Cumulative Risk and Trends in Lung Cancer Incidence in Greater Mumbai

Namrata Agarwal[1], B.B Yeole[2] & Usha Ram[3]

Abstract:

Objective: *To estimate the probability of developing lung cancer in the entire life span of the people of Greater Mumbai and see for the variations according to age and sex.*

Background and data source: *Information on cancer incidence trends in a community forms the scientific basis for planning and organising prevention, diagnosis and treatment of cancer. During the last 24 years period, a total of 11,458 lung cancer cases got registered (9,052 male and 2,406 female) by the Bombay Cancer Registry. Lung cancer accounts for 9.4% of all male cancers and 2.7% of all female (6.2% of all cancers) in Greater Mumbai. The probability of developing cancer in the entire life span of the people of Greater Mumbai was estimated.*

Method: *A method based on the cumulative risk of cancer was used to estimate the probabilities using lung cancer data collected by the population based Bombay Cancer Registry from the year 1982 to 2005. For evaluation of trends, linear regression model based on the logarithm of the observed incidence rates has been used. The annual percentage change was also computed for the evaluation. The cumulative incidence rate percentage was calculated by adding up the age-specific incidence rates at single ages and then expressed them as a percentage.*

Results: *The results show that the trends in age-adjusted incidence rates of lung cancer during the period 1982 to 2005 showed a statistically significant decreasing trend in males and a statistically significant increasing trend among females. When these trends were seen across different age-groups (00-39, 40-64 and 65+), the rates showed a statistically significant decreasing trend from 0-64 years in males and a statistically significant increasing trend in 65+ years among females. The rates proved stable across the other age-groups. The probability estimates indicate that one out of every 74 men and one out of every 242 women will contract lung cancer at some time in their whole life in the absence of other causes of death assuming that the current trends prevail over the time period and most of them will acquire the disease after the age of 40 years. The risk of the disease increases with age.*

Conclusion: *The variations in age-adjusted incidence rate across different age-groups in both sexes clearly indicate that there has been a change in the etiology of lung cancer in Greater Mumbai over time. The most important reason for this would be decrease in smoking prevalence among males. The other reasons for this have to be explored through risk assessment studies, but these findings may be of general interest because changes in diagnostic practices are confounders in time trends of lung cancer in many developed countries preventing inferences on changes in risk.*

Key Words: *Time trend - incidence - cumulative risk - lung cancer*

Introduction

Information on cancer incidence trends forms a scientific basis for planning and organizing prevention, diagnosis and treatment of cancer in a community. A trend, however, always represents a summary curve of changes that are occurred within different groups of people living under divergent conditions. A change in incidence and mortality figures to a large extent depends on the various factors like awareness about the disease, availability of health facilities, treatment seeking behaviour in the defined population. The new advancements in the diagnostic and treatment facilities also effect this change. Although cancer remains a significant cause of mortality at all ages and is the second most common cause of death after heart disease, but its burden is felt disproportionately among older citizens (*Kennedy et al, 1994*). The majority of cancers occur in adults over the age of 65, with about 70 percent of all cancer deaths in this population (*Greenlee et al, 2001*). Several studies have reported trends in cancer incidence for various sites: *Yeole 2008 for- Brain cancer, Non-Hodgkin's Lymphoma, Prostate cancer, Breast cervix and ovary cancer in females and esophagus stomach colon rectum and liver in males, Yeole 2007and Elango et. al. 2006 for head and neck cancer; Murthy et. al. 2005 for cervical cancer; Yeole and Kurkure 2003 for breast cancer and Mathew et.al. 2002 for kidney cancer*. Monitoring of trends helps us to understand not only the overall pattern of change in the incidence of the disease, but also helps us in comparing one time period to another, one

[1] Research Scholor, International Institute for Population Sciences, Govandi Station Road, Deonar, Mumbai-88
Contact email: nagarwaliips@gmail.com

[2] Director, Bombay Cancer Registry, Indian Cancer Society, 74, Jerbai Wadia Road, Parel, Mumbai-12

[3] Reader, Dept. of Public Health & Mortality Studies, International Institute for Population Sciences, Mumbai-88

geographical area to another and one population to other. It also helps us in making future projections. The information related to the trend of incidence and mortality explains the magnitude of problem in the society.

Methods and Material

In the present study data during 1982-2005 from the oldest population based cancer registry of Mumbai covering the urban population has been used. During the last 24 years period a total of 11,458 lung cancer cases (9,052 male and 2,406 female) got registered in the registry. Lung cancer accounts for 9.4% of all male cancers and 2.7% of all female (6.2% of all cancers) in Greater Mumbai.

