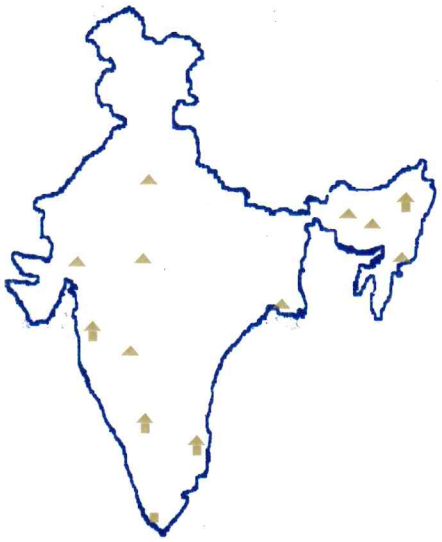
CANCER REGISTRY ABSTRACT



NEWSLETTER, VOLUME XII NATIONAL CANCER REGISTRY PROGRAMME OF INDIA

PUBLISHED BY
HOSPITAL BASED CANCER REGISTRY
REGIONAL CANCER CENTRE
THIRUVANANTHAPURAM
FOR THE
NATIONAL CANCER REGISTRY PROGRAMME
INDIAN COUNCIL OF MEDICAL RESEARCH

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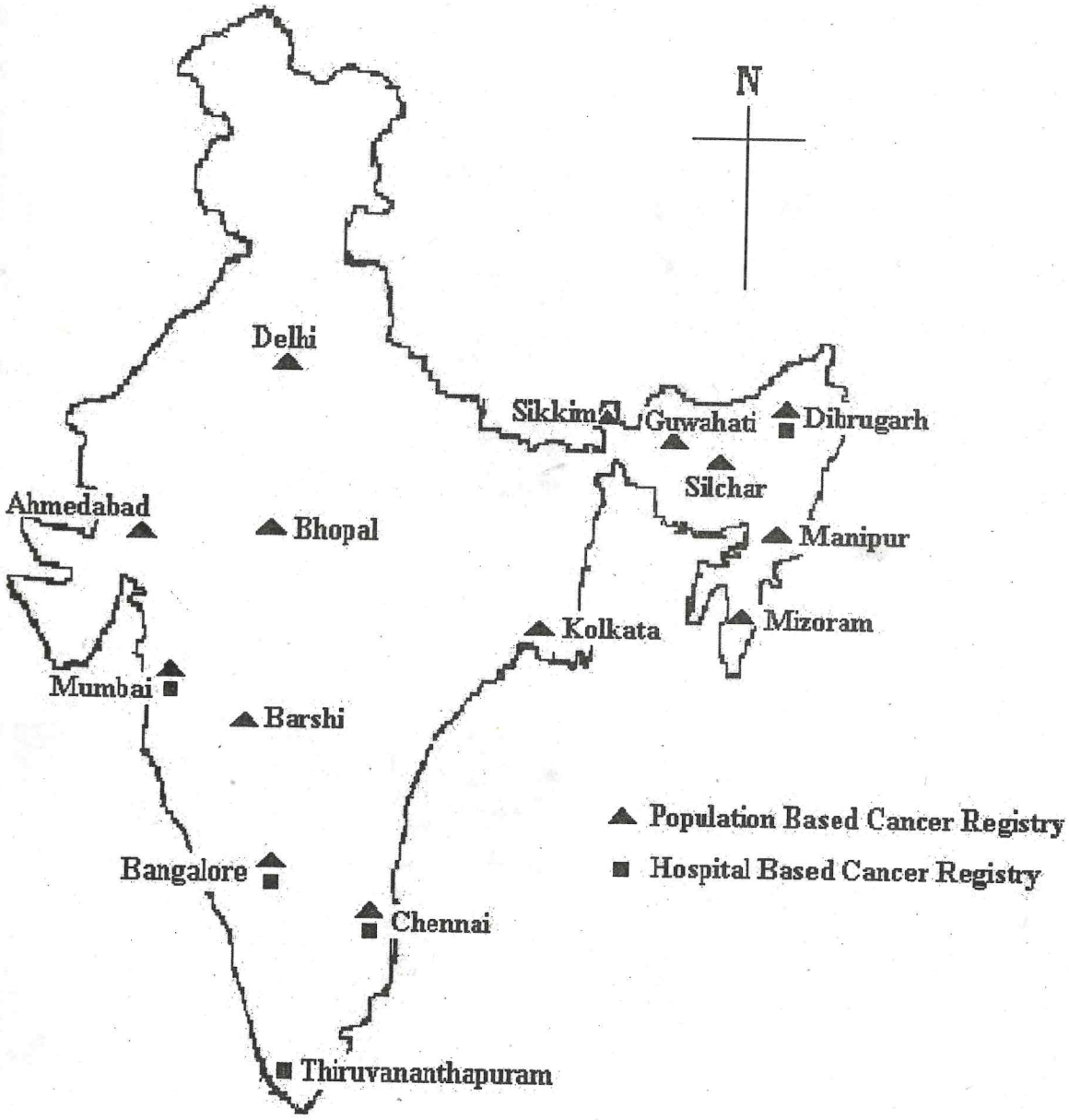
NEWS LETTER OF THE NATIONAL CANCER REGISTRY PROGRAMME

Indian Council of Medical Research, Volume XII, 2005

CONTENTS

CANCER REGISTRIES IN INDIA (2005)

(Under the National Cancer Registry Programme of India)



XX ANNUAL REVIEW MEETING OF NATIONAL CANCER REGISTRY PROGRAMME, I.C.M.R

CANCER REGISTRY TRAINING COURSE

PREFACE

This issue of "CRAB" consists of three sections. The first section comprises the findings utilizing the cancer registry/ cancer atlas data such as highlights of cancer pattern in India based on the cancer atlas project report, comparison of cancer pattern between the north eastern region and the already established population based cancer registries under the network of ICMR, epidemiology of female breast & reproductive cancers in India and cancer mortality data collection methods in Chennai and Bhopal cancer registries. The second section depicts some of the statistical methodologies such as design, conduct and analysis of case-control studies, statistical aspects relating to cancer survival analysis, effect of loss to follow-up and some solutions for estimating survival rates and time-trend analysis with emphasis on cancer. These methodological papers were presented at the NCRP pre-ARM workshop held at Gangtok, Sikkim during 3-4 December 2004. Section III deals with highlights from various cancer registries which are under the network of national cancer registry programme.

We thank all the contributors.

Dr. Aleyamma Mathew

Associate Professor of Epidemiology

Regional Cancer Centre, Thiruvananthapuram

EDITORIAL

Can cancer be made a notifiable disease?

Cancer has become a major health problem in India due to increase in life expectancy, control o communicable diseases and changing life styles. The national cancer control programme of India was started in 1975 with the objective of primary prevention of cancer by health education, secondary prevention o cancer by early detection and diagnosis, strengthening of existing cancer treatment facilities and palliative care in terminal stage cancers. An adequate and authentic information system is an essential pre requisite fo planning and evaluation of cancer control programmes. Cancer registries which provide pattern and burden of cancer in the population are the appropriate tools for such action plan in any meaningful contro programme. All developed countries utilize information obtained from such standardized registry operations.

Methodology of cancer registration

Reporting of cancer cases to a population based cancer registry (PBCR) which records all new cancer cases occurring in a defined population may be compulsory by legislation or by an administrative order issued by a statutory body such as the ministry of health or a provincial health authority. In many developed countries such as Finland, Sweden, Norway, Denmark, Germany, etc., the notification of cancer cases to a *central registry* is compulsory for all hospitals, as well as pathological, cytological and hematological laboratories Such legislation facilitates the collection of data for PBCRs. The hospitals in the areas with compulsory notification and the hospital cancer registries abstract information from the patient records on a specified proforma and send it to the central registry. Such a system of recording cancer cases in the registry is known as *passive registration.*

Cancer registration can be voluntary or an active process done at the source by trained investigators In some countries such as England and Wales (SW Region), Iceland etc., the registration of cancer cases is by a voluntary registration system. In the voluntary registration system, the co-operating centers report cancer cases to the central registry voluntarily. *Unless cancer is a legally reportable disease, the cancer registry is in effect operating on a voluntary reporting basis or through active registration process.*

Currently more than 200 PBCRs exist in various parts of the world. In several registries, the reporting of data to PBCR is through passive registration system.

As an illustration of compulsory reporting of cancer cases to the PBCR, the system followed in Finland is briefly described (*Pukkala E, et al. Cancer atlas of Northern Europe, Cancer Society of Finland Publication 62, Helsinki 2001, pp. 50-51*)

The national board of health in Finland issued a by-law for compulsory reporting of cancer cases in 1961. All physicians, all hospitals and other institutions in Finland must send a notification to the Finnish Cancer Registry for all cancer cases that come to their attention. Pathological, cytological and hematological laboratories send the respective laboratory notification. Finnish Cancer Registry receives an increasing number of notifications in machine-readable format. This automatic reporting contains the same information as the manual reporting forms inclusive of free texts, detailed descriptions of the tumor site and histology. In addition, the cancer registry receives annually, *a computerized file on death certificates in which all malignant diseases are mentioned.* The registry publishes excellent annual reports which are being extensively used for research, administration, and health education at all levels.

