

# Prevalence based Epidemiological Cancer Statistics: A Brief Assessment from Different Populations in India

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## Abstract

Modern civilization, urbanization, industrialization, changes in daily life, population growth and ageing all have contributed to epidemiological changes in many diseases, including cancer, in India and other countries. Tobacco has been identified as the most important cause of cancer followed by alcohol consumption, dietary practices, inadequate physical activity, infections due to viruses and sexual behavior. The total number of new cancer cases is increasing rapidly, due to growth in size of the population, and an increase in the proportion of elderly persons, as a result of improved life expectancy, following control of communicable diseases. Such changes in the age structure automatically alter the disease pattern associated with ageing and increase the burden of problems such as cancer, cardiovascular and other non-communicable diseases in the society. Knowledge based on epidemiological patterns and trends would be of great help in identifying persons at high risk for the development of a particular cancer. Public education on 'tobacco and its health hazards', recommended dietary guidelines, safe sexual practices, and lifestyle modifications form the scientific basis for planning and organizing prevention, diagnosis and treatment of cancer in a community. Moreover, incorporating screening for cervical, breast and oral cancers into the peripheral health infrastructure can have a significant effect on reducing mortality from these diseases. This paper highlights the incidence and prevalence based epidemiological cancer statistics, its early detection and prevention measures in India.

*Key Words: Cancer, Prevalence, Tobacco, Epidemiology*

## Introduction

Cancer is one of the leading causes of adult deaths worldwide. In India, the International Agency for Research on Cancer (IARC) estimated that indirectly the number of people died from cancer in 2008 was 8% of all projected global cancer deaths and about 6% of all deaths in India [1]. It is expected that average life expectancy of the Indian population will increase to 70 years by 2021-25 (Registrar General of India, 1996) [2]. There will be a substantial rise in the proportion of elderly people (60+) in the country. In-terms of absolute numbers, the increase will be from 14 million as recorded during the year 1971 to 113 millions in the year 2016 [3]. Due to such changes in age structure, population will face an increase in incidence of cancers and some other non-communicable diseases, which have a higher chance of occurrence among elderly. India is facing a variety of nontransferable diseases or epidemics like cancer that need immediate attention.

Oral cancer is a heterogeneous group of cancers arising from different parts of the oral cavity, with different predisposing factors, prevalence, and treatment outcomes. Oral cancer is sixth most common cancer reported globally with an annual incidence of over 3,000,000 cases, of which 62% arise in developing countries [4]. In India, more than 75% of reported cases of oral cancers are associated with a history of tobacco consumption in smoke or smokeless form. There is a significant difference in the incidence of oral cancer in different regions of the world. The age-adjusted rates of oral cancer vary from over 20 per 100,000 populations in India, to 10 per 100,000 in the U.S., and less than 2 per 100,000 in the Middle East [5]. The life expectancy at birth has steadily risen

in India from 45 years in 1971 to 62 years in 1991, indicating a shift in the demographic profile. It is estimated that life expectancy of Indian population will increase to 70 years by 2021-25 [6].

## Search Strategy

Several epidemiological and epigrammatic studies in reported in past literature were accessed using the keywords 'Epidemiology' 'Prevalence' 'Risk factors' 'Tobacco'. Please give far more detail to describe how you accessed the studies whose results you report in this paper. For example, which databases did you interrogate and back to which year. The epidemiology of cancer is defined as study of the factors affecting cancer, as a way to infer possible trends and causes. Formerly, a number of epidemiological studies paid attention on major cancers viz., oral, kidney, prostate, breast, lung, esophageal etc have been reported [7-9].

Murthy and Mathew (1999) have described epidemiology of cancers, its control and prevention measure applicable to Indian population [10] tobacco, alcohol, dietary habits and behavioral factors are considered as the major risk factors for cancers. On an average, up to 30% of all cancers in occurred in developing countries are tobacco related as stated by WHO. The overall incidence of tobacco associated future cancer cases in India by 2001 was proposed to be nearly 0.33 million annually [11,12] alcohol consumption.