Population data are estimated from the 1981, 1991 and 2001 census reports (as on 1st March). The estimates for the years 1982 through 2001 (as on 1st July) are calculated using geometric rate of growth for each age-group and sex after smoothing the population. However, the population from 2002-2005 has been projected using Maharashtra urban abridge life table (due to the non-availability of district life table) for corresponding time period using MORTPAK software. Care has been taken about the difference in the definition of "resident" in census and that in Mumbai Cancer Registry by eliminating all migrants whose duration of residence in Mumbai was less than one year.

Age adjusted rates were computed using the world standard population given by *Segi 1960* and modified by *Doll et.al. 1966*. For evaluation of incidence trends we used a linear regression analysis based on the logarithm of the observed incidence rates. Logarithmic transformation was preferred specifically because this facilitates the comparison of trends at varying incidence levels, i.e. the trends at different ages are examined. A model that fits this data well is the logarithm of $Y=AB^x$, which represented a linear regression model, where, 'Y' is the estimated incidence rate per 100,000 of the population; and 'x' is the calendar year minus the initial year (1982) for the current data. 'A' therefore represents the estimated rate of the initial year and (B-1)*100 gives the average annual percentage change in the incidence rate during the period.

The cumulative incidence rate is computed which is a summary measure of the experience of a population over a long time span or age-interval. It is obtained by summing up the age specific incidences for each year in the defined age interval and then expressed as a percentage. Since age specific incidence rates are usually computed for five year age intervals, the cumulative incidence rate between birth to 70+ years of age is 5 times the sum of the age specific incidence rates calculated over five year age groups. The cumulative incidence rate is directly standardized incidence rate and is a good approximation to the actuarial or cumulative risk. The reason of interest in the cumulative incidence rate is that it has a useful probabilistic interpretation. Another advantage is that as a form of direct age standardization, the arbitrariness in choosing a standard population is removed. The probability of developing a specific cancer, expressed in terms of 'one in every n persons' is computed by reciprocating the estimated cumulative incidence rate expressed as a percentage.

Results

During the last 24 years period, 1982-2005, the average crude and age adjusted incidence rates for lung cancer were 6.48 and 10.78 among males and 2.13 and 3.38 among females respectively per 100,000 population. In order to see for the variation in the rates according to age-interval cumulative incidence rate was first computed by sex for the successive age intervals from 0 through age 70 for BCR data during last two decades (1986-2005) of Greater Mumbai **(Figure 1)**. From the figure it is evident that age-specific lung cancer incidence rates and cumulative incidence rates rise quickly after age 40 in Females and after age 44 in Males; in both time intervals at which time mortality rates are also increasing sharply. Hence, based on the cumulative incidence rate the age intervals were divided into 00-39, 40-64 and 65+ years to see for the variations if any.

When these rates were seen across different age-groups (00-39, 40-64 and 65+) it was found that among males the rates were 0.42 and 0.35, 17.18 and 20.18, 78.53 and 76.33 respectively per 100,000 population and among females the rates were 0.23 and 0.20, 5.55 and 6.25, 23.62 and 24.09 respectively per 100,000 population **(Table 1 and 2)**. Analysis of the trend in age-adjusted incidence rates of lung cancer showed a statistically significant decreasing trend in males and a statistically significant increasing trend among females. When these trends were seen across different age-groups (00-39, 40-64 and 65+), the rates showed a statistically significant decreasing trend in 00-39 and 40-64 years in males and a statistically significant increasing trend in 65+ years among females. The rates proved stable across the other age-groups. **Figure 2** shows the trends in AAR of lung cancer for different age groups by sex on a log-linear scale.

The probability estimates indicate that one out of every 74 men and one out of every 242 women will contract lung cancer at some time in their whole life. When these probability estimates were seen across different age-groups, it was found that one out of every 9 men will contract lung cancer after reaching 65 years while one out of every 42 men will contract lung cancer between 40-64 years and only one out of every 3771 men will contract this cancer before his 40's **(Table 3)**. Among females, one out of every 30 women will contract lung cancer after reaching 65 years while one out of every 145 women will contract lung cancer between 40-64 years and only one out of every 6614 women will contract this cancer before her 40's **(Table 4)**.

From the estimated cumulative incidence rate percentages for lung cancer, it is found that 1.4% of the male population in Mumbai will get lung cancer at some time in their whole life and 10.6% out of this 1.4% belong to the age of more than 65 years. Similarly, 0.4% of female population in Mumbai will get lung cancer at some time in their whole life and 3.3% out of this 0.4% belong to the age of more than 65 years. Though these percentages seem to be very low yet when it comes to absolute numbers the figures are quite large.