All individuals residing in Finland since 1967 have been assigned a unique 11 digit personal identifier (PID), which is widely used in a number of different every day activities including delivery of health care. The PID is mentioned on all cancer registry notifications and is stored in the registry data-base. It forms an important personal identification for various purposes such as coding, searching from the file, combining notifications etc., from different sources and in removing duplicate registrations.

The following have been declared as notifiable diseases in Finland.

- All malignant neoplasms such as carcinomas, sarcomas, lymphomas, leukaemias, multiple myeloma, gliomas, melanoma etc.
- Carciniod tumours, pheochromocytomas, thymomas, ameloblastomas and chordomas
- CIN III of the cervix, histologically benign tumours of the central nervous system and meninges, transitional cell papillomas of the urinary tract and ovarian tumors with borderline malignancy.

Cancer registration-system in our country (active registration process)

The cancer registration system in India is through an active method of data collection from hospital records as well as through interview of patients, supplemented by data from vital statistics division in the respective areas. Trained registry workers are employed for this who reach the health facilities in the area and search for cancer cases from the medical records and abstract the information required on a case abstract form. This process takes considerable time.

The data on occurrence of cancer in India is available from the PBCRs established in various parts of the country. A network of fourteen PBCRs (including the recently established eight PBCRs) is functioning under the NCRP of ICMR.These are located at Bangalore, Barshi, Bhopal, Chennai, Delhi and Mumbai, and the recently organized registries in Kolkata, Ahmedabad (rural) and six north eastern registries located at Dibrugarh, Guwahati, Manipur, Mizoram, Silchar and Sikkim. There are some other PBCRs outside the ICMR network. The PBCRs at Pune, Aurangabad and Nagpur are operating under the Indian Cancer Society, Mumbai. The Ahmedabad urban PBCR is under the Gujarat Cancer Research Institute, Ahmedabad. The Thiruvananthapuram (urban and rural) and Karunagappally (rural) registries are under the Regional Cancer Centre, Thiruvananthapuram, Kerala. The Dindigul Ambilikai cancer registry is functioning under the supervision of cancer registry, Chennai. Although the area and population covered by all the above registries are minimal, it gives some idea of the extent of cancer problem in our country. The accumulated data from these registries show interesting geographic differences in patterns of cancer in the country which can be optimally used for all control activities. However, extensive areas remain essentially uncovered and therefore the magnitude of cancer in several urban and rural regions in the country remains largely unknown.

In India, more than 70% of the population lives in rural areas. A realistic estimate of the national cancer burden is therefore possible only if cancer incidence in the vast uncovered rural and urban areas is documented. Hence, need exists, for setting up of more registries through out the country as existing in some western countries. In India, at present there are 205 cancer treatment center and 22 regional cancer centers. Amongst the above centers, wherever the cancer registries have not been set-up, effort should be made to initiate hospital based cancer registries. Such hospital based registries may serve as the nucleus for the later development of PBCRs.

Until 2003, the NCRP of ICMR comprised of only six PBCRs covering a total population of 3.5%. For a vast country like India, this was obviously inadequate. In order to increase the knowledge of the geographic patterns of cancer in the country, a project on "Development of cancer atlas in India" was initiated by the coordinating centre of NCRP with support from WHO. The objectives of the project were (i) to obtain an overview of cancer patterns in different parts of the country and (ii) to estimate cancer incidence wherever feasible. Modern electronic information technology was used to capture information from different centers on cancer cases as and when diagnosed. Hence this, in a way, represented a voluntary reporting system. Information on 217,174 microscopically diagnosed cancers for the period 2001-2002 was collected from pathology laboratories in the country. An analysis of this data has identified some hitherto unknown cancer patterns and identified possible areas for establishing PBCRs. (Nandakumar A, Gupta PC, Gangadharan P, Visweswara RN and Parkin DM: Geographic pathology revisited: Development of an atlas of cancer in India. Int. J. Cancer: 116, 740-754, 2005).

When we consider the cost involved, it may be difficult to establish more PBCRs in the country. Hence, it is strongly felt that at least those states where the health care facilities are available in majority of areas and health information system has attained a stable position (like Kerala, Maharashtra etc.) must consider declaring cancer as a notifiable disease by making a legislation as practiced in some developed countries of the world. This will provide a big boost for strengthening the cancer registration system which would help further supplementing evaluation of national cancer control programme.

Dr. Aleyamma Mathew
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Section I

Some findings utilizing the cancer registry / cancer atlas data

The NCRP Makes a Mark
Remarkable Progress Achieved By NCRP (2001 –2004)

Information given by P. Gangadharan, Monitoring Committee Member, NCRP

"IF IT IS GOOD IT CAN BE MADE BETTER" Dr. S. Radhakrishna

A) Expanded population coverage by registries

Eight more cancer registries covering populations with diverse socio-cultural and life style practices were newly included in the NCRP network making a total of 14 population based cancer registries in 2004. Six of these cover highly diverse population groups of north eastern states. The newly included registries cover a population of more than 12 million people. These registries include state-wide, district-wide, urban, rural and tribal populations. Till 2001, the registries under the NCRP covered a total of 35.5 million people. More registries are waiting to join the NCRP. All these and more are required for productive cancer control activities.

B) Geographic pathology revisited --- Atlas of cancer in India

The project on "Development of an atlas of cancer in India" was another land mark. In this, 105 collaborating centers were participated and 217,174 microscopically proved cancer cases were analysed. Many areas where the cancer incidence and pattern were unknown contributed to the map for the first time in India or for that matter in any developing country. Modern electronic information technology was used to capture and process the data. Microscopically proved average annual age adjusted incidence rates for the years 2001 and 2002 presented in the atlas report revealed significantly different patterns of cancer in various population groups and showed geographic patterns of cluster. - - ***'Diversity in Unity!'***

In spite of the limitations of the data, the International Journal of Cancer (April 2005) published an article based on the findings. An appreciation and a real encouragement to our efforts.

C) Cancer patient care evaluation – 1st time in the country

The third significant progress achieved was the introduction of a new study, 'Cancer patient care'. Studies on pattern of care and survival evaluation were initiated for breast, cervix, oral and pharyngeal cancers. These are ongoing with several centers participating and hopefully as the data accrue, it shall be possible to present and discuss how efficiently the cancer patients are looked after in our country. It would certainly be a revealing study and will bring to focus the lacunae and the needs to augment care services for better quality of life and improved end results of cancer patients - ***-A real medical audit***

D) Human Resource Development (HRD) Programmes

During the past 4 years there have been several HRD programmes for all facets of cancer registration activities. This has been an unusual achievement because of the more than standard attendance. Also, several medical officers have attended these programmes.

i) Atlas project workshops

There have been special workshops for 'Cancer Atlas' project. With support from WHO these were held in different parts of the country with focus on Epidemiology and Principles of Cancer Registration. The IARC chief of Epidemiology Dr. Max Parkin, Dr. N. K. Ganguly, DG-ICMR, Dr. Bela Shah, NCD Chief, ICMR and several others participated in the deliberations. There have been numerous queries from people expressing keen desire for organizing registries in their respective areas.

ii) Patient care evaluation workshops

There were 4 workshops held in connection with the innovative programme of Patient Care Evaluation. These workshops evoked excellent response. Diagnosis, treatment modalities, outcome evaluation and quality of life after treatment were discussed in detail. Defining the patient and disease characteristics as well as treatment and end result evaluation protocols for breast, cervix, head and neck cancers were actively debated and conclusions derived for the first time under registry organization.

iii) Tumour Registry Training

Apart from the regular pre-ARM workshop, Dr. John Young & Dr. Andrew Glass from N.C.I, USA, conducted an intensive training session extending to 5 days on 'Cancer case abstracting & coding'. These proved to be highly beneficial to the north east registries for which this workshop was held.

During the previous three years, several other training programmes on cancer registration and epidemiology have been held in various cancer institutes. One in Cancer institute, Chennai, another one in Regional Cancer Centre, Thiruvananthapuram, with WHO support and the third one was an International course on epidemiology conducted by IARC in Thiruvananthapuram with several foreign faculties.

AREA, POPULATION COVERED AND INVESTIGATORS OF NEW CANCER REGISTRIES IN INDIA UNDER THE NCRP

Information given by P Gangadharan

Area and Population of new cancer registries

Place	Base	Population	Area(Sq. km)	Coverage
Sikkim	STNM Hospital, Gangtok	54,085	7042	Statewide
Guwahati Kamrup District	Dr. B. Barwah Cancer Institute, Guwahati	900,518	4345	Kamrup urban district
Dibrugarh	Assam Medical College Hospital, Dibrugarh	117,256	3381	Dibrugarh rural - 81% urban - 19%
Manipur	Regional Institute of Medical Sciences, Imphal	22,93,896	22,327	State wide
Mizoram	Civil Hospital, Aizwal	891,058	21,087	Total Mizoram
Silchar	Medical College, Silchar	150,000	20	Silchar town
Ahmedabad	Gujarat Cancer Research Institute, Ahmedabad	1568,605	7677	Ahmedabad rural
Kolkata	Chittranjan National Cancer Institute, Kolkata & Cancer Centre Welfare Home & Research Institute, Thakurpukur, Kolkata	6430,000	300	Kolkata urban
Total Population covered by the above registries		**12,405,418**		

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GEOGRAPHIC PATHOLOGY REVISITED: DEVELOPMENT OF AN ATLAS OF CANCER IN INDIA

Atlas Project Paper Abstract:

Int. J. Cancer: **116**, 740 – 754 (2005), © 2005 Wiley – Lis, Inc.

