RESEARCH COMMUNICATION

# Trends in Cancer Incidence in Esophagus, Stomach, Colon, Rectum and Liver in Males in India

**Balkrishna B Yeole**

## Abstract

**Time trends in cancers of the esophagus, stomach, colon, rectum and liver cancers among the male population in five Indian urban population based cancer registries (Mumbai, Bangalore, Chennai, Delhi, and Bhopal) were examined over the period of the last two decades. The model applied fits data to the logarithm of Y=ABx. This Linear Regression method showed decreasing trends in age-adjusted incidence rates for cancers of the stomach and esophagus, especially in Bjopal, and increasing trends for colon and rectum and liver, throughout the entire period of observation in most of the registries. The five cancers together constitute more than 80% of the total gastro intestinal cancers and are serious diseases in both sexes. To understand the etiology of these cancers in depth, analytic epidemiological studies should be planned in the near future on a priority basis.**

**Key Words:** Trends - oesophagus - stomach - liver - colon

*Asian Pacific J Cancer Prev,* **9**, 97-100

## Introduction

In all the Indian cancer registries, in males the digestive system as a whole is the commonest cancer site group. In women, cancer involved the breast most frequently followed by the genital organs and the digestive systems (National Cancer Registry Consolidated Report of Caner Registries, 2006). Cancer of the large bowel is the 3rd most frequent cancer in the world in both the sexes, after cancer of the lung and stomach in males and after those of breast and cervix in females (IARC Scientific Publication, 1993). Cancer of the stomach is one of the most frequent cancers in the world. Cancer of the esophagus is estimated as the 7th most common cancer in the world. The pattern of incidence and mortality is diverse in the world but trends in the incidence are somewhat similar of prominent sites of digestive system.

In this paper an attempt has been made to study the trends in cancers esophagus, stomach, colon, rectum and liver cancers among the male population in five Indian urban population based cancer registries (Mumbai, Bangalore, Chennai, Delhi, and Bhopal) 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, Bangalore and Chennai registries and for 16 years period (1988-2003) for Delhi and Bhopal registries. The data used for trends analysis from these 5 registries has been coded in the same format, i.e. for topography ICD-10 (WHO, 1992) and for morphology ICD-O3 (IARC Scientific Publication, 1982) has been used. For calculating various rates, population by age, sex and year has been estimated by using "Distribution Method" (National Cancer Registry Consolidated Report of Caner Registries, 2006) by using 1981, 1991 and 2001 census figures for all these registries. For calculating age adjusted incidence rates world standard population (IARC Scientific Publication, 1992) has been used.

## Materials and Methods

In India the first population based cancer registry was established in Mumbai (Bombay) by the 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 another two 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 rate or age specific rates, as well as modeling by age, period and cohort has been used to study the trends in cancer incidence.

For studying trends we use 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 data. Capital "A" therefore represents the estimated rate of the initial year and (B-1)*100 gives the Average Annual Percentage Change in the incidence rates during the period (Cancer Incidence & Mortality in Greater Mumbai-2001, 2005).

*Bombay Cancer Registry, Indian Cancer Society, 74, Jerbai Wadia Road, Bhoiwada, Parel, Mumbai – 400 012, Maharashtra. Email: bcrics@vsnl.com*

**Table 1. Average Age-Adjusted Incidence Rates per 100,000 Population for Gut and Liver Cancers**

| Registry | Esophagus | Stomach | Colon | Rectum | Liver |
|---|---|---|---|---|---|
| Mumbai | 8.52 | 5.89 | 3.06 | 2.65 | 3.57 |
| Chennai | 8.32 | 13.11 | 1.70 | 2.66 | 2.46 |
| Bangalore | 7.97 | 9.28 | 2.43 | 2.67 | 2.98 |
| Delhi | 5.69 | 3.42 | 2.39 | 2.00 | 2.23 |
| Bhopal | 7.64 | 2.99 | 2.14 | 1.94 | 2.29 |

The observed and estimated (based on model fitting) age adjusted incidence rates for each site for all registries are shown diagrammatically. The estimates of the average annual percentage rates of various cancers are given in tabular form.