Discussion

Worldwide, lung cancer is the most common of all cancers accounting for about 1.4 million new cases being reported annually which amounts to 12.3 percent of total cancer cases and 1.2 million deaths (*IARC, 2002*). It is a leading cause not only because of its high incidence but also in terms of high number of deaths. It predominantly affects the middle and the older adults. The prognosis of lung cancer is still poor, with 5-years survival rate of approximately 14 percent in the early stages and less than 5 percent in locally advanced stages (*Mghfoor & Michael 2005; Montain 1986*). About 80 percent of lung cancer cases in men and 50 percent in women are caused by tobacco smoking so it is primarily called the disease of smokers. Historically, more men than women die from lung cancer as a result of higher levels of smoking but now the male to female mortality ratio is showing signs of narrowing down (*WHO, 2005*). Even if the incidence rates in lung cancer were to remain unchanged, a large increase in absolute number of cases is a certainty because of the increase in population size and its ageing and poses a veritable time-bomb in public health terms, particularly for the developing countries. Prevention therefore can be considered to be one of the most important cancer-control strategies.

Trends in lung cancer incidence vary widely by geographical areas, age, sex and overtime. In men, the highest rates are observed in Europe (especially Eastern Europe) and North America. Moderately high rates are also seen in Australia/New Zealand and Eastern Asia (China and Japan) and the lowest in Western Africa. In women, incidence rates are comparatively lower (globally the rate is 12.1 per 100,000 women compared to 35.5 per 100,000 in men) (*Parkin et.al. IARC, 2002*). The highest rates are in North America and Northern Europe. It is to note that the incidence in

China is rather high (ASR, 19.0 per 100,000), very much similar to that in Australia/New Zealand (17.4 per 100,000). Very low rates are observed in Middle and West Africa (0.6 per 100,000).

The 1990 global lung cancer incidence rate of 37.5 per 100,000, gave rise to 771800 cases, constituting 18% of all new cancer cases in men. The increase in the burden of lung cancer in men over 15 years has been 66% since 1975 *(Parkin et.al. IARC 2002; Notani 2001)*. Although the incidence rate in men is lower in the developing countries (24.1 per 100,000 in 1990) than the developed ones (62.6 per 100,000 in 1990) but it is to be noted that between 1985 and 1990, lung cancer burden of the developing countries went up by 25% (from 261,000 to 327,100), while that of the developed ones went up by only 7% (415,000 to 444,700). Thus, the global increase in lung cancer cases in men is now being fuelled by the cases from the developing countries.

In some parts of the world, lung cancer rates peaked among men, but rates among women were on the rise. Among men, incidence rates in the United States, Canada, England, Denmark and Australia have already peaked with more than 50 per 100,000 population, but they continued to rise in Spain, China and Japan ranging between 35-50 per 100,000 population and low incidence with less than 35 per 100,000 population countries included Utah (USA), Latin America, most Asian countries, Iceland, Norway and Sweden (*Parkin, 1989)*. Among women, rates have been considerably lower, increase started a little later. Most western countries are still showing a rising trend in incidence and mortality among females, although in some this is recent and is affecting only recent generations (Spain), while for others (United Kingdom), it seems that the peak of risk may have been reached.

During 1977-86, the incidence and mortality of lung cancer ranked first among all sites in Beijing and has been on the increase from year to year *(Wang 1991)*. The annual average crude incidence rate of cancer was 31.3 per 100,000 males during 1982-84 compared to a world standard rate of 33.0 per 100,000. Incidence due to lung cancer accounted for 20.3% of all male cancer cases and 16.1% among all female cancer cases. Female mortality rate due to lung cancer in Beijing was the highest compared to other countries of the world. In France between 1985 and 1995 the incidence rates increased by 56% in women and by 5% in men under the age of 65 as a result of change in tobacco consumption practices and rates in most areas have not yet peaked.

Devesa et.al. 2005 studied the varying trend in lung cancer by histologic type and sex using IARC and EUROCIM data *(European registry data)* from 1980 to 1997. The results showed that among men, rates declined by 20–25% over virtually the entire time period in all areas except Iceland and France, where they were relatively stable and in Norway, Slovenia and Spain, where they increased. In contrast, rates among females rose rapidly in all areas over most of the time period; rates in the Netherlands and Norway more than doubled. Deceleration of the increase occurred in several areas, such as Canada, U.S. whites and Denmark; declines were suggested for U.S. blacks, in Switzerland and possibly Iceland. The male to female rate ratio was greater than 2 in every area except Iceland and ranged from 8 or more in Slovenia, Spain, France and Italy, to more than 14 in the Netherlands.