## Relative Demographic Incidence Pattern of Cancer in Various Provinces of the Country

In India, by the year 2020, the cases of head & neck cancers are

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**Table 1.** Prevalence of cancer in Uttar Pradesh, Madhya Pradesh and Rajasthan States of India [47].

State	Area included (%)	Prevalence in the population (%)	Prevalence % in the population in Males	Prevalence % in the population in Females
Uttar Pradesh	34.88	0.023	48.15	48.15
Rajasthan	-	51.85	67.67	-
Madhya Pradesh	11.6	15	-	62.79

**Table 2.** Prevalence of cancer in several districts of Uttar Pradesh [47].

City	Prevalence in the population	Male	Female	Male and Female	Male	Female
Agra	13.33	50.00	50.00	3.46	3.29	3.76
Banda	13.33	-	100.00	13.33	-	28.83
Firozabad	13.33	50.00	50.00	8.15	7.54	8.86
Jhansi	13.33	50.00	50.00	9.54	8.92	10.25
Lalitpur	20.00	-	100.00	20.46	-	43.62

**Table 3.** Age-adjusted (world population) incidence rates (AAR) per 100,000 males of 10 leading cancers in India [13,15,47].

Delhi		Mumbai		Bangalore	
Site	AAR	Site	AAR	Site	AAR
Lung [C33-C34]	14.0	Lung [C33-C34]	14.5	Stomach [C-16]	10.3
Larynx [C-32]	9.2	Oesophagus [D-00]	10.8	Oesophagus [D-00]	8.8
Hodgkin's disease Lymph [C-77]	6.9	Hypopharynx [C-13]	8.3	Lung [C33-C34]	8.1
Oesophagus [D-00]	6.2	Larynx [C-32]	8.2	Hypopharynx [C-13]	5.8
Tongue [C-01]	6.0	Prostate [C-61]	7.9	Hodgkin's disease lymph C-77	5.0
U. Bladder [C-67]	5.8	Stomach [C-16]	7.7	Prostate [C-61]	4.7
Prostate [C-61]	5.7	Tongue C-01	6.5	Larynx [C-32]	4.3
Leukaemia [C-90-95]	5.5	Mouth [D-10]	6.2	Tongue [C-01]	3.5
Mouth [D-10]	4.6	U. Bladder [C-67]	4.8	Leukaemia [C-90-95]	3.5
Brain [D-43]	4.3	NHL [C-82]	4.1	U. Bladder [C-67]	3.3

**Table 3a.**

Chennai		Nagpur		Pune	
Site	AAR	Site	AAR	Site	AAR
Stomach [C-16]	15.9	Hypopharynx [C-13]	6.7	Oesophagus [D-00]	8.3
Lung [C33-C34]	12.6	Oesophagus [D-00]	5.8	Lung [C33-C34]	7.7
Oesophagus [D-00]	10.5	Mouth [D-10]	3.8	Mouth [D-10]	7.1
Mouth [D-10]	7.5	Penis [C-60]	3.3	Prostate [C-61]	6.7
Hypopharynx [C-13]	6.5	Larynx [C-32]	2.5	Larynx [C-32]	6.3
Tongue [C-01]	5.8	Rectum [C-20]	2.6	Stomach [C-16]	5.4
Larynx [C-32]	5.1	Tongue [C-01]	2.3	Hypopharynx [C-13]	4.6
Rectum [C-20]	3.8	Leukaemia [C-90-95]	1.9	Tongue [C-01]	4.3
NHL [C-82]	3.7	Liver [C-22]	1.8	Brain [D-43]	4.2
Prostate [C-61]	3.6	Hodgkin's disease Lymph [C-77]	1.4	Hodgkin's disease Lymph [C-77]	4.2

**Table 3b.**

estimated to be around 218, 421 (19.0% of All sites cancers) [6]. Literature search of the risk factors pertaining to different Indian situation reveals little information [13]. Nonetheless, the relative incidence of Lung, oesophagus, stomach, oral and pharyngeal cancers are much higher in men while in females the cancers of cervix and breast are predominant forms followed by those of stomach and oesophagus [12]. Relatively, oesophagous cancers are frequently noticed in the southern Indian cities such as in Bangalore and Chennai and also in Mumbai whereas stomach cancers are more common in southern most India with the maximum incidence rate in Chennai city. Mouth cancers are high in Kerala while the

pharyngeal cancers in Mumbai. Moreover, the tumors arising from thyroid among women are more common in Kerala whereas Gall bladder cancer is more common in Delhi and Kolkata cities [14,15], (Tables 1-4).