## Results

Average age adjusted in incidence rate for cancers of esophagus, colon, rectum and liver in men are almost of similar order of magnitude between these five registries i.e. 8 per 100,000 population for esophagus and 3 per 100,000 for the cancers of colon, rectum and liver. When age adjusted incidence rates per 100,000 population for cancer of stomach compared between these five registries, there is wide variation, the highest being 13 for Chennai Cancer Registry and lowest 3 for Bhopal Cancer Registry (Table 1)

In Indian registries, for recent periods, in the ranking of cancer incidence in men, cancer of esophagus ranks 3rd in Mumbai, Chennai and Bangalore Registries, 4th in Bhopal registry and 8th in Delhi registry. In the same list of ranking, cancer of the stomach ranks first for Bangalore Registry, 2nd for Chennai Registry and 9th for Mumbai Registry.

The observed and expected age adjusted incidence rates over a period of time for these sites are presented by line graphs in Figures 1 to 5. The values of average annual percentage changes in age adjusted incidence rates with statistical significance for these sites in five registries are given in Table 2. It has been observed that there is a statistically significant decrease in the incidence of esophagus cancer for Mumbai and Delhi registries while increase in the incidence for Chennai registry. There has been statistically significant decrease in the incidence of stomach cancer over a period of time in most of the registries, highest decrease was observed for Delhi registry.

**Table 2. Annual Percentage Change in Age-Adjusted Incidence Rates for Gut and Liver Cancers**

| Registry | Esophagus | Stomach | Colon | Rectum | Liver |
|---|---|---|---|---|---|
| Mumbai | -2.91** | -2.45** | 0.64$^{ns}$ | 0.17$^{ns}$ | 1.74** |
| Chennai | 1.12* | -0.98* | 2.07** | 2.38** | 0.25* |
| Bangalore | 0.13$^{ns}$ | -0.74$^{ns}$ | 2.08* | 1.69* | 1.54* |
| Delhi | -1.36* | -1.57* | 1.71* | -0.36$^{ns}$ | 1.32$^{ns}$ |
| Bhopal | 1.24$^{ns}$ | -6.13* | 2.79$^{ns}$ | 2.75$^{ns}$ | 2.10$^{ns}$ |

$^{ns}$ Not Significant, * p< 0.05, ** p< 0.01

The trend in the incidence of colon, rectum and liver has been shown increasing in all the registries. Statistical significant increase was noticed in Chennai, Bangalore and Delhi registries for cancer of colon. For rectum, there has been increase in the incidence for Chennai and Bangalore registries. For liver cancer increase in Mumbai, Chennai and Bangalore registries has been noted over the time period examined.

## Discussion

International trends in incidence from esophageal cancer show quite mixed data. Age standardized rates are decreasing in Nordic countries and Switzerland while increasing in France, US-Blacks and in Australia. Alcohol