The overwhelming cause of lung cancer is cigarette smoking which is universally known but risk increases with early age at initiation, intensity and duration. There is a documented decline in incidence and mortality rates since 1991 in men in the US *(Ries et.al. 2000)* and has been attributed to a decline in smoking prevalence. Several West European countries have also registered a decline, particularly in the younger cohorts of men *(Coleman et.al. IARC, 1993).* Early case-control studies suggested that women were more susceptible than men to the adverse effects of cigarette smoking, but more recent cohort data have not supported pronounced sex differences in susceptibility *(Patel et.al. 2004; Bain et.al. 2004)*.

Geographical variations in lung cancer patterns are noted not only throughout the world but also between various regions within the same country. In India too, lung cancer remains the leading site accounting for more than 41,000 cases and 38,000 deaths annually. It is estimated that there are around 48,000 people living with lung cancer alone in India at any given time *(NCRP 2002)*. It is observed that lung cancer incidence is higher in men than in women, but these days the incidence in women is on the rise *(MoHFW, 2002; ICS, 2001)*. Population as well as hospital based data from the Cancer Registry under the National Cancer Registry Programme *(NCRP)* and the Cancer Atlas Programme of the *ICMR* revealed that lung cancer has increased in India during the last few years. In India although 70 percent of the population reside in rural areas, but currently the available data on incidence and patterns are mainly from urban population available from the cancer registries. Even though the geographic area and population covered by these registries are quite small *(about 20 percent urban and 1.5 percent rural)*, yet they give a fair idea of the cancer problem in selected parts of the country. However, results based on these fragmentary statistics cannot be generalised for the whole country. Presently there are sixteen urban and four rural population based cancer registries functioning in India. Statistics of patients on cancer incidence and mortality are complete and reliable in all registries of India. The registries provide site wise information on incidence and mortality of cancer patients. It also provides information on their demographic, social, clinical and lifestyle factors which are essential for epidemiological research. Based on the data from the Population based cancer registries, overall among males, cancer of the lung is the number one cancer. Though the incidence rates are not as high as in some of the western countries and vary from 6 to 18 per 100,000 in urban areas. Nonetheless, lung cancer is gaining in importance in certain registry areas of India, like Mumbai, Delhi, Bhopal and Imphal where it is the leading cancer site in men and is one of the five leading sites in all the other registries. The incidence rate of lung cancer is much lower in women worldwide and ranks fifth in absolute number of new cases. In 1990, a third of all lung cancer cases were in women and it constituted 7% of all cancers that women developed. Incidence rates in Indian women are also quite low (1 to 5 per 100,000) *(Parkin et.al. IARC, 2007)*. Lung cancer ranks one of the 10 leading sites in nine registries of India including Mumbai.

The population based Bombay Cancer Registry is the oldest cancer registry in India established in the year 1963 as a unit of the Indian Cancer Society at Mumbai with the aim to obtain reliable morbidity data on cancer from a precisely defined urban population (approx. 12 million inhabitants). The majority of the hospitals in the city are maintained by the Municipal Corporation and the State Government which are basically responsible for conducting public health and medical services in the city. The diagnosis and treatment of cancer is centralized only to a certain extent in Mumbai. All malignant tumors either confirmed or suspected for a malignant chance based on pathology reports are registered. Cancer cases where the death certificate is the only source of information are also included in the list. Patients in whom cancer has been ruled out or has not yet been diagnosed are omitted from the case list. The cancer registry utilizes the coding system devised by the World Health Organization using code numbers C00.1-C98.9 as published in the manual of the International Classification of Diseases, Injuries and Causes of Death *(WHO, 1977)*. The registry also utilizes the International Classification of Diseases for Oncology (*ICDO-3*) *(WHO, 1976)*, simultaneously for coding the primary site. ICDO-3 gives histogenic and malignancy codes in conjunction with the primary site as suggested by the WHO. Validation checks are applied to avoid duplication of data entry in the computer. Quality control exercises are regularly undertaken to ensure the validity, reliability and completeness of the collected data. Two special studies *(Yeole 2001; Yeole and Jussawalla 1988)* have been carried out to evaluate the completeness and accuracy of the data. The inclusion of data in the IARC periodical publications itself states that the data quality is reliable.