The associated time dependent risk factors of cancer are the crucial descriptor to comprehend the changes in cancer incidence and prevalence over a longer period of time. Data over sufficient duration enabling study of time trends is available only from Mumbai registry where the Population-based Cancer Registry (PBCR) has been operating since 1964. Trend analysis of cancer incidence data for the period 1964–96 showed that the overall rates of cancer are increasing with

**Table 4.** Age-adjusted (world population) incidence rates (AAR) per 100,000 females of 10 leading cancers in India [13,15,47].

Delhi		Mumbai		Bangalore	
Site	AAR	Site	AAR	Site	AAR
Breast [C-50]	27.6	Breast [C-50]	282	Cervix [C-53]	27.2
Cervix [C-53]	22.6	Cervix [C-53]	202	Breast [C-50]	21.3
Ovary [C-56]	9.0	Oesophagus [D-00]	83	Mouth [D-10]	8.9
Gall bladder [C-23]	9.0	Ovary [C-56]	72	Oesophagus [D-00]	8.5
Oesophagus [D-00]	3.9	Mouth [D-10]	46	Stomach [C-16]	5.1
Hodgkin's disease lymph [C-77]	3.6	Stomach [C-16]	38	Ovary [C-56]	4.3
Leukaemia [C-90-95]	3.4	Lung [C33-C34]	37	Thyroid [C-73]	3.2
Brain [D-43]	32	Colon [C-18]	30	Leukaemia [C-90-95]	2.8
Lung [C33-C34]	2.9	Rectum [C-20]	27	Rectum [C-20]	2.8
Stomach [C-16]	2.4	Gall bladder [C-23]	27	Hodgkin's disease Lymph [C-77]	2.7

**Table 4a.**

Chennai		Nagpur		Pune	
Site	AAR	Site	AAR	Site	AAR
Cervix [C-53]	38.9	Cervix [C-53]	22.4	Breast [C-50]	26.3
Breast [C-50]	23.5	Breast [C-50]	22.3	Cervix [C-53]	21.1
Mouth [D-10]	8.2	Oesophagus [D-00]	9.1	Oesophagus [D-00]	7.4
Oesophagus [D-00]	7.0	Ovary [C-56]	6.6	Ovary [C-56]	6.8
Stomach [C-16]	7.0	Mouth [D-10]	3.3	Lung [C33-C34]	4.0
Ovary [C-56]	5.7	Leukaemia [C-90-95]	3.1	Mouth [D-10]	3.9
Rectum [C-20]	2.8	Rectum [C-20]	2.3	Stomach [C-16]	3.0
Lung C33-C34	2.4	Lung [C33-C34]	2.3	Colon [C-18]	2.7
Hypopharynx [C-13]	2.4	Stomach [C-16]	2.1	Rectum [C-20]	2.7
Corpus uteri [C-54]	2.2			Brain [D-43]	2.5

**Table 4b.**

greater increase among females. The largest increase among females was seen for cancer of the breast and among males for cancer of the prostate. Increasing trends were noticed for lymphoma, urinary bladder, gall bladder and brain tumors in both sexes [16].

Geographical variations in lung cancer patterns have been identified not only throughout the world but also between various regions within India wherein it remains the foremost site accounting for more than 41,000 cases and 38,000 deaths annually. According to the National Cancer Registry Program (2002), there are around 48,000 people living with lung cancer alone in India at any given time. 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 different cancer registries. Albeit, the geographic area and populace covered by these registries are literally 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 [17]. Conversely, results based on these fragmentary statistics cannot be generalized for the whole country. Currently there are sixteen urban and four rural population based cancer registries operating in India to provide site wise information on incidence and mortality of cancer patients as related to their demographic, social, clinical and lifestyle factors.

