

RESEARCH COMMUNICATION

Projections of Number of Cancer Cases in India (2010-2020) by Cancer Groups

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Abstract

Introduction: Recently, NCRP (ICMR), Bangalore, has published a report on Time Trends in Cancer Incidence Rates. The report also provided projected numbers of cancer cases at the India country level for selected leadingsites. **Objective:** In the present paper, an attempt has been made to project cancer cases for India by sex, years and cancer groups. **Sources of data:** The incidence data generated by population-based cancer registries (PBCRs) at Bangalore, Barshi, Bhopal, Chennai, Delhi and Mumbai for the years 2001-2005 formed the sources of data. In addition, the latest incidence data of North Eastern Registries for the year 2005-06 were utilized. **Methods:** The crude incidence rate (CR) was considered suitable for assessing the future load of cancer cases in the country. The Linear Regression method (IARC 1991) was used to assess the time trend and the projection of rates for the periods 2010-2020. For whichever sites where trends were not found to be significant, their latest rates were taken into consideration and assumed to remain same for the period 2010-2020. **Results:** The total cancer cases are likely to go up from 979,786 cases in the year 2010 to 1,148,757 cases in the year 2020. The tobacco-related cancers for males are estimated to go up from 190,244 in the year 2010 to 225,241 in the year 2020. Similarly, the female cases will go up from 75,289 in year 2010 to 93,563 in the year 2020. For the year 2010, the number of cancer cases related to digestive system, for both males and females, are estimated to be 107,030 and 86,606 respectively. For, head and neck cancers, the estimates are 122,643 and 53,148 cases, respectively. and for the lymphoid and hematopoietic system (LHS), for the year 2010, are 62,648 for males and 41,591 for females. Gynecological-related cancers are estimated to go up from 153,850 in 2010 to 182,602 in 2020. Among males and females, cancer of breast alone is expected to cross the figure of 100,000 by the year 2020.

Keywords: Organ system-based cancer groups - tobacco related cancers - projections - India

Asian Pacific J Cancer Prev, 11, 1045-1049

Introduction

The Indian Council of Medical Research (ICMR) started a National Cancer Registry Programme (NCRP) in the year 1982 with the main objective of generating reliable data on the magnitude and pattern of cancer in India. There are 24 population-based cancer registries (PBCR) which are currently functioning under the network of NCRP. Of these, six PBCR's have been functioning since the year 1982/88.

Recently, NCRP has published a report on Time Trends in Cancer Incidence Rates (NCRP 2009). This report depicts the changes in incidence rates of cancer from five urban registries and one rural registry of India. In the last chapter of the report, an attempt was made to project the number of cancer cases at India level for selected leadings sites. However, in the present paper, a siumilar attempt has been made to project cancer cases for India by sex, years and cancer groups.

Materials and Methods

The incidence data generated by PBCRs at Bangalore,

Barshi, Bhopal, Chennai, Delhi and Mumbai for the years 2001-2005 formed the sources of data. In addition, the latest incidence data of North Eastern Registries for the year 2005-06 was utilized (NCRP, 2008). The crude incidence rate (CR) was considered suitable for assessing the future load of cancer cases in the country. The CR is preferable to the age-adjusted rate (AAR) as the latter is more suitable for comparison of rates between areas than for assessing the disease burden for the area. The linear regression method (IARC, 1991) was used to assess the time trend and the projection of rates for the periods 2010-2020. For whichever sites, the trends were not found to be significant, their latest rates were taken into consideration and assumed to remain same for the period 2010-2020.

The CRs of various cancer sites provided in the report of 2005-06 for the North East region were assumed to represent the respective areas. For the rest of the Indian states, the pooled crude rates of all urban registries were taken to represent them. Barshi being a rural registry, the rates of the registry were taken to represent the rural areas of India. Using the weight of 0.7 and 0.3 for rural and urban registries respectively, the estimates for India level were calculated for breast and cervix.

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The estimated populations for India by sex and selected years are calculated using the reduced growth rates. The reduction in growth rate for each sex was determined by taking the ratio of growth rate of 1991-2001 to that of observed in the period 1981-91. Multiplying this ratio with the growth rate of 1991-2001, the growth rate was arrived for the period 2001-2011. Further, multiplying this growth rate, with the ratio, the growth rate for the period 2011-2021 was determined. Having decided the growth rate for each decade (2001-2011; 2011-2021), the yearly populations were arrived using the reduced growth rates. The time trend in pooled crude rates of selected sites for latest five years and population estimates for respective years were used to arrive at the projections for the above periods.