Tobacco smoking in any form whether it is cigarettes, which has long been established as a major risk factor, or bidis which is smoked on the Indian subcontinent, are all causatively associated with lung cancer, depending on the intensity of exposures, with 75% of new cases attributable to tobacco smoking *(Pisani & Parkin, 1993)*. With the expansion of sale of cigarettes in the developing world, one can predict an explosion in the number of lung cancer cases from this part of the world. Only a complete elimination of this product would result in a substantial decline in the disease occurrence. Further, in non-smoking Indian women, indoor air pollution due to the use of bio-fuels for cooking is a significant risk factor. Apart from the increase in tobacco consumption, facts from *(NFHS-3, 2005-06)* data shows that, more than 700 million people in India (70.8% households) depend on solid fuels for cooking and other purposes. High exposure to indoor air pollution from the combustion of solid fuels have shown to cause serious health problems such as acute respiratory infections, chronic obstructive pulmonary disease, lung cancer, pulmonary tuberculosis and other respiratory diseases (*Smith et al, 2000; Bruce et al, 2000, Ezzati and Kammen, 2002*). Bio-fuel smoke contains the dangerous mixture of many pollutants including carbon monoxide and small particles but also nitrogen oxides, sulphur oxides, benzene, formaldehyde and many other health-damaging chemicals**.** Also in India where tuberculosis is a very common respiratory illness *(NFHS-3)* and has very similar symptoms to that of lung cancer so if only symptomatic investigation is done it may be misunderstood for TB and further delay in appropriate treatment may take place resulting in poor survival rates.

The age adjusted incidence rate of lung cancer in Mumbai is only 10.8 per 100,000 population among males and 3.4 per 100,000 population among females which is less than approximately one tenth of the rates in both sexes seen in the developed regions *(Ferlay et.al. 2002; Parkin et.al. IARC 2007)*. Still lung cancer remains the leading site in age-adjusted incidence rates among all male cancers and it ranks 5th among females in Mumbai, India *(BCR 2002-04)*. The present study showed a statistically significant decreasing trend in age-adjusted incidence rates among males and a statistically significant increasing trend among females in Greater Mumbai during the period 1982 to 2005.

Lung cancer is diagnosed in almost one seventh of the total population in U.S. (14% in males and 13% in females) and the probability estimates indicate that one in 12 men and one in 17 women will have lung cancer during their lifetime *(Greenlee et al., 2001)*. In Mumbai, India, the present study showed that only one out of every 74 men and one out of every 242 women will be diagnosed with lung cancer during their lifetime. Hospital as well as population based registries show different patterns of the disease in different parts of the country. The variations in age-adjusted incidence rate across different age-groups in both sexes are clearly seen which indicates that there has been a change in the etiology of lung cancer in Greater Mumbai over time. The most important reason for this would be decrease in smoking prevalence among males. The other reasons for this have to be explored through risk assessment studies, but these findings may be of general interest because changes in diagnostic practices are confounders in time trends of lung cancer in many developed countries preventing inferences on changes in risk.

Limitation of the Study

The major limitation in time trend analysis is that the estimates vary considerably from year to year, but our rates are based on most currently available incidence data, however these data are three year old, at the time the estimates are calculated. Though the change may not be very large but it cannot be captured by our modelling efforts.

Table 1: Number of Incident cases of Lung Cancer in Males with Crude and adjusted rates per 100,000 population by broad age groups with APC in AAR, 1982-2005