### Cancer Control and Prevention in India

In India, approximately 556 400 people died of cancer in 2010,

according to estimates published in The Lancet today [18]. The study conducted by Dr. Prabhat Jha, the Director of the Centre for Global Health Research at St. Michael's Hospital, Toronto, in collaboration with Indian national institutions and the IARC, used a distinctive method of projecting cancer deaths for the whole of India based on the patterns of cancer mortality in 2000-2003 in a sample of households. Cancer mortality is a key measure of the cancer burden in a given country and provides an important basis for implementing public health preventive measures. India is the first of the emerging economies to join IARC in 2006, and is an active participating state of the global cancer research agency [19].

Among males and females, it is the cancer of breast alone which is expected to cross the figure of 100,000 by the year 2020 [6]. Cancer is frequently considered as one of the most imperative causes of morbidity and its global burden on the financial system for providing health care will be substantial accordingly [20]. Well equipped hospitals, beds, sophisticated apparatus, machinery, drugs and other health care facilities such as trained nurses, oncologists, large number of hospital days are required for the successful management of cancer patients. Additionally, the indirect expenditure like the loss due to premature deaths, loss due to hindrance of productivity, economic dependence, etc. cannot be quantified. Therefore cancer prevention and control is the most appropriate measure rather than its successful management. As a very effectual footstep, the Government of India has recently banned chewable tobacco products in more

than 14 states. The Government of India has also launched the National Cancer Control Programme (NCCP) in 1975–76 to handle the ever-increasing incidence of cancers in the country which was further revised in 1984–85 based on the primary prevention and early detection of cancers [21]. The primary prevention primarily focused on health education concerning hazards of tobacco consumption, genital hygiene, and sexual and reproductive health whereas the secondary prevention aims at early diagnosis of cancers of uterine cervix, breast and oro-pharyngeal cancers by screening methods. Other state boards were suggested at the state levels called as State Cancer Control Board (SCCB) for the proper co-ordination of activities which was headed by the National Cancer Control Board. Several states have formulated SCCB. During the period 1990–91, a demonstration project named District Cancer Control Programme (DCCP) was initiated in selected districts of the country for early detection of cervical, oral and breast cancers at the doorsteps of rural community [22,23].

### Cancer Prevention Strategies

The data from the National Cancer Registry Programme stated that one third of the cancers occurring in Indian population are related to tobacco usage and thus are preventable [24]. The prime objective for the effective control of tobacco related cancers would be through primary prevention. Widespread convincing health education needs to be directed to control/reduce the tobacco habit. School going children are the best target population for this purpose as most of them pick up habits at this time. The school curricula should involve messages for a healthy lifestyle and warn about the harmful effects of tobacco and alcohol. Suitable lawmaking actions should be done to check the sale of tobacco to youngsters, to help in protection of the nonusers of tobacco – ‘passive smokers’ and for stopping advertisements on tobacco. Though there is a ban on advertisement of cigarettes, cigarette smoking is glamorized in various ways. Existing rules and regulations concerning smoking in public places of entertainment and public transport need to be rigidly enforced. In addition to the above, more strategies are needed for control of tobacco related cancers [25].

The IARC, the WHO, and the Bureau Against Smoking Prevention and several other international organizations are actively working for the widespread tobacco-control programme intended to tobacco control [26]. The best suited recommendations for Indian scenario would be the (i) health education of public, (ii) practice of tobacco control and (iii) encouragement for tobacco control. The results of an eight-year primary prevention follow-up study of oral cancer among Indian villagers have shown that through extensive and persuasive health education programme, it is possible to control the tobacco habits in the community [27-29]. In addition, proper health warning symbols and pictures must be printed on cigarette packets and on all tobacco products, advertisements, warning on smokeless tobacco products, and prohibition for smoking in public places, ban on sale of tobacco products to minors, higher taxation on other indigenous country made cigarettes similar to that on cigarettes needs to be adopted. Public education on tobacco and its health hazards, price increase and legislative measures

form the main features of primary prevention of tobacco-related cancers [30-32]. Dietary intervention for cancer prevention in terms of lowering dietary fat content, increasing intake of fiber, fruits and vegetables is needed to control cancer and other diseases, besides avoiding risk factors such as smoking and alcoholism and exposure to genotoxicants. Public education and awareness about the beneficial effects of consuming plenty of fresh vegetables and fruits with species such as turmeric in adequate amounts to prevent cancer are required. There is a need to popularize the following dietary guidelines for prevention of cancer [33-35]. The imperative dietary guidelines includes the maintenance of proper weight for a particular body height (Body-mass Index), regular body workout to avoid obesity and accumulation of fat, intake of plant foods (green leafy and yellow vegetables).