The selected cancer groups, the sites which belong to these groups and the corresponding ICD10 codes are shown in Table 1.

Results

The estimates of cancer cases for all sites for Indian males are 462,408; 497,081 and 534,353 for the years 2010, 2015 and 2020, respectively. The corresponding estimates of cancer cases for females are 517,378; 563,808 and 614,404. Further, the total cancer cases are likely to go up from 979,786 cases in the year 2010 to 1,148,757 cases in the year 2020.

The estimated number of cases by various cancer sites related to tobacco by sex and selected years are provided in Table 2. The tobacco related cancers (TRC) for males

are estimated to go up from 190,244 in the year 2010 to 225,241 in the year 2020. Similarly, the female cases will go up from 75,289 in year 2010 to 93,563 in the year 2020. The three major contributors to pooled TRC cases for the year 2020 will be lung (67,218; 21.2%), mouth (64,525; 20.4%) and oesophagus (42,513; 13.4%).

The estimated number of cancer cases related to digestive System by sex and selected years is provided in Table 3. For the year 2010, for males and females they are estimated to be 107,030 and 86,606, respectively. The first three major contributors for the year 2020 will be stomach (45,196; 19.8%), oesophagus (42,513; 18.6%) and colon (32,433; 14.2%).

The estimates for head & neck cancers for the year 2010 for males and females are 122,643 and 53,148, respectively, which by the year 2020 will rise to 153,636 and 64,785 cases. For the year 2020, mouth (64,525; 29.5%), tongue (38,052; 17.4%) and larynx (33,855, 15.5%) are the sites which are expected to contribute maximum in the decreasing order (Table 4).

The cancer cases of lymphoid and haematopoietic system (LHS), for the year 2010, are estimated to be 62,648 for males and 41,591 for females. By the year 2020, the number of cases is expected to go up to 77,190 for males and 55,384 for females. For the year 2020, the NHL (38,098, 28.7%) and myeloid leukaemia (34,701, 26.2%) are estimated to contribute maximum to LHS related cancers (Table 5).

The gynaecological related cancers are estimated to be 153,850; 167,658 and 182,602 for the years 2010, 2015 and 2020, respectively. Among these, for the year 2020,

Table 1. Selected Cancer Groups, ICD10 Codes and Respective Cancer Sites

Cancer Group	ICD 10 Codes	Cancer Sites
Tobacco Related (TRC)*	C00, C01-C02, C03-C06, C10 and C12-C14, C15, C32, C33-C34, C67	Lip, Tongue, Mouth, Pharynx, Oesophagus, Larynx, Lung, Bladder
Digestive System (DS)**	C15, C16, C17, C18, C19-C20, C21, C22, C23-C24, C25	Oesophagus, Stomach, Small Intestine, Colon, Rectum, Anus & Anus Canal, Liver, Gall Bladder etc., Pancreas
Head & Neck (HN)**	C00, C01-C02, C03-C06, C07-C08, C09, C10, C11, C12-C13, C14, C30-C31, C32, C73	Lip, Tongue, Mouth, Salivary Gland, Tonsil, Oropharynx, Nasopharynx, Hypopharynx, Pharynx unspecified, Nose & Sinus etc., Larynx, Thyroid
Lymphoid and Haematopoietic System (LHS)*	C81, C82-85 & C96, C90, C91, C92-C04, C95	Hodgkins Disease, NHL, Multiple Myeloma, Lymphoid Leukaemia, Myloid Leukaemia, Lukaemia Unspecified
Gynaecological (Gyn)**	C51, C52, C53, C54, C55, C56, C57, C58	Vulva, Vagina, Cervix Uteri, Corpus Uteri, Uterus Unspecified, Ovary etc., Other Female Genital, Placenta

Source: * - NCRP: Consolidated Report of Hospital Based Cancer Registries (2004-06) - (2009).; ** UICC: TNM Classification of Malignant Tumours; Seventh Edition-Wiley-Blackwell Publications (2009).

