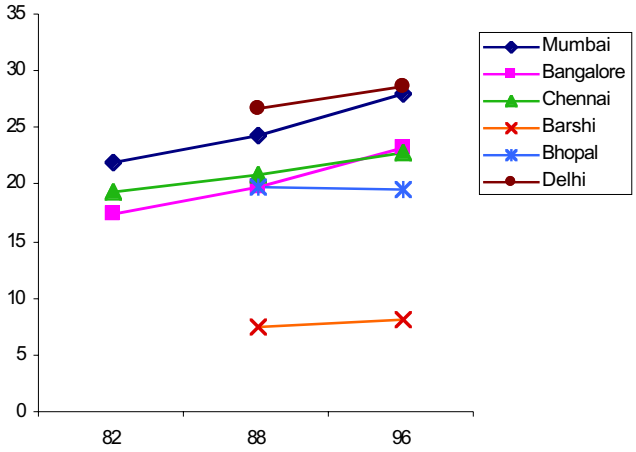

Figure 4. Trends in Age Adjusted Incidence Rates for Breast Cancer in Various Population, 1982-96

Table 6. Estimated from Regression Analysis for Age Adjusted Incidence Rates for Various Population in India

Population	Period	Average % change	T-Test
Greater Mumbai	1982-99	1.75	3.43***
Bangalore	1982-96	2.14	4.04**
Chennai	1982-96	1.21	2.76*
Delhi	1988-96	0.94	2.32*
Barshi	1988-96	0.99	0.26ns
Bhopal	1988-96	-0.14	0.15ns

*** Significant at t less than 0.001 level
** Significant at t less than 0.005 level
* Significant at t less than 0.01 level
ns Not significant

of approximately 35 years occurrence of a pregnancy increases rather than reduces breast cancer risk. Prolonged lactation conveys some protection against the breast cancer risk, but the effect is small and may be limited to pre-menopausal breast cancer. Height is positively associated with breast cancer risk. Obesity is inversely related to breast cancer risk among pre-menopausal but positively among forced menopausal woman. Caucasian woman in Europe and in North America have a more than 5 fold risk in compared to woman in Asia or Japan. A high-density mammogram indicates an almost 4 fold risk in comparison to a low-density mammogram. Breast cancer tends to be slightly more common among woman of higher socio-economic status. Breast cancer tends to be more common among urban than among rural residents. At least four genes that convey increased susceptibility to breast cancer have been identified (Brca1, Brca2, p53, AT), but these genes are responsible for less than 5% of breast cancer cases overall. Current or recent use of oral contraceptives slightly increases the risk for breast cancer. Current or recent use of long-term Harmon replacement therapy increases the risk for breast cancer. Ionizing radiation is an established cause of breast cancer but of limited quantitative importance. Consumption of alcoholic beverages increases breast cancer risk. Adult life diet and physical activity have limited effect on breast cancer risk. There is no compelling evidence that exposure to organochlorines or electro magnetic fields affect breast cancer risk.

As far as etiology of breast cancer is concerned a synthesis of existing hypothesis has four key components (Adami et al, 1998).

1. The likelihood of breast cancer occurrence depends on the number of cells at this (Trichopoulos and Lippman, 1992). This preposition is supported by theoretical arguments and imperial data such as follows:

- Mammographic density, which expresses memory gland mass as a fraction of total breast area, is a strong predictor of breast cancer registry.
- Women with small mammary gland mass who were

motivated to have augmentation mammoplasty were found to have inherently reduced breast cancer risk.

2. The number of target cells and their responsiveness to hormonal stimulation is partially determined early in life, perhaps even in utero.
- There is substantial experimental evidence in support of this hypothesis (Hilakivi-Clarke et al, 1997).
- In large studies a positive association between birthrates and breast cancer risk (Adami et al, 1998).

3. The long term effect of the pregnancy is considered to convey protection against breast cancer through terminal cellular differentiation in the memory gland (Russo et al, 1992).
- There is substantial experimental evidence in support of this preposition.
- A pregnancy transiently increases breast cancer risk by hormonally stimulating the reflection of already initiated cells but in the long term it has a definitive protective effect.

4. In adult life estrogens and other mammogropic hormones in conjunction with their receptors affect the rate of expansion of initiated clones.
- In case control and cohort studies estrogen level have been positively associated with breast cancer risk.
- Estrogen. a (alpha), receptor is much lower among Japanese woman who are at low risk for breast cancer than among Caucasian who are at high risk for breast cancer (Lawson et al, 1999).

Several factors have been identified as potentially responsible for increasing breast cancer risk but their mechanism of action is unclear. Early menarche, late first pregnancy, low parity and late menopause have all been associated with an increased risk of breast cancer in several studies (Ewertz et al., 1990; Lund,1990; Harris et al., 1992; Hirose et al., 1999), suggesting strongly reproductive history place a role as a determinant at the risk of this disease. The increase in risk has been attributed to the pattern of exposure to oestrogens, a notion, which is supported by protective effect of oophorectomy. Oral contraceptive has been suspected of increasing the risk of breast cancer, especially after long-term before age 25 or before the first pregnancy, but the evidence is still limited (Thomas, 1993).

The role of dietary factors has been carefully investigated in several ecological and case control studies and this suggest that diet, by influencing the pattern of oestrogen exposure may also be an important determinant of the risk. Further, the risk of breast cancer is positively associated with socio-economic status, and it is difficult to assess the specific roles of each of the potential risk factors, even their strong inter-correlation and the difficulty in adjusting for confounding. The well identified role of genetic pre-disposition and ionizing the radiation should also be noted, although these factors have little evidence in the interpretation of time trends.

There has been increase in breast cancer incidence globally in western countries part of the increase was attributed to screening mammography. In US breast cancer incidence rates have remained appropriately during 1990's. However it appropriately increased in younger women. Recent studies indicate that there has been decreasing trend in breast cancer mortality in US which was attributed to earlier diagnosis and management.

In Asia the risk has been increasing rapidly. In Japan and Singapore is more than double between 1915-1940 work Cohorts but the increase in less marked in Mumbai (India) Shanghai (China &Hongkong), the highest truncated rates (66 per 100,000). Recorded in recent years the Asian populations (Hongkong-Singapore) are of the same order of magnitude as the lowest rates recorded in Europe in 1970 (Spain).

In developing countries the present patient attendants in the hospitals indicate that less than 10% attend the treatment for treatment in stage one disease. The necessity for early detection of breast cancer, when cure rates can be above 90%, need the propagated in view of the fact that of present there are no known powerful modifiable lifestyle factors. The need is thus for early detection and to follow strict treatment protocols developed and tested in Indian conditions. From the available estimates it may be seen that there would soon be between 90,000 to 100,000 incident breast cancer cases annually in the country. The prevalence rate if considered as three time the incidence rate indicates the approximate requirements of major creative and rehabilitative services.

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