Nevertheless, the epidemiological data potentially advocate the relative occurrence of Invasive Cervical Cancer (ICC) and its association with early onset of sexual activity and multiple sexual partners therefore raising the age at marriage beyond 18 years, observing small family size, adopting safe sexual practices, attention to personal hygiene of both males and females and use of obstructive methods of contraception could help towards primary prevention of ICC [10,30,35,36]. In India, the prevention of exposure to Human Papilloma Virus (HPV) by vaccination may prove to be most efficient and feasible option for the prevention of pre-cancerous and cancerous lesions of cervix however with the introduction of hepatitis B vaccination into basic immunization vaccination schedule would definitely help in the development of liver cancer [32,37-41]. Recently, a gene test that can identify people at risk for mouth cancer has been developed by British researchers. The test detects precancerous cells in patients with benign-looking mouth lesions and could lead to earlier treatment for at-risk patients and improve their chances of survival, according to the team at Queen Mary, University of London [42-47]. So, as a definitive management modality, multidisciplinary approach to cancer treatment is crucial and this has to be made available at all Regional Cancer Centers. Unfortunately, the existing treatment facilities for cancer in India are sadly inadequate to take care of even the present load. More than 80% of the patients usually report to cancer care centers in advanced stages of disease [15,48]. The only way to fight this scourge under such circumstances is to have pragmatic programme and policies based on currently available scientific information and sound public health principles. Primary prevention, public education and training of the health care workers are the real hope for reducing overall cancer morbidity [49].

### Conclusion

As it is obvious from the current scenario, the need of the hour is to seriously assimilate and reinforce our efforts toward enforcement of legislation, public health awareness program, and promoting tobacco cessation clinics. Epidemiological data based studies often provides research foundation for the establishment of suitable strategies to assist in national cancer control program in India where the cancer is a crucial public health problem. The presented epidemiological review on cancers not only provides valuable information on patterns

of cancer prevalence and incidence, but unquestionably in accurate identification of risk factors allied with different types of cancers. Therefore, eradication of tobacco use and associated nutritional counseling must be aimed. However, a combined strategy of traditional and advanced molecular epidemiology, increase in the taxation across the range of tobacco products, and adequate utilization of mass media (Print media and TV channels) would be highly effective in cancer control and prevention program.