Table 2. Estimated Number of Tobacco Related Cancers (TRC) by Sex - India - (2010-2020)

ICD10	Cancer Sites	Males			Females			Pooled		
		2010	2015	2020	2010	2015	2020	2010	2015	2020
C00	Lip	1,889	2,429	3,040	1,244	1,662	2,145	3,133	4,091	5,185
C01-C02	Tongue	24,735	26,589	28,583	7,973	8,689	9,469	32,708	35,278	38,052
C03-C06	Mouth	30,920	38,380	46,784	14,939	16,280	17,741	45,859	54,660	64,525
C10	Other Oropharynx	4,847	5,211	5,601	972	1,059	1,155	5,819	6,270	6,756
C12-C13	Hypopharynx	14,605	15,700	16,877	4,792	5,222	5,691	19,397	20,922	22,568
C14	Pharynx Unspecified	2,463	2,648	2,847	1,479	2,070	2,756	3,942	4,718	5,603
C15	Oesophagus	23,280	22,114	20,642	18,417	20,070	21,871	41,697	42,184	42,513
C32	Larynx	25,172	27,060	29,089	4,038	4,401	4,796	29,210	31,461	33,885
C33-C34	Lung	44,301	47,622	51,193	13,494	14,705	16,025	57,795	62,327	67,218
C67	Bladder	16,022	17,224	18,515	5,931	7,771	9,894	21,953	24,995	28,409
	TRC	190,244	206,992	225,191	75,289	83,944	93,563	263,523	288,921	316,734

Table 3. Estimated Number of Digestive System Cancers by Sex - India - (2010-2020)

ICD10	Cancer Sites	Males			Females			Pooled		
		2010	2015	2020	2010	2015	2020	2010	2015	2020
C15	Oesophagus	23,280	22,114	20,642	18,417	20,070	21,871	41,697	42,184	42,513
C16	Stomach	25,831	27,767	29,850	12,923	14,082	15,346	38,754	41,850	45,196
C17	Small Intestine	1,355	1,457	1,566	864	942	1,026	2,220	2,399	2,593
C18	Colon	11,613	12,483	13,420	11,895	15,205	19,013	23,509	27,689	32,433
C19-20	Rectum	12,131	13,041	14,019	9,341	10,179	11,093	21,473	23,221	25,112
C21	Anus And Anal Canal	2,303	2,476	2,661	1,197	1,304	1,421	3,500	3,780	4,083
C22	Liver	14,533	15,623	16,794	8,334	10,411	12,794	22,867	26,034	29,589
C23-24	Gall Bladder.Etc.	8,677	9,328	10,028	18,504	20,165	21,975	27,182	29,494	32,003
C25	Pancreas	7,304	7,851	8,440	5,128	5,588	6,090	12,432	13,440	14,530
(C15-C25)	Digestive System Cancers	107,030	112,144	117,423	86,606	97,950	110,633	193,637	210,095	228,056

Table 4. Estimated Number of Head & Neck Cancers by Sex - India - (2010-2020)

ICD10	Cancer Sites	Males			Females			Pooled		
		2010	2015	2020	2010	2015	2020	2010	2015	2020
C00	Lip	1,889	2,429	3,040	1,244	1,662	2,145	3,133	4,091	5,185
C01-02	Tongue	24,735	26,589	28,583	7,973	8,689	9,469	32,708	35,278	38,052
C03-06	Mouth	30,920	38,380	46,784	14,939	16,280	17,741	45,859	54,660	64,525
C07-08	Salivary Gland	2,840	3,053	3,282	2,081	2,268	2,471	4,921	5,321	5,753
C09	Tonsil	6,056	6,510	6,998	1,245	1,356	1,478	7,301	7,866	8,476
C10	Other Oropharynx	4,847	5,211	5,601	972	1,059	1,155	5,819	6,270	6,756
C11	Nasopharynx	2,244	2,413	2,594	1,250	1,362	1,484	3,494	3,775	4,078
C12-13	Hypopharynx	14,605	15,700	16,877	4,792	5,222	5,691	19,397	20,922	22,568
C14	Pharynx Unsp.	2,463	2,648	2,847	1,479	2,070	2,756	3,942	4,718	5,603
C30-31	Nose,Sinus Etc.	2,408	2,589	2,783	1,384	1,508	1,644	3,792	4,097	4,427
C32	Larynx	25,172	27,060	29,089	4,038	4,401	4,796	29,210	31,461	33,885
C73	Thyroid	4,464	4,798	5,158	11,751	12,808	13,955	16,215	17,606	19,113
	Head and Neck cancers	122,643	137,380	153,636	53,148	58,685	64,785	175,791	196,065	218,421