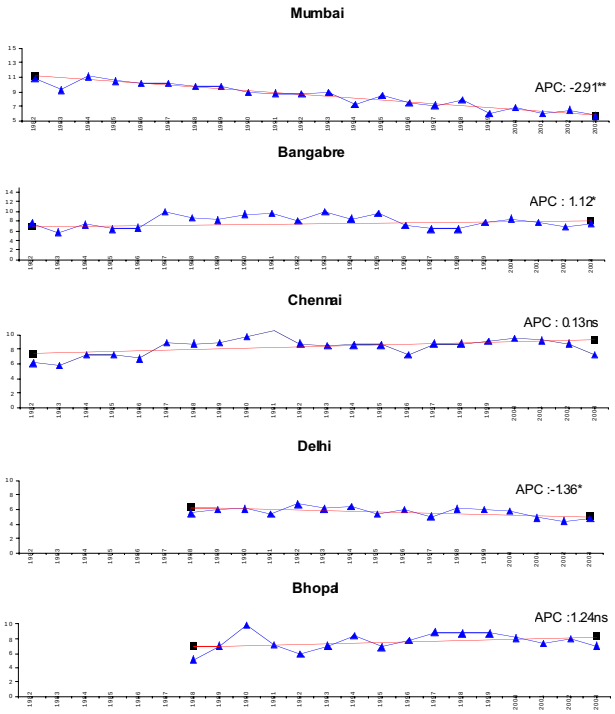


**Figure 1. Trends for Oesophageal Cancer Incidences**

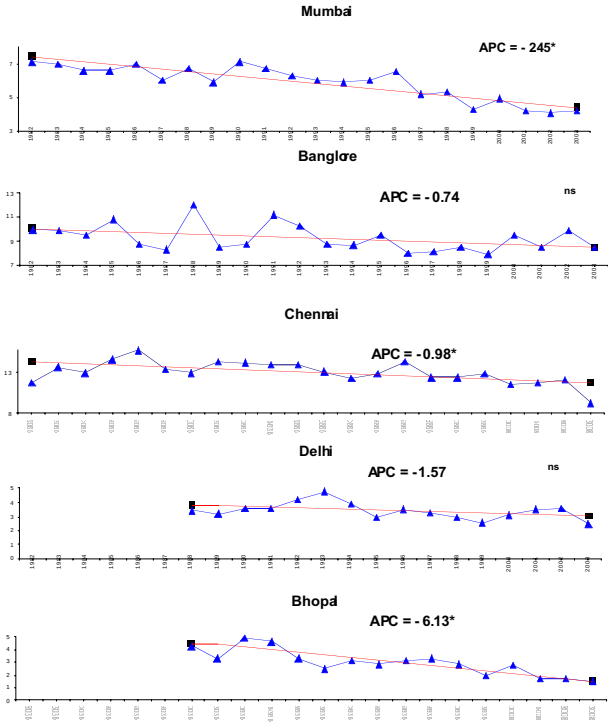


**Figure 2. Trends for Stomach Cancer Incidences**

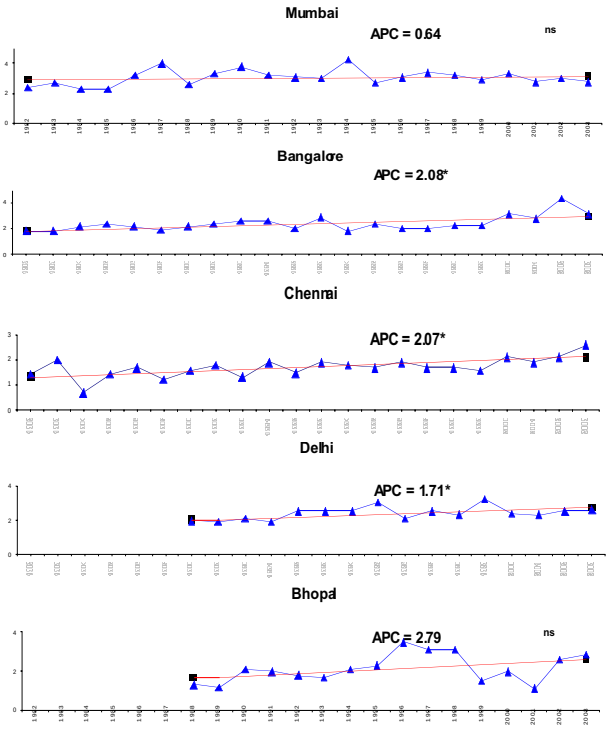


**Figure 3. Trends for Colon Cancer Incidences**

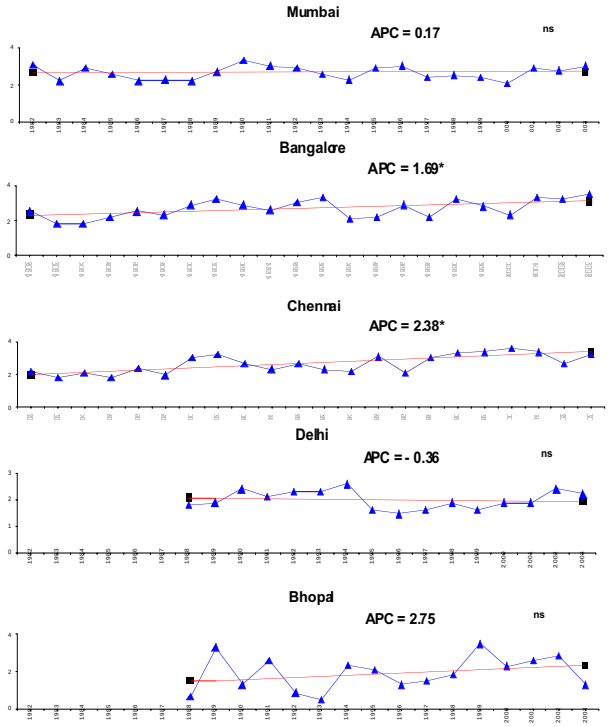


**Figure 4. Trends for Rectum Cancer Incidences**

and tobacco consumption are major risk factors for esophagus cancer in Europe and America (Tuyns, 1976), but they do not explain the very high incidence in parts of China and Iran, where poor nutrition and ingestion of opium pyrolysates are involved (Munoz and Day, 1982). In India association between tobacco usage and trend in incidence of esophagus cancer has been shown by Jussawalla (Jussawalla, 1981). Small decrease in incidence in esophagus cancer among males in successive birth cohorts has been reported previously from Singapore and Bombay- India (Jayant and Yeole, 1987).

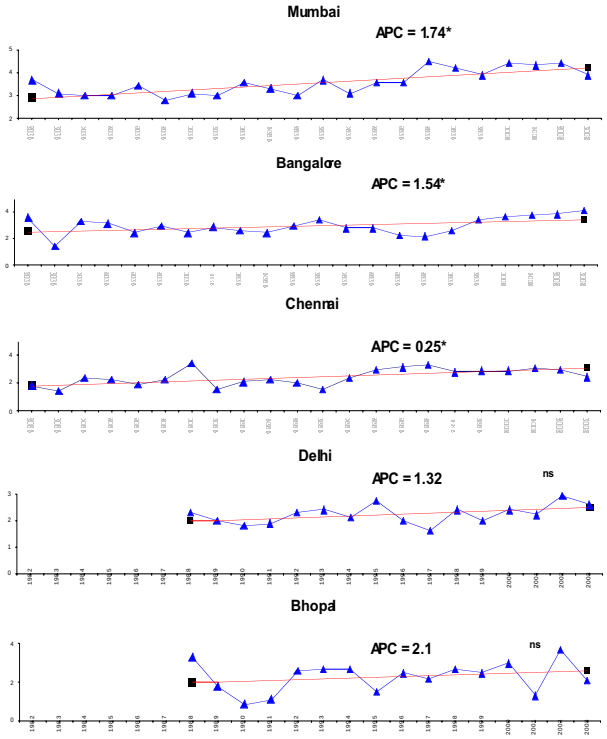


**Figure 5. Trends for Liver Cancer Incidences**

The most remarkable feature of the epidemiology of gastric cancer is the virtually universal decline in its incidene, at above 2-4% per year, but with much variation in different countries and the time of onset. Rates are falling more rapidly for females than males. The decrease in the incidence of stomach cancer is associated with the improving standard of living, which results in changes in dietary habits. The current opinion is that adequate intake of certain vitamins is likely to decrease the probability of contracting stomach cancer. Hirayama showed that consumption of green-yellow vegetables is associated with a decreased risk (1977). Many diet studies, including those by Hakama and Saxen, 1967) and Bjelke (1974), suggest that a high intake of complex carbohydrates or salty foods may be important risk factors or indicators (Tulinius, 1978; Nomura,1982). Jensen (1982) has shown that the decrease in the incidence of stomach cancer coincides with an increase in the consumption of fruits and vegetables and with a decrease in the consumption of cereals. Data from cancer registries indicate temporal changes in the incidence of gastric cancer in Norway (Munoz and Aswall, 1971) and Japan (Hanai et al., 1982) to be due largely to the disappearance of the 'intestinal' type of gastric cancer as opposed to the diffuse type. *Helicobacter pylori* infection is now widely recognized as a cause of stomach cancer (Replogle et al., 1976; Tanida, 1997).