## References

1. Ferlay J, Shin HR, Bray F, Forman D, Mathers C, Parkin D. Estimates of worldwide burden of cancer in 2008: GLOBOCAN 2008. *International Journal of Cancer*. 2010; **127**: 2893-2917.
2. Murthy NS, Chaudhry K, Rath GK. Burden of Cancer and Projections for 2016, Indian Scenario: Gaps in the Availability of Radiotherapy Treatment Facilities. *Asian Pacific Journal of Cancer Prevention*. 2008; **9**: 671-677.
3. SRS based abridged life tables 1990-94 and 1991-95. *SRS Analytical Studies*. 1998; **1**: 3.
4. Parkin DM, Laara E, Muir CS. Estimates of the worldwide frequency of sixteen major cancers in 1980. *International Journal of Cancer*. 1988; **15**: 184-197.
5. Sankaranarayanan R, Masuyer E, Swaminathan R, Ferley J, Whelan S. Head and neck cancer: a global perspective on epidemiology and prognosis. *Anticancer Research*. 1998; **18**: 4779-4786.
6. National Cancer Control Programme, India: DGHS, MHF and W, Govt. of India, New Delhi, 1996.
7. Washbrook E. Risk factors and epidemiology of breast cancer. *Women's Health Medicine*. 2006; **3**: 8-14.
8. Rubagotti AG, Martorana G, Boccardo FM. Epidemiology of Kidney Cancer. *European Urology Supplements*. 2006; **5**: 558-565.
9. Ruano-Ravina A, Figueiras A, Barros-Dios JM. Lung cancer and related risk factors: an update of the literature. *Public Health*. 2003; **117**: 149-156.
10. Murthy NS, Mathew A. Screening for cancer of uterine cervix and approaches adopted in India. *Indian Journal of Cancer*. 1999; **36**: 154-162.
11. Murthy NS, Juneja AR, Sehgal A, Prabhakar, Luthra UK. Cancer projection by the turn of century. *Indian Journal of Cancer*. 1990; **27**: 74-84.
12. WHO. The World Health Report, Geneva, 1997.
13. National Cancer Control Programme, India: DGHS, MHF and W, Govt. of India, New Delhi, 1996.
14. Cancer Registry Abstract, Newsletter. National Cancer Registry Project India, 2001.
15. Parkin DM, Whelan SL, Ferlay J, Raymond L, Young J. Cancer Incidence in five continents. IARC Scientific Publications, Lyon; 1997.
16. Yeole BB. Trends and predictions of cancer incidence cases by site and sex for Mumbai. *Indian Journal of Cancer*. 1999; **36**: 163-178.
17. National Cancer Registry Program 2002. Development of an Atlas of Cancer in India: A project of the NCRP (ICMR) supported by WHO.
18. Dikshit R, Gupta PC, Ramasundarahettige C, Gajalakshmi V, Aleksandrowicz L, Badwe R, et al. Cancer mortality in India: a nationally representative survey. *Lancet*. 2012; **12**: 1807-1816.
19. The International Agency for Research on Cancer (IARC). [Internet]. India: Indian cancer statistics, a model to be followed; 2012 [updated 2012 Mar 28; cited 2012 Sep 06]. Available from: [http://www.iarc.fr/en/media-centre/pr/2012/pdfs/pr210\\_E.pdf](http://www.iarc.fr/en/media-centre/pr/2012/pdfs/pr210_E.pdf).
20. Murthy NS, Mathew A. Cancer epidemiology, prevention and control. *Current Science*. 2004; **86**: 154-162.
21. National Cancer Control Programme. [Internet]. India: National Documentation Centre; 2012 [updated 2012 Sep 06; cited 2012 Sep 06]. Available from: <http://www.nihfw.org/NDC/DocumentationServices/NationalHealthProgramme/NATIONALCANCERCONTROLPROGRAMME.html>.
22. Takiar R, Nadayil, Nandakumar A. Projections of Cancer Cases in India (2010-2030) by Cancer Groups. *Asian Pacific Journal of Cancer Prevention*. 2012; **11**: 1045-1049.
23. Gupta S, Rao YN, Agarwal SP. Emerging strategies for cancer control in women of India. In 50 Years of Cancer Control in India, Director General of Health Services, Govt. of India, 2001, pp. 184-194.
24. National Cancer Registry Programme, Biennial Report 1988-89, Indian Council of Medical Research, New Delhi; 1992.
25. Chaudhry K. Tobacco control in India. In 50 Years of Cancer Control in India, Director General of Health Services, Govt. of India, 2001; pp. 196-211.
26. Osborne M, Boyle P, Lipkin M. Cancer prevention. *Lancet*. 1997; **349**: 27-30.
27. Gupta PC, Aghi MB, Bhonsle RB, Murti PR, Mehta FS, Mehta CR, Pindborg JJ. Intervention study of chewing and smoking habits for primary prevention of oral cancer among 12,212 Indian villagers. In Tobacco: A Major International Health Hazard (Zaridze DG and Peto R, editors), International Agency for Research on Cancer, Lyon, 1986; pp. 307-318.
28. Gupta PC et al., Intervention study for primary prevention of oral cancer among 36,000 Indian tobacco users. *Lancet*. 1986; **1**: 1235-1238.
29. Gupta PC, Mehta FS, Pindborg JJ, Daftary D K, Aghi MB, Bhonsle RB, Murti PR. A primary prevention study of oral cancer among Indian villagers. Eight year follow-up results. In Evaluating the Effectiveness of Primary Prevention of Cancer (Hakama M, Beral V, Cullen JW and Parkin DM, editors), International Agency for Research on Cancer, Lyon, 1990.
30. Pandey M, Mathew A, Nair MK. Cancer vaccines: a step towards prevention and treatment of cancer. *European Journal of Surgical Oncology*. 1999; **25**: 209-214.
31. Sankaranarayanan R, Shyamalakumary B, Wesley R, Sreedevi Amma N, Parkin DM, Nair MK. Visual inspection with acetic acid in the early detection of cervical cancer and precursors. *International Journal of Cancer*. 1999; **80**: 161-163.
32. Nair MK, Varghese C, Mathew B, Sankaranarayanan R. Prevention and early detection of oral, breast and cervical cancer: a practical approach in Indian context. *Indian Medical Association*. 1993; **91**: 94-96.
33. Krishnaswamy K. Nutrition and cancer in India. *Bulletin of Nutritional Foundation India*. 1997; **18**: 4.
34. Krishnaswamy K, Polasa K. Diet, nutrition and cancer –The Indian scenario. *Indian Journal of Medical Research*. 1995; **102**: 200-209.
35. Krishnaswamy K, Prasad MRP. Profile of cancers in India – possible role of dietary factors. In Diet, Nutrition and Chronic Disease: An Asian Perspective (Shetty P, Gopalan C, editors), Smith-Gordon, UK, 1995, pp. 61-67.
36. Cancer Registry Abstract, Newsletter. National Cancer Registry Project India, 2001; **8**.
37. Sankaranarayanan R, Mathew B, Binu JJ, Thomas G, Somanathan T, Pisani P, Pandey M, Ramdas R. Early findings from a community-based cluster randomized controlled oral cancer screening trial in Kerala, India. *Cancer*. 2000; **88**: 664-673.
38. Mathew B, Sankaranarayanan R, Sunilkumar KB, Kuruvila B, Pisani P, Nair MK. Reproducibility and validity of oral visual inspection by trained health workers in the detection of oral pre-cancer and cancer. *British Journal of Cancer*. 1997; **76**: 390-394.
39. Mitra I. Screening for breast cancer in India. *National Medical Journal of India*. 1993; **6**: 101-104.
40. Mitra I. Early detection of breast cancer in industrially developing countries (Suppl.). *Gan To Kagaku Ryoho*. 1995; **3**: 230-235.
41. Robert Preidt. New Gene Test Predicts Whose Mouth Lesions Might Be Cancerous Available from <http://www.nlm.nih.gov/>