Table 5. Estimated Number of Lymphoid and Haematopoietic System (LHS) Cancers by Sex - India - (2010-2020)

ICD10	Cancer Sites	Males			Females			Pooled		
		2010	2015	2020	2010	2015	2020	2010	2015	2020
C81	Hodgkins disease	6,846	7,360	7,912	3,524	3,840	4,185	10,370	11,200	12,096
C82-85,C96	NHL	20,501	22,038	23,690	12,133	13,222	14,408	32,633	35,259	38,098
C90	Multiple Myeloma	9,651	12,605	15,947	4,890	5,329	5,807	14,541	17,934	21,754
C91	Lymphoid Luekemia	9,886	10,627	11,424	5,916	6,447	7,025	15,802	17,074	18,449
C92-94	Myeloid luekemia	12,005	12,905	13,873	12,492	16,363	20,828	24,497	29,269	34,701
C95	Lukaemia uns	3,759	4,041	4,344	2,636	2,873	3,131	6,395	6,914	7,474
	Cancers of LHS	62,648	69,576	77,190	41,591	48,073	55,384	104,239	117,649	132,574

Table 6. Estimated Number of Gynaecological Related Cancers by Years - India - (2010-2020)

ICD10	Site of cancer	2010	2015	2020
C51	Vulva	1,762	1,920	2,092
C52	Vagina	2,238	2,439	2,657
C53	Cervix	103,821	113,138	123,291
C54	Corpus uteri	14,848	16,181	17,533
C56	Ovary etc.	30,482	33,218	36,199
C57	Other Female genital	215	235	256
C58	Placenta	484	527	574
C51-58	Gynaecological cancers	153,850	167,658	182,602
C50	Breast	90,659	106,124	123,634

cervix (123,291; 67.5%), ovary (36,199; 19.8%) and corpus uteri (17,533; 9.6%) are expected to contribute maximum in their decreasing order. The estimated number of Breast cancer cases for the years 2010, 2015 and 2020 will be 90,659, 106,124 and 123,634 respectively (Table 6).

Discussion

There are different approaches and models available to us to predict the burden of cancer using the registry data. Many authors have used age, period, cohort models to arrive at cancer burden in communities (Clarke, 1995; Verdecchia et al., 2002; Olsen, Parkin and Sasieni, 2008). One of the simple approaches to project the cancer cases for future is by making use of the approach of linear regression. In this approach the trend of the incidence rates of certain site is first determined and then rates are estimated for the desired future periods using the linear regression equation. Multiplying rates so arrived with appropriate estimated population figures, the projected number of cases is estimated. However, while studying the time trends in NCRP data for selected five urban registries, it was observed that few sites, over the years, do exhibit inconsistent changes like shown by the sites of Mouth and Oesophagus at Bhopal (NCRP, 2009). These changes can

be characterized by initial increase or decrease in the rates for certain period followed by a decreasing or increasing trend in the later part of the period. The study of the time trends in incidence data of various sites of cancer of urban registries of India, with the help of Join point regression (Joinpoint Regression Program, Version 3.0. April 2005) has brought out the existence of inconsistent trends in various cancer sites which forces investigators to shift their focus from the overall linear changes to the latest linear changes that are occurring in the incidence data. For this, it was thought enough to consider the incidence data of recent five years. Hence, for present paper, the trend in the incidence data was assessed by considering the incidence data of most recent five years only.

For projection of cancer cases at country level, it is important that we have the knowledge of the populations for desired periods. As mentioned in the methodology, utilizing the concept of reduction in growth rates of India by sex the population figures for India level were estimated for the years 2010, 2015 and 2020. Combining the knowledge of population and estimates of incidence rates for the given periods, the numbers of cancer cases are projected at India level.

Based on the NCRP data, it is estimated that for the year 2010, there will be about 936,908 new cancer cases in India which will be raised to 1,044,650 by the year 2020. Such an attempt is also made in the past by other authors in India (Murthy et al., 2008). The increase in cancer incidence is not only due to an increase in the population size but also due to a regular increase in life expectancy and sustained efforts of the Indian Government to control many communicable diseases. Estimation of projection of cancer cases for the entire country has been based on the pooled data of five urban registries and utilizing the latest incidence rates from North Eastern Registries. The present projections carried out have not made any adjustment for possible increase in prevalence of tobacco habits. In the absence of adequate data on cancer incidence from rural based registries, the adjustment for rural urban differences in the projection of cancer cases at country level could not be made for many sites. However, a limited adjustment was done in the projections of breast and cervix cancer cases at the country level utilizing the data from the Barshi Registry as there were adequate numbers available for both the sites.