Ambakumar Nandakumar[1], Prakash Chandra Gupta[2], Paleth Gangadharan[3], Rudrapatna Narayanrao Visweswara[4] and Donald Maxwel Parkin[5]

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[2] *Tata Institute of Fundamental Research, Mumbai, India.*

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[5] *Descriptive Epidemiology Group, International Agency for Research on Cancer, Lyon, France.*

Information on 217,174 microscopically diagnosed cancers diagnosed in 2001–2002 was collected from pathology laboratories in 68 districts across India. Data collection took place primarily via the internet. Average annual minimum age–adjusted incidence rates for microscopically diagnosed cases (MAAR) by gender and site were calculated for each of the 593 districts in the country. The rates were compared to those from established population based cancer registries (PBCR). In 82 districts, the MAAR for 'all cancer sites' was above a "completeness" threshold of 36.2/100,000 (based on results of a rural PBCR). The results confirmed some known features of the geography of cancer in India, and brought to light new ones. Cancers of the mouth and tongue are particularly frequent in both genders in the southern states. Very high rates of nasopharynx cancer were found in the northeastern states (Nagaland, Manipur). There was clear geographic correlation between the rates of cervical and penile cancer, and a high rate of stomach and lung cancer (in both genders) in many districts of Mizoram State. The area of high risk for gallbladder cancer seems larger than suspected previously, involving a wide band of northern India. There is a belt of high incidence of thyroid cancer in females in southwest coastal districts. Other than identifying possible existence of high – risk areas of specific cancers, our study has recognized places where PBCR could be established. The study was remarkably cost–effective and the electronic data – capture methodology provides a model for health informatics in the setting of a developing country.

COMPARISON OF INCIDENCE RATES OF LEADING CANCERS IN THE NORTH EAST REGIONS WITH THAT OF POPULATION BASED CANCER REGISTRIES UNDER THE NETWORK OF NCRP (ICMR)

Ruma Bhattacharjee[1] and Aleyamma Mathew[2]
[1]Population Based Cancer Registry, Guwahati and [2]Hospital Based Cancer Registry, Thiruvananthapuram

Introduction

World wide approximately 10 million people are diagnosed with cancer annually and more than 6 million die of th disease every year. Currently, at any point of time, over 22 million people in the world are reported to be sufferin from cancer. Without any exception, all communities are burdened with cancer, but marked regional difference have been noticed. The total cancer burden is highest in affluent societies, mainly due to a high incidence tumours associated with smoking and western life style, including tumours of the lung, colo-rectum, breast an prostate. Differences in the regional distribution of cancer and its outcome, as documented by a worldwide network population based cancer registries (PBCR), help to identify causative factors and those influencing survival.

The study on "Development of an atlas of cancer in India" was initiated with the overall aims (i) to obtain a overview of patterns of cancer in different parts of the country and (ii) to estimate the cancer incidence whereve possible. The first All India atlas report covering the calendar years 2001 and 2002 was published recently [1]. F the first time, in the north east, eight states viz. Mizoram, Manipur, Nagaland, Sikkim, Assam, Meghalaya, Tripu and Arunachal Pradesh collaborated with the above project to assess the burden of cancer in the region.

The present communication attempts to compare the similarities and differences in patterns of canc incidence in the north east regions of the country as obtained from the cancer atlas report, with that of the canc registry data published in the latest report of the PBCRs under the NCRP [2].

Methodology

The PBCR data for the years 1999 and 2000 and the cancer atlas data for the years 2001 and 2002 published by t NCRP formed the basic material of the present analysis. Currently, there are fourteen PBCR's under the network NCRP. However, for the present analysis, only data relating to PBCR's operating at Bangalore, Barshi, Bhop Chennai, Delhi and Mumbai were included as the other registry data are yet to be published [2]. Age-adjust

incidence rates (AAR) of ten leading cancer sites of the above 6 registries were noted from the PBCR report. The average annual minimum age-adjusted incidence rates (MAAR) of the north east (NE) regions such as Aizwal, Imphal, Dibrugargh and Kamrup as documented in the atlas report were obtained [1]. (MAAR of leading cancer sites were available only in the above 4 north east regions). Further, the highest AAR of leading cancer sites and the corresponding registries among the 6 PBCRs and the highest MAAR and the corresponding NE regions were noted.

Results

Leading cancer sites among males

The AAR of top ten leading cancer sites in the various PBCRs for males is given in Table 1. The leading cancer sites (range of AAR's per 100,000 males) were lung (2.21-14.04), stomach (2.48- 13.53), tongue (3.50-10.69), esophagus (3.69-10.23), prostate (5.04-8.92), mouth (2.29-8.35), larynx (4.38-8.32), hypopharynx (4.75-7.38), urinary bladder (5.80), NHL (1.82-5.34), brain (2.60-5.00), gall bladder (3.90), liver (3.86), rectum (2.51), penis (2.26) and other skin (excludes melanoma) (2.22).

When the above leading sites are arranged according to the magnitude of highest AAR, the top 10 leading sites are lung, stomach, tongue, esophagus, prostate, mouth, larynx, hypopharynx, urinary bladder and NHL (Table 2). The highest AAR of cancer sites such as lung (14.0 per 100,000 males), tongue (10.7 per 100,000 males), mouth (8.4 per 100,000 males) and hypopharynx (7.4 per 100,000 males) were reported in Bhopal. The highest AAR of cancer sites such as stomach (13.5 per 100,000 males) and esophagus (10.2 per 100,000 males) were reported in Chennai. Prostate cancer incidence rate (8.9 per 100,000 males) is highest in Mumbai. Cancers of the larynx (8.3 per 100,000 males), urinary bladder (5.8 per 100,000 males) and NHL (5.3 per 100,000 males) have the highest AAR in Delhi.

The MAAR of top ten leading cancer sites for males in the NE regions is given in Table 3. The leading cancer sites (range of MAARs per 100,000 males) in the 4 NE regions were stomach (1.4-41.4), esophagus (2.7-22.1), lung (1.6-17.5), hypopharynx (9.1-12.3), NHL (2.3-10.8), tongue (2.3-7.6), nasopharynx (6.3-6.5), mouth (3.6-6.2), larynx (2.4-4.8) rectum (1.0-1.4), tonsil (2.2-4.2), liver (4.8), colon (2.6), myeloid leukemia (1.9) and unspecified pharynx (1.8).

When the above leading sites are arranged according to the magnitude of highest MAARs, the top 10 leading sites are stomach, esophagus, lung, hypopharynx, NHL, tongue, nasopharynx, mouth, larynx and liver (Table 4). The highest MAAR of cancer sites such as stomach (41.4 per 100,000 males), esophagus (22.1 per 100,000 males), NHL (10.8 per 100,000 males), tongue (7.6 per 100,000 males) and liver (4.8 per 100,000 males) were reported in the Aizwal region. The highest MAAR of cancer sites such as lung (17.5 per

100,000 males), nasopharynx (6.5 per 100,000 males) and larynx (4.8 per 100,000 males) were reported in Impha (west). The highest incidence of hypopharyngeal cancer is reported in Dibrugargh (12.4 per 100,000 males) and tha of mouth cancer (6.2 per 100,000 males) in Guwahati, Kamrup.

Leading cancer sites among females

The AAR of the top ten leading cancer sites of PBCRs for females is given in Table 5. The leading cancer site (range of AAR per 100,000 females) in the various PBCRs were cervix uteri (17.43-32.32), breast (6.77-31.54), ga bladder (3.18-9.06), ovary (1.44-8.80), mouth (1.45-7.70), esophagus (3.22-7.61), stomach (1.21-5.88), corpus ute (2.86-4.03), lung (1.31-3.84), brain (2.28-3.59), NHL (2.20-3.50), thyroid (2.12-3.39), myeloid leukemia (1.93-2.22 rectum (1.77), other skin (excludes melanoma) (1.56) and tongue (1.21).

When above leading sites are arranged according to the magnitude of highest AAR, the top 10 leading site are cervix uteri, breast, gall bladder, ovary, mouth, esophagus, stomach, corpus uteri, lung and brain (Table 2). Th highest AAR of the uterine cervix cancer (32.3 per 100,000 females) is reported in Chennai and that of breast cance (31.5 per 100,000 females) is reported in Mumbai and Delhi. The highest AAR of gallbladder (9.1 per 100,00 females) and ovarian cancer (8.8 per 100,000 females) are reported in Delhi. Similar to the incidence of mout cancer in males, it is highest among females in Bhopal also. The highest incidence of esophageal (7.6 per 100,00 females) and corpus uteri cancers (4.0 per 100,000 females) are observed in Bangalore. Similar to the high incidenc of stomach cancer among males, it is highest among females in Chennai also (5.9 per 100,000 females). Mumb registry has reported the highest incidence of cancers of the lung (3.8 per 100,000 females) and brain (3.6 p 100,000 females).

The MAAR of the top ten leading cancer sites for females in the NE regions is given in Table 6. The leadir cancer sites (range of MAAR per 100,000 females) in the various NE regions were cervix uteri (5.9-27.7), breast (1. 26.6), ovary (0.9-7.9), tongue (1.5-1.6), hypopharynx (1.6), stomach (0.7-21.4), esophagus (4.4-6.1), rectum (3.3 liver (0.7-6.2), gall bladder (1.2-5.0), lung (13.7-20.6), colon (3.0-5.8), nasopharynx (3.8-4.4), NHL (2.2) and thyro (4.1).