medlineplus/news/fullstory\_130087.html [Early Online Since Oct 09; 2012, Cited on Oct 10; 2012].

42. Rao DN, Ganesh B. Estimate of cancer incidence in India in 1991. *Indian Journal of Cancer*. 1998; **35**: 10-18.

43. Sutnick AI, Puchkov YI. Cancer in India. *New England Journal of Medicine*. 1980; **303**: 945.

44. Jussawalla DJ. Cancer statistics in India. *Indian Journal of Cancer*. 1973; **1**: 1-2.

45. International Institute for Population Sciences (IIPS) and Ministry of Health and Family Welfare. Global Adult Tobacco Survey (GATS India), 2009–2010. New Delhi: Government of India, 2010.

46. Gupta PC. Socio-demographic characteristics of tobacco use among 99598 individuals in Bombay, India, using hand-held computers. *Tobacco Control*. 1996; **5**: 114-120.

47. Population based Cancer Registry Report 1991–95, Regional Cancer Centre, Trivandrum, 1999.

48. Ganjewala D. Prevalence of Cancers in Some Parts of Madhya Pradesh and Uttar Pradesh in India. *Academic Journal of Cancer Research*. 2009; **1**: 12-18.

49. Gupta DK. Wakeup call to manage oral cancers in India. *Journal of Oral Biology and Craniofacial Research*. 2011; **2**: 1.