As observed in our data, incidence and mortality rates for cancer of the colon are rising, particularly in areas where the risk was formally low (Boyle et al., 1985). These changes have been a complied by changing ratios between the sub sites within the colon, with left-sided tumors (of the descending and sigmoid colon), becoming more frequent (Haenszeal and Correa, 1971; deJong et al.,1972). Diet is regarded as the most important risk factor for colon (Tomatis et al., ????). It is also associates with a high standard of living, the risk being highest among the

wealthiest and most educated segment of the population. Consumption of vegetables and fibers is preventive while consumption of total and saturates fats, animal and total proteins and totals energy may increase the risk (Schottenfield et al., 1978; Teppo, 1980). The rapid increase in incidence among Chinese in Singapore has been attributed to changes in diet (Lee, 1988).

The geographical patterns of colon and rectal cancer are also similar, though not identical and although the causes of both tumors are essentially unknown, environmental and particularly dietary factors are likely to predominate in both (Favire and Hill, 1987; Willett, 1990). An important difference between cancer of colon and rectum is the sex ratio, which is now generally around unity for colon cancer but about 1.5 or greater for rectal cancer. Trends in the incidence of colon and rectums are similar, rising in most populations, possibly due to partly similar risk factors like a diet rich in fat.

An increase in trend in the incidence of liver cancer in the both the sexes was observed in Mumbai population (Yeole,1997). In males the risk was found to increasing in successive birth cohorts. Time trends in liver cancer are difficult to interpret due to changes in classification and variable inclusion of metastasis tumors (Parkin, 2001). However, the incidence of hepatocellular carcinoma in Japan, the UK, the USA, and several Nordic countries has increased noticeably over the past two decades and has become progressively associated with younger age groups (Bergsland and Venook, 2000). Some of these increases may be due to result of improved detection.

In conclusion all these five cancers constitute more than 80% of total gastro intestinal cancers and are also serious diseases in both the sexes. Esophagus and stomach cancers are decreasing and cancers of colon, rectum and liver are increasing in Indian populations. To understand the etiology of these cancers, analytic epidemiological studies are a high priority.

## References


Bergsland EK, Venook AP (2000). Hepatocellular carcinoma, *Curr Opin Oncol*, **12**, 357-61.

Bjelke E (1974). Epidemiological studies of cancer of the stomach, colon & rectum, With special emphasis on role of diet, *Scand J Gastroenterol*, **9 Suppl 31**, 1-235.

Boyle P, Zaridje DG, Smans M (1985). Descriptive epidemiology of colorectal cancer. *Int J Cancer*, **36**, 9-18.

Cancer Incidence & Mortality in Greater Mumbai-2001, Indian Cancer Society, 2005.

Colmean MP, Esteve J, Damiecki P, et al (1993). Trends in Cancer Incidence and Mortality, IARC Scientific Publication, No-21, International Agency of Research on Cancer, Lyon, France.

deJong UW, Day NE, Muir CS, et al (1972). The distribution of cancer within the large bowel. *Int J Cancer*, **10**, 463-77.

Favire J, Hill MJ et al (1987). Causation and Prevention of Colorectal Cancer, Excerpta Medica, Amsterdam.

Haenszeal W, Correa P (1971). Cancer of the colon and adenomatous polyps. A review of epidemiologic findings. *Cancer*, **28**, 14-24.

Hakama M, Saxen E (1967). Cereal consumption and gastric cancer. *Int J Cancer*, **2**, 265-68.

Hanai A, Fugimoto I, Taniguchi H (1982). Trends of Stomach Cancer Incidence and Histological types in Osaka, In: Trends in Cancer Incidence – Causes and Practical Implications, Eds: K Magnus, Washington DC, Hemisphere, 143-54.

Hirayama T (1977). Descriptive and analytic epidemiology of stomach cancer, *IARC, Scientific Publication*, **20**, 167-89, Lyon, France.