When the above leading sites are arranged according to the magnitude of highest MAAR (per 100,00 females), the top 10 leading sites are cervix uteri (27.7), breast (26.6), stomach (21.4), lung (20.6), ovary (7.9), liv (6.2), esophagus (6.1), thyroid (6.1), colon (5.8) and gall bladder (5.7) (Table 4). The highest MAAR of all the abo sites except for thyroid and gall bladder were reported in Aizwal and that of thyroid and gall bladder cancers we reported in Imphal (west).

Discussion

A strict comparison of the PBCR data with that of cancer atlas has to be carried-out with a great caution. The north east regions present incidence rates which are only minimum incidence rates. However, all the 6 PBCRs, present a true age-adjusted incidence rates. These registries were established much earlier and have a long standing. The data from cancer atlas relates to two year period only. The present analysis reveals that the amount of intra-variation is quite high among the 4 NE regions particularly for sites such as stomach (1.4-41.4), esophagus (2.7-22.1), lung (1.6-17.5) and NHL (2.3-10.8) among males.

It is observed that there are marked differences in the cancer pattern reported in the PBCRs with that of NE regions. Among males, the MAAR of the sites such as stomach, esophagus, lung, hypopharynx, NHL, nasopharynx and liver were higher in the NE region as compared to the AAR in the various PBCRs. Among the north east regions, Aizwal has shown the highest incidence rate of most of the leading cancer sites in males. The MAAR of stomach (41.4 per 100,000 males) and esophageal (22.1 per 100,000 males) cancers were observed to be quite high in Aizwal compared to the highest AAR of 13.5 and 10.2 for stomach and esophageal cancers respectively as observed in PBCR Chennai. The actual rates in NE regions may be much higher than that presented here as these rates refer to minimum incidence rates. Another observation is that nasopharyngeal cancer has been shown to be one of the ten leading cancer sites in some of the NE regions. However, this is not emerging as a leading site in any of the PBCRs under the NCRP.

Prostate cancer is one of the leading site (highest AAR: 8.9 in Mumbai) in the PBCRs where as this is not a common cancer in the NE regions. Cancers of the mouth and tongue are particularly frequent in the PBCRs. Also laryngeal cancer incidence among males is slightly higher in the various PBCRs compared to the rate seen in the NE regions.

Among females also, the MAAR was noted to be higher in NE region as compared to the PBCRs for the cancer sites such as stomach, lung, liver, thyroid and colon. The amount of intra-variation in incidence is quite high in the NE regions for the sites such as female breast (1.2-26.6), cervix uteri (5.9-27.7) and ovary (0.9-7.9). Further, lung cancer incidence among females was higher than that of males in some of the NE regions. Aizwal region has shown the highest rate of all leading cancer sites except for thyroid and gall bladder among females. Similar to the high incidence of stomach cancer among males in Aizwal, it is high among females also in this region.

Conclusion

"Development of an atlas of cancer in India" is a successful effort towards gathering disease related information. Even though, the Atlas data is limited to the hospital / pathological laboratory sources, yet the result has brought

a whole set of new findings especially for the north east regions which hitherto was unknown. Marke differences in the cancer pattern have been noted between the PBCRs and the north east regions. Th possible reason for observing such differences in cancer pattern could be due to the changes in th environmental and life-style factors. Further studies are needed to understand the reasons for suc differences. The account of recently established PBCRs from the north east regions will help us gain mor reliable information.

Source

1. Development of an Atlas of cancer in India. A project of the National Cancer Registry Programm (ICMR) supported by the World Health Organisation. First All India Report – 2001-2002. Mappin patterns of cancer, 2004.
2. Two-year report of the Population Based Cancer Registries 1999-2000 Incidence and Distribution cancer, National Cancer Registry Programme ICMR, New Delhi, 2005.

Table 1. Age-adjusted incidence rates (AAR) (per 100, 000 males) of leading cancer sites in the PBCRs under the NCRP (1999-2000)

Bangalore		Barshi		Bhopal		Chennai		Delhi		Mumbai	
Leading Sites	AAR	Leading Sites	AAR	Leading Sites	AAR	Leading Sites	AAR	Leading Sites	AAR	Leading Sites	AAR
Stomach	9.54	Hypopharynx	5.22	Lung	14.04	Stomach	13.53	Lung	12.24	Lung	11.71
Oesophagus	8.99	Oesophagus	3.69	Tongue	10.69	Lung	11.29	Larynx	8.32	Oesophagus	7.45
Lung	8.05	Liver	2.84	Oesophagus	9.96	Oesophagus	10.23	Prostate	7.83	Mouth	6.15
Prostate	6.58	Stomach	2.48	Mouth	8.35	Mouth	5.97	NHL	5.34	Larynx	7.39
Hypopharynx	4.75	Rectum	2.51	Hypopharynx	7.38	Hypopharynx	5.85	Tongue	5.87	Prostate	8.92
Larynx	4.38	Mouth	2.29	Prostate	8.20	Tongue	5.59	Oesophagus	6.04	NHL	5.20
NHL	3.56	Lung	2.21	Larynx	6.03	NHL	4.99	Brain, NS	4.06	Tongue	4.07
Brain, NS	2.98	Penis	2.26	NHL	4.62	Larynx	5.17	Bladder	5.80	Brain, NS	5.00
Liver	3.86	Other Skin	2.22	Brain, NS	2.60	Prostate	5.04	Mouth	3.89	Stomach	5.24
Tongue	3.50	NHL	1.82	Rectum	3.41	Brain, NS	3.49	Gallbladder	3.90	Hypopharynx	
All Sites	**97.77**	**All Sites**	**45.02**	**All Sites**	**119.83**	**All Sites**	**118.67**	**All Sites**	**111.75**	**All Sites**	**116.47**

Table 2. Highest age-adjusted incidence rates (AAR) (per 100, 000 persons) **of leading cancer sites and the espective registries under the NCRP** for both sexes (1999-2000)

Male			Female		
Registry	**Site**	**AAR**	**Registry**	**Site**	**AAR**
Bhopal	Lung	14.0	Chennai	Cervix	32.3
Chennai	Stomach	13.5	Mumbai & Delhi	Breast	31.5
Bhopal	Tongue	10.7	Delhi	Gall Bladder	9.1
Chennai	Oesophagus	10.2	Delhi	Ovary	8.8
Mumbai	Prostate	8.9	Bhopal	Mouth	7.7
Bhopal	Mouth	8.4	Bangalore	Oesophagus	7.6
Delhi	Larynx	8.3	Chennai	Stomach	5.9
Bhopal	Hypopharynx	7.4	Bangalore	Corpus Uteri	4.0
Delhi	Bladder	5.8	Mumbai	Lung	3.8
Delhi	NHL	5.3	Mumbai	Brain (NS)	3.6

Table 3. Average annual minimum age-adjusted incidence rates (MAAR) (per 100,000 males) of leading cancer sites in the north east regions (2001-2002)

Aizwal, Mizoram		Imphal, Manipur		Kamrup. Assam		Dibrugarh, Assam	
Leading Sites	MAAR	Leading Sites	MAAR	Leading Sites	MAAR	Leading Sites	MAAR
Stomach	41.4	Lung	17.5	Oesohpagus	10.3	Hypopharynx	12.3
Oesophagus	22.1	Stomach	7.3	Hypopharynx	9.1	Oesophagus	9.2
Lung	15.4	Nasopharynx	6.5	Mouth	6.2	Mouth	4.8
Hypopharynx	11.5	Larynx	4.8	Lung	3.5	Tongue	3.6
NHL	10.8	Mouth	3.6	Tongue	2.6	Tonsil	3.6
Tongue	7.6	NHL	2.3	Oropharynx	2.4	Larynx	2.4
Nasopharynx	6.3	Oesophagus	2.7	Larynx	2.5	Stomach	1.4
Mouth	5.4	Myel. Leukemia	1.9	Tonsil	2.2	Lung	1.6
Tonsil	4.2	Colon	2.6	Stomach	2.1	Rectum	1.4
Liver	4.8	Tongue	2.3	Rectum	1.0	Pharynx unsp.	1.8

Table 4. Highest minimum age-adjusted incidence rates (MAAR) (per 100,000 persons) of ten leading cancer sites and the respective north east regions for both sexes (2001-2002)

Male			Female		
Region	**Site**	**MAAR**	**Region**	**Site**	**MAAR**
Aizwal	Stomach	41.4	Aizwal	Cervix Uteri	27.7
Aizwal	Oesophagus	22.1	Aizwal	Breast	26.6
Imphal (west)	Lung	17.5	Aizwal	Stomach	21.4
Dibrugarh	Hypopharynx	12.4	Aizwal	Lung	20.6
Aizwal	NHL	10.8	Aizwal	Ovary	7.9
Aizwal	Tongue	7.6	Aizwal	Liver	6.2
Imphal (west)	Nasopharynx	6.5	Aizwal	Oesophagus	6.1
Kamrup, Guwahati	Mouth	6.2	Imphal (west)	Thyroid	6.1
Imphal (west)	Larynx	4.8	Aizwal	Colon	5.8
Aizwal	Liver	4.8	Imphal (west)	Gall Bladder	5.7