	Age Group											
Year	**0-39**			**40-64**			**65+**			**Total (all ages)**		
	Cases	**CR**	**AAR**	**Cases**	**CR**	**AAR**	**Cases**	**CR**	**AAR**	**Cases**	**CR**	**AAR**
1982	20	0.54	0.49	214	22.66	26.74	94	78.54	80.49	328	6.86	12.66
1983	25	0.67	0.57	233	24.16	28.71	100	80.36	85.10	358	7.37	13.52
1984	24	0.63	0.54	198	20.11	24.10	104	80.37	84.64	326	6.61	12.32
1985	23	0.60	0.53	227	22.59	27.65	101	75.08	76.37	351	7.01	12.62
1986	14	0.36	0.31	192	18.72	22.15	109	77.94	80.30	315	6.19	11.37
1987	34	0.86	0.71	232	22.16	26.37	121	83.24	85.48	387	7.49	13.06
1988	18	0.45	0.38	225	21.06	26.10	109	72.14	71.57	352	6.71	11.8
1989	13	0.32	0.28	257	23.57	28.22	114	72.60	72.54	384	7.21	12.32
1990	19	0.46	0.38	250	22.47	27.28	133	81.52	83.42	402	7.43	12.92
1991	25	0.60	0.49	223	19.65	23.70	131	77.29	80.50	379	6.90	11.89
1992	16	0.38	0.30	241	20.73	25.30	125	70.19	72.29	382	6.82	11.59
1993	23	0.53	0.44	189	15.87	19.21	155	82.85	86.53	367	6.42	11.16
1994	18	0.41	0.33	206	16.90	20.38	164	83.46	84.93	388	6.66	11.26
1995	19	0.43	0.36	184	14.75	17.91	177	85.78	87.40	380	6.40	10.84
1996	17	0.37	0.31	243	19.03	23.06	168	77.53	77.91	428	7.07	11.43
1997	10	0.22	0.17	226	17.30	21.15	153	67.25	68.11	389	6.30	10.17
1998	23	0.49	0.42	189	14.14	16.72	190	79.54	80.87	402	6.39	10.13
1999	20	0.42	0.38	226	16.54	19.58	179	71.38	72.36	425	6.62	10.22
2000	15	0.31	0.27	183	13.09	15.31	185	70.27	70.58	383	5.85	8.95
2001	11	0.22	0.17	196	13.72	16.81	164	59.34	59.50	371	5.56	8.48
2002	15	0.30	0.24	176	11.90	14.00	168	90.59	105.59	359	5.37	11.05
2003	9	0.18	0.14	188	12.18	14.14	196	99.95	117.59	393	5.81	11.86
2004	20	0.41	0.32	200	12.42	14.81	185	89.33	102.50	405	5.92	11.10
2005	12	0.25	0.19	191	11.39	12.83	195	89.26	105.50	398	5.76	10.70
82-05	**443**	**0.42**	**0.35**	**5089**	**17.18**	**20.18**	**3520**	**78.53**	**76.33**	**9052**	**6.48**	**10.78**
APC			**-4.17*** **			**-3.18*** **			**+0.65ns**		**-0.98*** **	**-1.11*** **

*** significant at 0.001 level; ** significant at 0.01 level; * significant at 0.05 level; ns- not significant

Table 2: Number of Incident cases of Lung Cancer in Females with Crude and adjusted rates per 100,000 population by broad age groups with APC in AAR, 1982-2005

	Age Group											
Year	**0-39**			**40-64**			**65+**			**Total (all ages)**		
	Cases	**CR**	**AAR**	**Cases**	**CR**	**AAR**	**Cases**	**CR**	**AAR**	**Cases**	**CR**	**AAR**
1982	3	0.10	0.10	37	5.79	6.65	22	20.98	21.40	62	1.67	3.23
1983	8	0.26	0.26	27	4.10	4.61	23	21.10	21.70	58	1.53	2.85
1984	8	0.26	0.25	40	5.89	6.83	31	27.36	27.64	79	2.03	3.81
1985	5	0.16	0.15	32	4.58	5.09	20	16.99	17.63	57	1.44	2.61
1986	4	0.13	0.12	24	3.33	3.62	16	13.08	14.67	44	1.09	2.02
1987	7	0.22	0.20	35	4.72	5.13	24	18.88	19.80	66	1.59	2.81
1988	8	0.24	0.23	41	5.37	5.85	32	24.23	24.85	81	1.92	3.36
1989	2	0.06	0.05	43	5.47	5.93	37	26.98	29.77	82	1.90	3.60
1990	7	0.20	0.18	50	6.17	6.52	26	18.25	19.82	83	1.88	3.14
1991	11	0.32	0.29	44	5.28	5.96	26	17.58	18.26	81	1.80	2.97
1992	9	0.25	0.22	53	6.15	6.93	50	31.86	33.50	112	2.44	4.23
1993	7	0.19	0.16	59	6.62	7.24	34	20.43	22.65	100	2.14	3.51
1994	7	0.19	0.17	50	5.43	6.21	44	24.93	26.92	101	2.12	3.55
1995	14	0.38	0.34	53	5.57	6.09	39	20.85	22.68	106	2.19	3.34
1996	10	0.27	0.23	52	5.29	5.87	43	21.69	22.54	105	2.11	3.20
1997	16	0.42	0.37	91	8.96	9.85	49	23.33	24.33	156	3.11	4.42
1998	3	0.08	0.07	59	5.62	6.17	49	22.02	22.77	111	2.17	3.18
1999	6	0.15	0.13	60	5.54	6.30	45	19.09	19.32	111	2.13	3.02
2000	8	0.20	0.17	71	6.35	6.92	49	19.63	20.18	128	2.43	3.26
2001	14	0.35	0.29	61	5.29	5.99	46	17.41	17.75	121	2.24	2.93
2002	12	0.30	0.26	64	5.40	6.09	54	29.36	34.48	130	2.39	4.11
2003	11	0.27	0.23	82	6.65	7.46	68	35.63	41.41	161	2.92	4.92
2004	5	0.12	0.10	65	5.07	5.87	74	37.43	44.77	144	2.57	4.67
2005	10	0.25	0.20	50	3.75	4.24	67	32.79	38.66	127	2.24	3.90
82-05	**195**	**0.23**	**0.20**	**1243**	**5.55**	**6.25**	**968**	**23.62**	**24.09**	**2406**	**2.13**	**3.38**
APC			**+0.65ns**			**+0.62ns**			**+1.51** **		**+2.46*** **	**+1.51** **