Tobacco is the most important identified cause of cancer and is responsible for 30 to 50% of cancers in men and about 10-15% of cancers in women, in different registry areas (NCRP-2008). In India, Tobacco chewing is also prevalent and is more than smoking in many areas (Reddy and Gupta, 2004). Tobacco chewing has resulted in additional burden of Oral cancers and oral precancerous conditions. In India, among the males, the TRCs are expected to be 225,241 (42% of all sites cancers) by the year 2020. For the same period, the number of cases for females will be 93,563 (15% of all sites cancers). The rate of increase in the incidence of cancer of the lung among women is glaring calling for systematic evidence based and focused anti-tobacco campaigns targeting the urban woman. A large proportion of tobacco related cancers can be prevented by anti-tobacco programs. Teen age

students need to be targeted as most of them pick up habits at this time. Legislation has to be enforced for prohibiting tobacco advertisement and sale of tobacco to youngsters. Prevention of cancers through reduction of tobacco use should be an important strategy of National Cancer Control Programme of India.

Most of the cancers have some relationships with diet. Predominant among them are cancers of the oesophagus, stomach, colon and liver. Consumption of large amounts of red chillies, food at very high temperatures and alcohol consumption are the main risk factors for stomach cancer in India. Consumption of a tobacco extract "Tuibur" and smoked meat have been linked to the high rates of Stomach cancer in Mizoram. Primary prevention is the best strategy for prevention of stomach cancer (Varghese, 2002).

In India, by the year 2020, the cases of head & neck cancers are estimated to be around 218,421 (19.0% of All sites cancers). The main risk factors for these cancers are tobacco and alcohol. Avoidance of tobacco and alcohol is the most important preventive action against mouth, throat and lung cancers. Cancer of the oral cavity can be detected early and every opportunity should be exploited to detect pre cancerous conditions or cancers of the oral cavity through interacting closely with those who have the habit of tobacco (Varghese, 2002). Thyroid cancer has been shown to be an emerging cancer particularly in Chennai and Bangalore PBCR.

Over the years, inspite of decreasing trend in cervix cancer, Gynaecological cancers have increased in India and are estimated to be around 182,602 by the year 2020 constituting about 30% of the total cancers among women in India. Among these, cancer of the uterine cervix followed by ovary and corpus uteri are the major contributors. In the year 2010, around 68,903 cases of cervix cancer are estimated to occur which may decrease to 53,654 cases by the year 2020. Early age at first intercourse, multiple sexual partners, poor sexual hygiene, repeated child birth etc are some of the reproductive risk factors for cervical cancers. Improvement in the living standard of women has resulted in a reduction in the incidence of cervical cancer. Regular cervical cytology examination (pap smear) by all women who have initiated sexual activity can prevent the occurrence of cervical cancer. However, there are limitations for cytology based cervical cancer screening in India (Varghese, 2002).

Breast cancer has emerged as the leading sites of cancer among women in India. 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. A large number of factors are identified as risk factors for breast cancer. Late age at first pregnancy (greater than 30 years), single child, late age at menopause etc are some of them. A high fat diet is also identified as a risk factor. Physical activity is found to be protective for breast cancer. Regular breast self examination by women themselves is a very good way of detecting breast cancer in early stages. Detecting a cancer at an early stage can improve the cure rate from breast cancer.

A multidisciplinary approach to cancer treatment is essential and this has to be made available at all Regional Cancer Centres. The services of a trained

surgeon and a clinical Oncologist are needed to plan the most appropriate treatment. Efforts should be made to reduce the waiting time for cancer patients to get any cancer directed treatments. An essential drug list has to be prepared for cancer chemotherapy and chemotherapy services for common cancers have to be made available in all centres. More than 80% of cancers in India present in advanced stages and palliative care and pain relief are essential to provide good quality life for these patients.

In conclusion, cancer has already become an important public health problem and need important inputs from various health and other agencies.

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