Table 5. Age-adjusted incidence rates (AAR) (per 100, 000 females) of leading cancer sites in the PBCRs under the NCRP (1999-2000)

Bangalore		Barshi		Bhopal		Chennai		Delhi		Mumbai	
Leading Sites	AAR	Leading Sites	AAR	Leading Sites	AAR	Leading Sites	AAR	Leading Sites	AAR	Leading Sites	AAR
Breast	26.80	Cervix uteri	23.41	Breast	25.54	Cervix uteri	32.32	Breast	31.52	Breast	31.54
Cervix uteri	23.26	Breast	6.77	Corpus uteri	24.40	Breast	27.98	Cervix uteri	20.45	Cervix uteri	17.43
Oesophagus	7.61	Oesophagus	3.22	Mouth	7.70	Ovary	6.44	Ovary	8.80	Ovary	7.94
Ovary	5.99	Rectum	1.77	Ovary	4.96	Oesophagus	6.30	Gallbladder	9.06	Oesophagus	5.77
Mouth	6.20	Mouth	1.45	Gallbladder	5.64	Stomach	5.88	Oesophagus	3.97	Mouth	4.57
Stomach	5.52	Ovary	1.44	Oesophagus	4.24	Mouth	5.86	Thyroid	3.39	Brain, NS	3.59
Corpus uteri	4.03	Other skin	1.56	NHL	2.20	NHL	2.40	NHL	2.89	NHL	3.50
Thyroid	3.00	Tongue	1.21	Corpus uteri	2.86	Thyroid	2.12	Brain, NS	2.46	Lung	3.84
Brain, NS	2.40	Lung	1.31	Myel. Leuk.	1.93	Lung	2.54	Myel. Leuk	2.22	Corpus uteri	3.38
NHL	2.74	Stomach	1.21	Lung	2.72	Brain, NS	2.28	Lung	3.22	Gallbladder	3.18
All Sites	**122.69**	**All Sites**	**54.21**	**All Sites**	**109.55**	**All Sites**	**126.72**	**All Sites**	**126.41**	**All Sites**	**125.33**

Table 6. Average annual minimum age-adjusted incidence rates (MAAR) (per 100,000 females) of leading cancer sites in the north east regions (2001-2002)

Aizwal, Mizoram		Imphal, Manipur		Kamrup. Assam		Dibrugarh, Assam	
Leading Sites	MAAR	Leading Sites	MAAR	Leading Sites	MAAR	Leading Sites	MAAR
Cervix uteri	27.7	Breast	15.9	Breast	6.9	Cervix uteri	5.9
Breast	26.6	Lung	13.7	Cervix uteri	6.3	Oesophagus	4.4
Stomach	21.4	Cervix uteri	11.3	Oesophagus	5.6	Breast	1.2
Lung	20.6	Stomach	6.6	Mouth	2.9	Mouth	1.5
Ovary	7.9	Thyroid	4.1	Ovary	1.2	Ovary	0.9
Oesophagus	6.1	Ovary	4.3	Tongue	1.6	Tongue	1.5
Liver	6.2	Gallbladder	5.0	Hypopharynx	1.6	Brain, NS	0.4
Colon	5.8	Nasopharynx	3.8	Gallbladder	1.2	Tonsil	0.8
Nasopharynx	4.4	Colon	3.0	Liver	0.7	Oth.Oropharynx	0.6
Rectum	3.3	NHL	2.2	Stomach	0.7	Salivary gland	0.5

Epidemiology of female breast and reproductive tract cancers in India

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Cancers of the female breast and reproductive tract has a high incidence amongst Indian women. Arou 50- 60% of all cancers among women in India pertains to mainly four organs --- breast, cervix ute corpus uteri and ovary. These cancers exercise an adverse influence on the productive role of women the society. The potential years of life lost due to breast and reproductive tract cancers among femal have been estimated to be 4736 years per million populations per year [1]. The present communication an attempt to report the magnitude of the female breast and reproductive tract cancers in variou registries in India and the established risk factors associated with these diseases.

Materials and methods

Incidence rates [age-specific, crude, age-adjusted, truncated (35-64 years) and cumulative incidenc rates] as well as life time risk for breast and reproductive tract cancers for the registries such a Bangalore, Barshi, Bhopal, Chennai, Delhi and Mumbai were obtained from the report of the populatio based cancer registries for the year 1999-2000 published by the National Cancer Registry Programme Indian Council of Medical Research. Incidence data for the registries such as Kolkata (1997-2001 Ahmedabad (1998), Thiruvananthapuram (Trivandrum) (2000), Karunagappally (1993-2000), Nagpu (1995-1999) and Pune (1996-2000) were collected from the individual registry reports. All the abov twelve registries are based on urban populations except Barshi and Karunagappally which are rura

Results

The age-standardized incidence rates (AAR) of breast and reproductive tract cancers together ranged between 46 and 72 per 100,000 women in urban registries and between 34 and 36 in rural registries. The highest AAR of these sites together is observed in Chennai. The truncated (35-64 years) age-adjusted incidence rates ranged between 114 and 168 in urban registries and between 70 and 81 in rural registries per 100,000 women (Table 1) [2-8].

Cancer of the Breast

Breast cancer is the first leading cancer among women in all the Indian registries except in Chennai and Barshi. It is listed as the second leading site among women in Chennai and Barshi. This disease accounts for 22 - 28% of all cancers in women in the various urban registries and 12 - 20% in rural registries in India. The AAR of breast cancer ranged between 25 and 32 in urban registries and between 7 and 16 in rural registries per 100,000 women. The highest AAR is observed in Mumbai and Delhi and

the lowest in Barshi. The cumulative incidence of breast cancer up to the age of 74 years is ranged between 2.65– 3.71% in urban registries and 0.81-1.70% in rural registries. In India, approximately 1 out of 27 to 38 women are at a chance to develop breast cancer during their lifetime. Age-specific incidence rates of breast cancer begin to rise in late twenties with a peak age-specific incidence rate at 65-69 years in majority of the registries (Table 2)[2-8].

Established hormone-related risk factors for breast cancer include early age at menarche, late age at menopause, nulliparity, and late age at first full-term pregnancy. The number of full-term pregnancies may be protective for women after the age of 50 years. Breast feeding and oophorectomy before menopause appear to be protective. Obesity in postmenopausal women elevates breast cancer risk, possibly due to peripheral conversion of androstenedione to estrogen in adipose tissue [9]. Convincing epidemiologic evidence exists that physical activity reduces breast cancer risk. The association may differ by menopausal status, because stronger evidence for a risk reduction exists for postmenopausal than for premenopausal women [10].

A family history of breast cancer predisposes members of affected families. Individuals with a history of premenopausal bilateral breast cancer in first-degree relatives have the highest risk. The susceptibility is inherited in an autosomal dominant fashion with high penetrance and is manifested in both females and males [11]. A gene mapped to chromosome 17q21 (*BRCA1*) has been associated with early-onset familial breast cancer with a penetrance of 85% through age 70 [12]. Current evidence suggests that BRCA-related breast cancer risk is positively associated with increased age at first childbirth and nulliparity. The incidence of BRCA1-related breast cancer is high before the age of 35 years and oral contraceptive use for 5 or more years is associated with increased risk of this disease among women carrying BRCA1 mutations [13].

Cancer of the Cervix uteri

Cervix cancer is the second leading cancer among women in all the Indian registries except for Chennai and Barshi where it is the first leading cancer. It accounts for 9-25% of all cancer cases among women in various registries in India. In the Barshi rural registry, cervix cancer accounts more than 43% of all female cancers. The age standardized incidence rates of cervix cancer ranged between 8 and 32 per 100,000 women. The highest incidence rate is observed in Chennai and the lowest rate in Trivandrum. The cumulative incidence rate of cervix cancer up to the age of 74 years is 1-4%. In India approximately 1 out of 27 to 104 women are at a chance to develop cervix cancer during their lifetime. Incidence of cervix cancer begin to rise in late twenties. The peak age specific incidence rate is at 65-74 years in most of the registries (Table 3) [2-8].

Basic and epidemiologic research conducted during the past 15-20 years have provided overwhelming evidence for an etiologic role for infection with certain types of sexually-transmitted human papillomavirus (HPV) types 16 and 18 as the primary cause of cervical cancer. The relative risks of cervical

cancer following HPV infection as ascertained in case-control and cohort studies are among the highest in cancer epidemiology. The available evidence indicates that virtually all cervical carcinoma specimens contain HPV DNA, which suggests that HPV infection is a necessary cause of cervical neoplasia. This is the first instance in which a necessary cause has been demonstrated in cancer epidemiology [14].

The risk is higher for women with multiple sexual partners; it has been reported to be three times higher for women who have had 10 or more partners than for women who have had one or no partners. Early age at first sexual intercourse increases the risk, perhaps because of increased susceptibility of the cervical epithelium to carcinogen exposure. Several studies have demonstrated that women who begin sexual intercourse before age 16 have about twice the risk as those who begin after age 20. Multiparity has been related to cervical cancer risk, possibly because of cervical trauma during delivery and hormonal and nutritional changes during pregnancy [15].