*** significant at 0.001 level; ** significant at 0.01 level; * significant at 0.05 level; ns- not significant

Table 3: Cumulative Incidence Rate Percent (CIRP) and Life Time Risk Expressed as One in Every 'n' Persons (LTR) at different age groups for lung cancer among Males, 1982-2005

Year	Age Group							
	0-39		40-64		65+		Total (all ages)	
	CIRP	LTR	CIRP	LTR	CIRP	LTR	CIRP	LTR
1982	0.035	2862	3.00	33	11.26	9	1.56	64
1983	0.043	2333	3.22	31	11.57	9	1.64	61
1984	0.040	2503	2.69	37	11.55	9	1.51	66
1985	0.039	2533	3.15	32	10.75	9	1.57	64
1986	0.024	4238	2.49	40	11.17	9	1.42	70
1987	0.056	1781	2.97	34	11.92	8	1.62	62
1988	0.030	3380	2.99	33	10.30	10	1.49	67
1989	0.021	4828	3.22	31	10.37	10	1.54	65
1990	0.029	3405	3.13	32	11.66	9	1.62	62
1991	0.039	2587	2.67	37	11.07	9	1.47	68
1992	0.024	4237	2.90	35	10.02	10	1.44	69
1993	0.034	2958	2.20	46	11.78	8	1.40	72
1994	0.026	3838	2.33	43	11.88	8	1.43	70
1995	0.026	3866	2.07	48	12.18	8	1.39	72
1996	0.023	4283	2.63	38	11.05	9	1.45	69
1997	0.013	7432	2.43	41	9.53	10	1.28	78
1998	0.031	3220	1.90	53	11.20	9	1.28	78
1999	0.026	3855	2.22	45	10.03	10	1.27	78
2000	0.020	5007	1.73	58	9.97	10	1.14	87
2001	0.014	7116	1.95	51	8.43	12	1.09	92
2002	0.018	5573	1.58	63	14.19	7	1.40	71
2003	0.011	9091	1.59	63	15.72	6	1.51	66
2004	0.025	4022	1.70	59	13.82	7	1.41	71
2005	0.014	6978	1.44	69	14.03	7	1.35	74
1982-2005	**0.027**	**3771**	**2.36**	**42**	**10.62**	**9**	**1.35**	**74**

Table 4: Cumulative Incidence Rate Percent (CIRP) and Life Time Risk Expressed as One in Every 'n' Persons (LTR) at different age groups for lung cancer among Females, 1982-2005

Year	Age Group							
	0-39		40-64		65+		Total (all ages)	
	CIRP	LTR	CIRP	LTR	CIRP	LTR	CIRP	LTR
1982	0.008	11849	0.74	135	3.02	33	0.40	249
1983	0.019	5214	0.50	200	3.05	33	0.35	285
1984	0.020	5072	0.79	127	3.92	25	0.49	206
1985	0.012	8202	0.56	178	2.46	41	0.32	312
1986	0.009	11157	0.39	257	1.94	51	0.24	418
1987	0.016	6343	0.55	183	2.74	37	0.34	295
1988	0.018	5595	0.64	157	3.49	29	0.42	240
1989	0.004	22771	0.64	156	3.97	25	0.44	227
1990	0.013	7756	0.69	145	2.67	37	0.37	272
1991	0.022	4589	0.64	155	2.54	39	0.35	283
1992	0.017	5832	0.76	132	4.60	22	0.52	191
1993	0.014	7320	0.80	125	2.98	34	0.42	240
1994	0.012	8058	0.71	141	3.60	28	0.44	229
1995	0.026	3790	0.66	151	3.00	33	0.39	254
1996	0.018	5705	0.64	157	3.10	32	0.39	257
1997	0.028	3633	1.09	92	3.33	30	0.52	191
1998	0.006	17527	0.67	149	3.14	32	0.39	255
1999	0.010	10397	0.71	141	2.72	37	0.37	267
2000	0.012	8005	0.76	132	2.79	36	0.39	255
2001	0.023	4278	0.69	145	2.47	40	0.36	277
2002	0.020	5085	0.69	146	4.61	22	0.51	197
2003	0.017	5906	0.82	123	5.54	18	0.60	166
2004	0.008	12782	0.67	149	5.91	17	0.59	171
2005	0.015	6618	0.47	213	5.12	20	0.49	206
1982-2005	**0.015**	**6614**	**0.69**	**145**	**3.29**	**30**	**0.41**	**242**