Jayant K, Yeole BB (1987). Cancer of the upper elementary and respiratory tracks in Bombay, India: A study of incidence over two decades, *Br Cancer J* , **56**, 847-52.

Jensen OM (1982). Nitrate in drinking water and cancer in Northern Juteland, Denmark, With Special reference to stomach cancer. *Ecotoxial Enviorn Saf*, **6**, 258-67.

Jussawalla DJ (1981).Oesophageal cancer in India. *J Cancer Res Clin Oncol*, **89**, 29-33.

Lee HP, Duffy SW, Day NE, et al (1988). Recent trends in cancer incidence among Singapore Chinese. *Int J Cancer*, **42**, 159-66.

Munoz N, Aswall (1971). Time trends of intestinal and diffuse types of gastric cancer in Norway. *Int J Cancer*, **8**, 144-157.

Munoz N, Day NE (1982). Oesophagus. In: Cancer Epidemiology & Prevention. pp.596-623. Eds: D'Schottenfield and JF Faraumani, Saunders, Philadelphia.

National Cancer Registry Consolidated Report of Caner Registries, 2001-2004, Indian Council of Medical Research, New Delhi, 2006.

Nomura A (1982). Stomach. In: Cancer Epidemiology & Prevention. Eds. D'Schottenfield and JF Faraumani, Saunders, Philadelphia, 624-37.

Parkin DM, Muir CS, Whelan SL, et al (1992). Cancer Incidence in Five Continents- Vol.VI, IARC Scientific Publication No.120, . IARC, Lyon, France.

Parkin DM, Bray F, Davesa SS (2001). Cancer burden in the year 2000. The global picture. *Eur J Cancer*, **37**, **Suppl 8**, 54-66.

Replogle ML, Kasumi W, Ishikawa KB, et al (1976). Increased risk of helicobacter pylori associated with birth in war time and post-war Japan. *Int J Epidemiol,* **25**, 210-14.

Schottenfield D, Hass JF et al (1978). Epidemiology of colorectal cancer. In: Gastrointestinal Tract Cancer. Eds:M Lipkin and RA good, Plenum Medical Book Co. New York, 207-40.

Tanida N, Sakagami T, Sawada Y, et al (1997). Critical Review on the WHO / IARC report regarding carcigenicity of *Helicobacter pylori*. *Nippon Ringsho*, **55**, 995-1002.

Teppo L, Pukkala E, Hakama M, (1980). Way of life and cancer incidence in Finland. A municipality-based ecological analysis. *Scan J Soc*, 32 (suppl 19).

Tomatis L, Aitio A, Day NE, et al (2000). Cancer: Causes, Occurrence and Control. IARC Scientific Publications No.100, Lyon.

Tulinius H (1978). Epidemiology of Gastric Cancer. Narings-forsking 22 Suppl 16, 52-63.

Tuyns AJ (1976). Double Wave Cohort increase for oesophageal and laryngeal cancer in France in relation to reduced alcohol. *Digestion,* **14**, 197-208.

Waterhouse J, Muir C, Shanmugaratnam K, et al (1982). Cancer Incidence in Five Continents- Vol.IV, IARC Scientific Publication No.42, IARC, Lyon, France.

Willett WC, Stampfer MJ, Colditz GA, et al (1990). Relation of meat, fat and fiber intake to the risk of colon cancer in a prospective study among women. N Engl. *J Med*, **323**, 1664-72.

World Health Organization Manual of the International Classification of Diseases, Injuries, causes of death (ICD-10) Vol.1, Geneva: WHO, 1992.

Yeole BB (1997). Cancer in India in 2001. University of Tampare, Tampare, Finland.

Time trends in cancers of the esophagus, stomach, colon, rectum and liver cancers among the male population in five Indian urban population based cancer registries (Mumbai, Bangalore, Chennai, Delhi, and Bhopal) were examined over the period of the last two decades. The model applied fits data to the logarithm of Y=ABx. This Linear Regression method showed decreasing trends in age-adjusted incidence rates for cancers of the stomach and esophagus, especially in Bjopal, and increasing trends for colon and rectum and liver, throughout the entire period of observation in most of the registries. Th