Cancer of the Ovary

Ovarian cancer accounts for 3 - 8% of all cancers among women in various registries in India. It is the third/ fourth most common cancer among women in all the registries except in Barshi where it is the sixth most common cancer among women. The age standardized incidence rates of ovarian cancer ranged between 5 and 9 in urban registries and 1.4 and 4.0 in rural registries per 100,000 women. The highest incidence rate is observed in Delhi and the lowest rate is in Barshi. The cumulative incidence rate of ovarian cancer up to the age of 74 years is 0.27- 0.94%. In India approximately 1 out of 106 to 179 women in urban registries and 1 out of 222 to 370 women in rural registries are at a chance to develop ovarian cancer during their lifetime (Table 4) [2-8].

Familial clustering of ovarian cancer poses an increased risk on the basis of genetic susceptibility. Three different entities—site-specific ovarian cancer, breast-ovarian cancer, and Lynch syndrome II (hereditary nonpolyposis colon cancer with proximal colonic predominance, endometrial cancer, and ovarian cancer)—are jointly referred to as hereditary ovarian cancer syndrome. The probability of a woman in an affected family developing ovarian cancer is about 50%. Two to four generations of a family are usually affected. In such families, the disease develops at an earlier age than sporadic cases do [16].

Hereditary ovarian cancers account for less than 1% of all cases. Genetic studies located a gene on chromosome 17q21 (*BRCA1*) that predisposes to familial breast-ovarian cancer. However, the lifetime risk of a 35-year-old woman developing ovarian cancer ranges from 1.6% if she has no affected relative members through 5% if she has one affected first-degree relative to 7% if she has two affected relatives [12].

Cancer of the Endometrium

Endometrial cancer accounts for 0.5 – 4.8 % of all cancer cases among women in various registries in India. It is the fifth leading cancer in Trivandrum. The rank is seven or higher in all other registries in India. The age standardized incidence rates ranged between 0.2–4.8 per 100,000 women. The highest incidence rate is observed in Trivandrum and the lowest rate in Barshi. Endometrial cancer begins to rise in the early twenties (Table 5) [2-8].

Established risk factors include use of unopposed estrogen replacement therapy, nulliparity, early age at menarche, and late menopause. Breast cancer patients are at increased risk of developing endometrial carcinoma, among other cancers, probably because of a shared hormonal effect. Polycystic ovarian disease and estrogen-secreting ovarian tumors are also associated with an increased risk. Obesity, diabetes and hypertension increase the risk of endometrial cancer while, low-fat diets and physical exercise appear to decrease the risk; all of these possibly exert their effects by various indirect influences on estrogen levels, thus influencing the level of stimulation of the target endometrial epithelium [17].

Other reproductive tract cancers

Other reproductive tract cancers include mainly those of the vulva, vagina, uterus, placenta, and fallopian tube. These cancers together account for 1–3 % of all cancer cases among women in various registries in India. The age standardized incidence rates range between 0.8–4.0 per 100,000 women. The highest incidence rate of the above cancers together is observed in Mumbai and the lowest rate in Trivandrum (Table 5) [2-8].

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Table 1. Incidence rates (per 100,000 women) of Female Breast and Reproductive Tract Cancers in India

Incidence rate	Bang-alore	Barshi	Bhopal	Chenn ai	Delhi	Mumbai	Nagpur	Pune	Kolkata	Ahme-dabad	Triva-ndrum	Kar gap
Total female cancers												
Crude rate	77.52	45.79	62.80	102.99	81.61	82.98	82.8	78.3	94.9	66.1	94.4	7
Age-adjusted rate	122.69	54.21	109.55	126.72	126.41	125.33	107.8	112.2	115.1	96.0	91.4	8
Truncated (35-64) rate	243.44	101.35	238.57	269.88	262.29	228.33	228.9	220.7	233.6	203.6	194.0	15
Breast & reproductive cancers												
Crude rate	39.51	28.3	34.41	58.13	42.63	45.14	44.4	41.3	46.9	32.9	47.4	3
Age-adjusted rate	62.41	33.5	60.11	71.69	65.95	64.33	57.5	58.4	55.5	48.4	45.7	3
Truncated (35-64) rate	139.82	69.44	144.95	167.7	152.7	132.75	136.6	129.1	130.5	114.0	114.9	8
Percentage	51.0	61.8	54.8	56.7	52.4	51.3	53.8	52.6	49.4	49.8	49.8	4

Table 2. Incidence rates (per 100,000 women) of Female Breast Cancer in India

Age Group	Bangalore	Barshi	Bhopal	Chennai	Delhi	Mumbai	Nagpur	Pune	Kolkata	Ahmedabad	Trivandrum	Karunagappally
0-4	--	--	--	--	--	--	0.2	0.1	--	--	--	--
5-9	--	--	--	--	--	--	--	0.1	--	--	--	--
10-14	--	--	--	--	--	--	0.2	0.4	--	--	--	0.5
15-19	--	3.0	--	0.2	--	--	0.6	0.5	1.0	0.5	--	--
20-24	0.5	--	1.3	0.6	2.1	0.7	2.2	0.5	0.7	0.5	--	1.4
25-29	2.5	2.4	4.4	5.0	4.9	4.4	6.0	3.5	5.3	3.2	3.8	2.8
30-34	9.4	--	15.0	14.0	13.8	10.9	17.0	11.0	14.3	10.2	12.2	8.1
35-39	20.6	3.3	26.0	26.7	27.8	23.5	28.8	17.5	33.6	26.1	12.5	32.6
40-44	46.3	3.8	37.7	50.5	62.4	46.2	58.6	42.3	51.0	53.4	51.2	49.5
45-49	75.8	21.4	66.6	72.6	73.9	72.0	72.2	61.2	65.7	62.8	67.3	37.7
50-54	83.5	14.8	87.5	79.1	102.6	88.7	72.9	95.9	82.9	101.6	61.3	38.8
55-59	104.6	26.2	104.8	87.8	84.5	92.8	53.0	70.2	71.8	93.3	101.5	47.0
60-64	73.4	17.5	84.0	93.2	112.7	94.3	86.3	83.9	81.7	81.3	140.1	36.8
65-69	114.1	47.1	63.4	89.0	120.2	158.6	78.8	116.0	110.5	83.4	60.5	59.1
70-74	74.5	23.1	85.1	107.6	113.6	149.3	53.2	87.5	46.3	67.7	35.8	24.8
75+	61.5	11.2	41.3	83.2	69.5	115.7	51.8	94.3	59.7	52.0	55.3	22.0
CR	**17.2**	**5.6**	**15.4**	**23.2**	**20.5**	**21.3**	**19.3**	**18.7**	**22.4**	**18.4**	**26.5**	**14.4**
AAR	**26.8**	**6.8**	**25.5**	**28.0**	**31.5**	**31.5**	**25.1**	**26.5**	**26.2**	**26.7**	**25.3**	**16.1**
TR	**64.1**	**13.6**	**63.7**	**65.1**	**73.8**	**65.9**	**60.6**	**58.8**	**62.4**	**66.5**	**66.4**	**40.3**
%	**22.1**	**12.2**	**24.4**	**22.5**	**25.1**	**25.7**	**23.3**	**23.9**	**23.6**	**27.8**	**27.8**	**19.8**
CUM	**3.03**	**0.81**	**2.88**	**3.13**	**3.59**	**3.71**	**2.65**	**2.95**	**2.82**	**2.92**	**2.73**	**1.70**
LTR	**33**	**124**	**35**	**32**	**28**	**27**	**38**	**34**	**36**	**34**	**37**	**59**
Rank	**1st**	**2nd**	**1st**	**2nd**	**1st**	**1st**	**1st**	**1st**	**1st**	**1st**	**1st**	**1st**

CR: crude incidence rate; AAR: age-adjusted incidence rate; TR: truncated (35-64 years) incidence rate; CUM: cumulative incidence rate; LTR (0-74 years): life time risk