Figure 1: Cumulative incidence rates (lifetime risk) for ICS data on lung cancer from 1986-2005 in both sexes

Males | Females

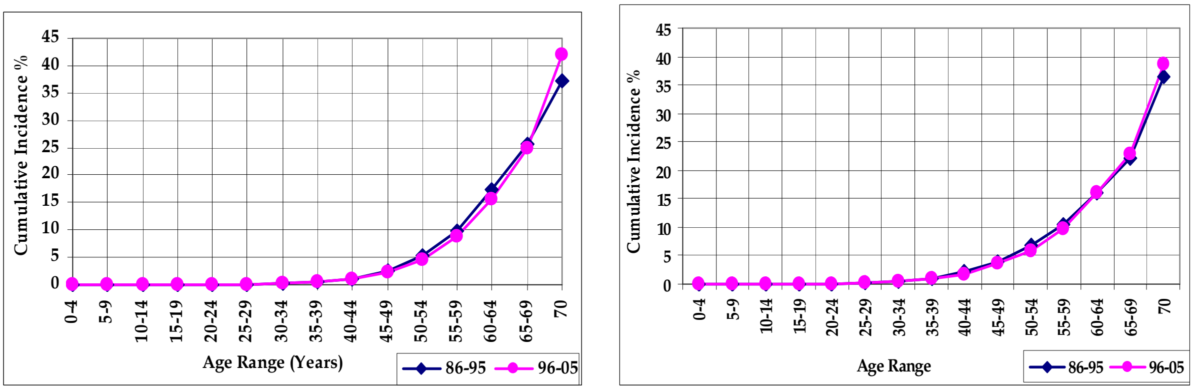
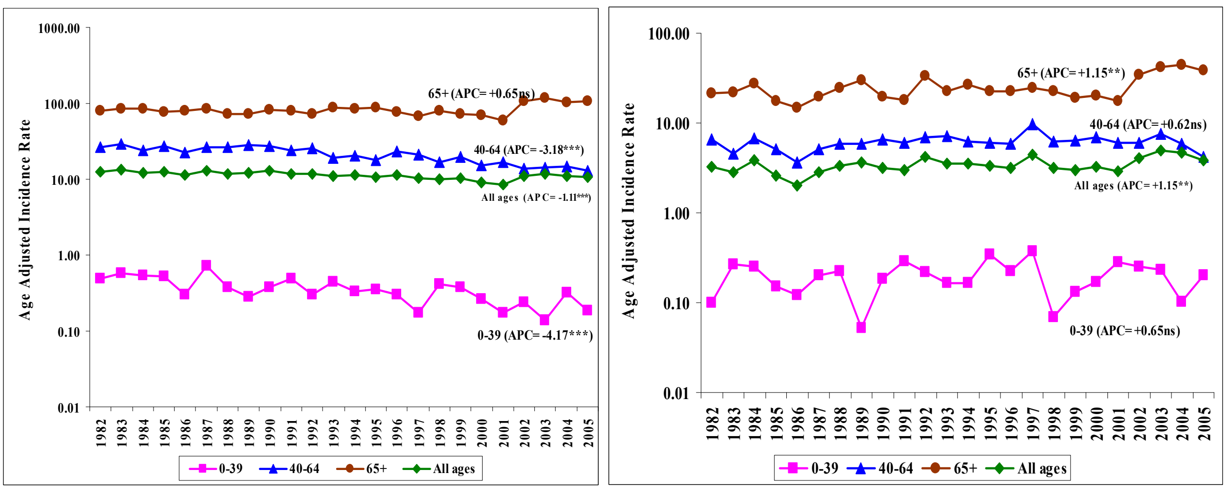


Figure 2: Trends in AAR of lung cancer incidence/ 100,000 for different age-groups and sex at all ages during 1982-2005 in Greater Mumbai

Males | Females



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