Table 3. Incidence rates (per 100,000 women) of Uterine Cervix Cancer in India

Age Group	Bangalore	Barshi	Bhopal	Chennai	Delhi	Mumbai	Nagpur	Pune	Kolkata	Ahmedabad	Trivandrum	Karunagappally
0-4	--	--	--	--	--	--	0.2	0.1	--	--	--	--
5-9	--	--	--	--	--	--	--	--	--	--	--	--
10-14	0.2	--	--	--	0.1	--	--	0.1	--	--	--	--
15-19	--	--	--	--	0.1	0.2	0.2	--	--	--	--	--
20-24	0.2	--	--	0.6	1.2	0.2	1.8	1.0	0.7	--	--	--
25-29	2.5	4.9	2.2	2.0	2.1	1.1	3.1	3.0	2.6	1.1	--	0.6
30-34	8.5	14.4	7.0	7.8	8.1	5.8	8.5	8.6	8.3	3.6	--	0.7
35-39	16.7	23.1	16.6	27.9	17.4	13.8	22.3	16.8	18.0	13.4	4.2	5.4
40-44	28.9	42.0	29.5	42.8	39.3	27.4	45.7	34.1	33.8	28.7	10.2	13.5
45-49	54.1	55.7	49.4	82.4	49.0	40.1	57.9	49.7	40.9	33.3	20.7	25.5
50-54	65.2	29.6	82.1	108.3	60.6	52.8	61.3	68.5	53.6	54.0	13.6	26.8
55-59	89.1	78.6	112.9	112.7	66.6	51.3	47.7	66.2	63.0	36.9	42.3	35.3
60-64	81.7	87.7	87.8	124.3	83.2	64.6	79.1	66.7	57.3	53.4	40.0	68.3
65-69	117.0	188.3	91.5	122.5	71.0	70.0	76.1	91.9	46.8	47.7	60.1	76.0
70-74	84.3	23.1	93.6	121.0	73.5	84.1	74.4	76.3	58.5	57.2	--	92.2
75+	63.1	33.7	66.2	73.5	36.5	51.0	25.2	36.2	34.1	26.0	27.6	56.3
CR	**14.5**	**19.8**	**13.4**	**25.9**	**13.2**	**13.9**	**15.6**	**14.8**	**14.5**	**9.7**	**8.7**	**11.5**
AAR	**23.3**	**23.4**	**24.4**	**32.3**	**20.5**	**17.4**	**20.9**	**20.7**	**17.1**	**14.4**	**8.4**	**13.5**
TR	**51.8**	**49.6**	**57.6**	**77.7**	**49.6**	**39.2**	**50.6**	**47.7**	**42.2**	**35.0**	**19.6**	**26.5**
%	**18.7**	**43.2**	**21.4**	**25.2**	**16.4**	**14.3**	**18.8**	**18.9**	**15.2**	**14.7**	**9.2**	**15.8**
CUM	**2.74**	**2.74**	**2.86**	**3.76**	**2.36**	**2.06**	**2.39**	**2.42**	**1.92**	**1.65**	**0.96**	**1.72**
LTR	**37**	**37**	**35**	**27**	**42**	**49**	**42**	**41**	**52**	**61**	**104**	**58**
Rank	**2nd**	**1st**	**2nd**	**1st**	**2nd**	**2nd**	**2nd**	**2nd**	**2nd**	**2nd**	**2nd**	**2nd**

CR: crude incidence rate; AAR: age-adjusted incidence rate; TR: truncated (35-64 years) incidence rate; CUM: cumulative incidence rate; LTR (0-74 years): life time risk

Table 4. Incidence rates (per 100,000 women) of Ovarian cancer in India

Age Group	Bangalore	Barshi	Bhopal	Chennai	Delhi	Mumbai	Nagpur	Pune	Kolkata	Ahmedabad	Trivandrum	Karunagappally
0-4	--	--	--	--	0.1	--	0.7	0.3	0.4	--	--	--
5-9	--	--	--	--	0.3	0.3	--	--	0.4	--	--	--
10-14	0.8	--	0.6	0.8	0.9	0.8	1.1	--	0.6	--	--	0.5
15-19	0.7	--	1.4	0.5	0.9	1.4	3.7	0.9	1.3	1.6	--	--
20-24	0.7	--	--	1.5	1.7	1.1	4.8	0.8	1.0	1.0	--	3.3
25-29	0.7	--	0.7	1.4	1.7	2.0	6.2	1.4	2.3	1.1	3.8	2.2
30-34	2.2	--	1.0	2.7	4.4	3.1	5.9	2.6	4.5	0.6	--	0.7
35-39	4.8	--	2.4	3.5	6.7	5.4	10.8	3.2	6.6	3.7	8.3	4.7
40-44	9.9	3.8	4.9	9.8	15.6	8.8	13.3	9.7	13.3	7.9	15.4	7.9
45-49	15.0	--	9.5	22.1	18.0	17.4	24.3	16.6	23.5	3.8	10.4	11.1
50-54	11.0	--	16.4	15.8	28.0	18.8	15.0	24.5	19.5	14.3	27.3	8.9
55-59	16.4	--	28.2	17.4	20.9	25.3	15.9	20.2	19.9	19.5	16.9	5.9
60-64	18.3	5.8	26.7	20.7	29.9	20.7	20.2	22.8	25.6	11.6	10.0	15.8
65-69	34.1	9.4	21.1	19.3	35.9	35.7	14.7	28.3	24.4	19.9	12.1	8.4
70-74	29.4	34.6	--	30.7	24.1	44.1	14.2	37.5	19.5	26.0	35.8	21.3
75+	14.2	--	--	14.7	33.3	32.8	7.4	31.8	17.1	3.71	27.6	2.4
CR	**3.9**	**1.2**	**2.8**	**5.3**	**5.8**	**5.5**	**6.8**	**5.2**	**6.6**	**3.0**	**7.0**	**3.6**
AAR	**6.0**	**1.4**	**5.0**	**6.4**	**8.8**	**7.9**	**7.7**	**7.4**	**7.7**	**4.5**	**6.4**	**4.0**
TR	**12.0**	**1.5**	**13.0**	**14.3**	**18.9**	**15.1**	**16.4**	**15.2**	**17.4**	**9.3**	**14.5**	**8.8**
%	**5.0**	**2.7**	**4.5**	**5.2**	**7.2**	**6.7**	**8.2**	**6.6**	**6.9**	**4.6**	**7.3**	**5.0**
CUM	**0.72**	**0.27**	**0.57**	**0.73**	**0.94**	**0.92**	**0.75**	**0.84**	**0.81**	**0.56**	**0.7**	**0.45**
LTR	**139**	**370**	**175**	**137**	**106**	**109**	**133**	**119**	**124**	**179**	**143**	**222**
Rank	**4th**	**6th**	**4th**	**3rd**	**3rd**	**3rd**	**3rd**	**3rd**	**4th**	**4th**	**4th**	**4th**

CR: crude incidence rate; AAR: age-adjusted incidence rate; TR: truncated (35-64 years) incidence rate; CUM: cumulative incidence rate; LTR (0-74 years): life time risk

Table 5. Incidence rates (per 100,000 women) of Endometrial cancer in India

Age Group	Bangalore	Barshi	Bhopal	Chennai	Delhi	Mumbai	Nagpur	Pune	Kolkata	Ahmedabad	Trivandrum	Karunagappally
0-4	--	--	--	--	--	--	--	--	--	--	--	--
5-9	--	--	--	--	--	--	--	--	--	--	--	--
10-14	--	--	--	--	--	--	--	--	--	--	--	--
15-19	--	--	--	--	--	--	0.2	--	--	--	--	--
20-24	0.3	--	--	--	0.1	0.1	--	--	--	--	--	0.5
25-29	0.7	--	--	--	--	0.1	0.2	--	0.3	--	--	1.1
30-34	2.2	--	1.0	--	0.4	0.1	1.3	0.3	0.8	--	--	--
35-39	2.1	--	1.2	0.3	1.4	0.5	1.6	1.3	1.2	--	--	0.8
40-44	2.4	--	1.6	2.6	3.0	3.5	4.3	1.7	2.8	1.0	--	2.3
45-49	7.2	--	1.9	3.6	4.6	4.9	5.5	4.0	4.0	1.3	5.2	4.4
50-54	12.8	--	8.2	7.0	10.7	9.7	11.0	5.9	8.9	1.6	6.8	6.0
55-59	13.6	--	16.1	9.1	11.2	13.2	3.0	8.4	5.5	2.2	25.4	1.5
60-64	14.2	--	22.9	12.1	14.5	14.6	11.3	5.6	11.0	--	60.1	1.8
65-69	17.8	--	7.0	9.0	21.1	25.7	12.0	7.1	13.1	--	24.2	4.2
70-74	25.5	--	8.5	11.5	16.1	16.8	5.3	12.5	14.6	5.2	--	--
75+	15.8	11.2	8.3	11.4	6.0	6.0	3.0	6.6	12.8	3.7	-	--
CR	**2.5**	**0.2**	**1.5**	**1.8**	**1.8**	**2.1**	**1.8**	**1.3**	**2.0**	**0.3**	**4.5**	**1.0**
AAR	**4.1**	**0.2**	**3.0**	**2.3**	**3.2**	**3.4**	**2.5**	**1.9**	**2.6**	**0.5**	**4.8**	**1.0**
TR	**7.9**	**--**	**7.3**	**5.1**	**6.8**	**6.9**	**5.8**	**4.1**	**5.1**	**1.0**	**13.1**	**2.8**
%	**3.2**	**0.5**	**2.4**	**1.7**	**2.2**	**2.5**	**2.2**	**1.6**	**2.1**	**0.5**	**4.8**	**1.4**
CUM	**0.49**	**--**	**0.34**	**0.28**	**0.41**	**0.45**	**0.28**	**0.23**	**0.31**	**0.06**	**0.61**	**0.11**
LTR	**204**	**--**	**294**	**357**	**244**	**222**	**357**	**435**	**323**	**1667**	**164**	**909**
Rank	**7th**	**> 10**	**8th**	**>10**	**> 10**	**9th**	**7th**	**8th**	**9th**	**7th**	**5th**	**> 10**

CR: crude incidence rate; AAR: age-adjusted incidence rate; TR: truncated (35-64 years) incidence rate; CUM: cumulative incidence rate; LTR (0-74 years): life time risk

Table 6. Incidence rates (per 100,000 women) of other female reproductive tract cancers in India

Age Group	Bangalore	Barshi	Bhopal	Chennai	Delhi	Mumbai	Nagpur	Pune	Kolkata	Ahmedabad	Trivandrum	Karunagappally
0-4	--	--	--	--	--	0.1	--	--	--	--	--	--
5-9	--	--	--	--	--	--	--	--	--	--	--	--
10-14	--	--	--	--	0.1	--	--	--	--	--	--	--
15-19	--	--	--	--	0.1	--	--	0.4	--	--	--	0.5
20-24	0.5	--	1.3	0.6	0.4	0.1	0.4	--	0.3	--	--	--
25-29	0.6	--	1.5	0.2	0.5	0.6	0.2	--	0.3	0.6	--	--
30-34	0.4	2.9	2.0	1.2	0.4	0.5	0.9	0.5	0.4	0.6	--	--
35-39	1.0	--	--	0.3	1.1	1.2	1.0	0.7	0.8	0.7	--	0.8
40-44	1.2	--	1.6	1.8	3.0	1.7	3.4	2.0	2.3	4.0	--	1.1
45-49	2.0	--	--	3.0	2.3	3.7	2.8	2.9	2.0	3.9	--	4.4
50-54	6.0	24.5	2.7	10.2	5.7	8.3	6.9	4.4	4.9	3.2	--	1.5
55-59	8.1	6.5	16.1	9.1	4.3	6.6	1.5	3.4	5.5	14.1	--	--
60-64	9.2	--	3.8	13.0	7.9	15.9	4.0	9.4	6.1	4.6	10.0	8.8
65-69	13.3	--	7.0	9.1	7.7	23.6	2.6	8.0	1.9	11.0	12.1	8.4
70-74	4.0	--	8.5	17.2	13.6	34.7	7.1	12.6	21.9	9.2	--	3.5
75+	22.0	--	24.8	9.6	10.0	39.7	--	14.3	10.6	7.4	--	2.4
CR	**1.4**	**1.5**	**1.3**	**2.0**	**1.2**	**2.4**	**0.9**	**1.3**	**1.4**	**1.5**	**0.7**	**1.0**
AAR	**2.3**	**1.7**	**2.3**	**2.6**	**2.0**	**4.0**	**1.3**	**1.9**	**1.9**	**2.3**	**0.8**	**1.2**
TR	**4.0**	**4.8**	**3.3**	**5.5**	**3.8**	**5.7**	**3.2**	**3.3**	**3.3**	**2.2**	**1.3**	**2.5**
%	**1.8**	**3.2**	**2.1**	**2.1**	**1.5**	**2.1**	**1.3**	**1.6**	**1.6**	**2.2**	**0.7**	**1.4**
CUM	**0.23**	**0.17**	**0.22**	**0.33**	**0.24**	**0.49**	**0.15**	**0.22**	**0.23**	**0.26**	**0.11**	**0.15**
LTR	**435**	**588**	**455**	**303**	**417**	**204**	**667**	**455**	**435**	**385**	**909**	**667**

CR: crude incidence rate; AAR: age-adjusted incidence rate; TR: truncated (35-64 years) incidence rate; CUM: cumulative incidence rate; LTR (0-74 years): life time risk

MORTALITY DATA IN POPULATION BASED CANCER REGISTRY, CHENNAI

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Introduction

The population based cancer registry (PBCR) Chennai, known as Madras metropolitan tumor registry (MMTR), covers an urban area of 170 sq. kms. with a population of 4.2 million (M:F:1:0.9). The deputed social investigators in fixed schedules visit government/ private hospitals, nursing homes, imaging centres, pathology laboratories and hospices to collect data on incident cancer cases. The total sources of coverage are more than 225. Majority of the cases are identified at the sources where the patients may undergo cancer directive investigations/treatment. The patients are interviewed to collect information on the socio-demographic variables wherever possible and the diagnosis and treatment details are updated from the records[1]. The vital statistics division (VSD) of corporation of Chennai is the most important source for mortality data. It is essential to have an overview of the death registration system to ensure completeness of death registration. The Chennai metropolitan area is divided into 10 zones comprising 155 divisions. The deaths are registered in the forms disbursed at the burial ground before the disposal of the bodies. Medical certification of the death is mandatory. These forms are collected by the VSD clerk from the burial grounds and filed at the zonal office. The deaths from hospitals are directly notified to the respective divisional offices. For the reasons of confidentiality, the diagnosis and the identifying information are filed separately.

Need for mortality data

Death certificates are potential sources of information[2] from where the information of cancer cases are obtained primarily if there is no other source by which the patient has been registered. These are cases that are not detected or registered during lifetime. The data on death supplements the incidence data and completes the follow-up activity of cancer incident cases for further studies like survival analysis. Mortality statistics are used to calculate the mortality/incidence ratio for different cancer sites as a measure of completeness[3-4].

Reasons for under-registration of death of known cancer cases in the VSD

- The death certificates are not available as source of information (i.e) VSD.
- Due to migration of the case to outside registry area.
- The death had occurred outside the area of registration and hence not registered in VSD.
- The deaths were missed from registration in VSD.

- If a cancer patient has a long survival and the death was not due to cancer, there is a high probability that the information that the deceased had cancer had been totally forgotten.
- The death registration system is defective.
- When the cause of death was erroneous.

Method of mortality data collection

Death information can be collected by active follow-up (field visit) or from vital statistics division. Validity of the mortality information from VSD is high due to the active follow-up by deputing field investigators to collect mortality information. In VSD, the exact date of death, cause of death and place of death are available instantly.

If the registry has access to VSD, then the certificates with a mention of cancer as immediate, antecedent, underlying or contributory causes of death should be abstracted. Data abstraction from VSD should be made as early as possible so that the legal and statistical parts of the certificate are available together. (The current practice is to separate the legal and statistical part and dispatch the latter to the central offices of the VSD). This minimizes the labour and the error in matching the unique records for recording the diagnosis/cause of death. The medical certificate attached to the death certificates should also be perused for the diagnosis or cause of death.

All causes of mortality data processing (Flowchart 1)

The death information for all resident deaths are abstracted from the VSD for house deaths and from hospital records for the hospital deaths since the diagnosis/cause of death is more valid and complete from the hospital records. They are coded for cause of death and entered in the computer. Inconsistencies and typographic errors are checked after standardizing the names.

Two types of matching procedures are involved (1) Computer matching- The mortality data is matched with morbidity data files since the inception of the registry and matching printouts are generated by the computer. The key fields for linkage of mortality and morbidity data are name, relative name, sex and PIN code. Sexwise matching printouts are generated for any two combination of these key fields. (2) Manual matching- alphabetic printouts of both morbidity and mortality database are manually perused for possible misclassification in address/ mis-spelt names etc. The matched death information (cancer and not cancer) including date, place and cause of death of the matched deaths are updated to the incidence database.

Cancer mortality matching

Deaths with cancer as cause of death mentioned in the death certificate are processed cautiously. The deaths with cancer as a cause that remain unmatched after the processing of the all cause mortality are the 'unmatched cancer deaths' and are classified as death certificate notifications (DCN). Trace back procedures are adopted for the DCN's. Field visits are made to collect more details about the diagnosis, date of incidence, residential status and treatment/hospitals visited. The clinical notes at the respective sources of registration of cases are verified for diagnosis of cancer and the case is registered from that source of registration. The cases where no further information can be obtained other than that from the death certificates are registered as Death Certificate Only (DCO). It is the DCN rather than DCO that is more relevant to monitor the completeness of cancer registration of a registry. New sources of registration of cases are identified by trace back of DCN's and the frequency of visits of the social investigators depends on the number of cases from them. Prevalent cases are excluded. If trace back procedure is not adopted then DCN's are equal to DCO's. DCN's may occur due to (a) failure in the registration system by which the individual having cancer was not notified by the registry, (b) it may be a source of registration that had not been covered by the registry (c) the diagnosis of cancer was done in a very late stage and was very close to the time of death (d) the date of diagnosis was made before the date of functioning of the registry and (e) the death certificate had an error of noting cancer.

Mortality to incidence ratio (M/I ratio) is a reliability index for completeness of coverage. In MMTR, during 1982-83, when data on deaths certified as cancer or tumor alone were abstracted from VSD, the M/I ratio was 23.3%. In 1984-91, when active follow-up of selected cancers was done, the M/I ratio increased to 44.9%. The result of active follow-up threw light on the cancer deaths registered under not cancer causes of death. So, as a special study, the Chennai registry started collecting information on all resident deaths registered in VSD[5]. This enhanced the M/I ratio to 53.5% during 1992-98 and 47.3% in 1999-01, comparable with the western countries from a single reliable mortality source (Table 1). The information on the deaths of many cancer cases might not have been registered if we had registered only deaths due to cancer. The percentage of matched deaths registered under not cancer deaths during 1992-2001 is 40.7% (Table 2).

An exercise was carried out to compare the accuracy of the deaths registered at the VSD and that in the hospital registers (Table 3). The result yielded an agreement of 87% of the registers of the VSD and the hospital and a disagreement of 13% wherein the cancer causes in the hospital registers were misclassified under not cancer causes of death at VSD. This is a pointer towards the abstraction of causes of deaths from the hospital sources wherever possible for the accuracy of diagnosis.

Table 1. Trend of Mortality/Incidence Ratio

Year	Total Deaths (M)	Total Cases (I)	M/I Ratio
1982-83	1133	4860	23.3
1984-91	10833	24114	44.9
1992-98	13239	24879	53.5
1999-01	5848	12364	47.3

Table 2. Distribution of deaths by causes (1992-2001)

Year	Cancer	NC	% of NC	Field Visit	Total
1992	942	684	42.1	326	1952
1993	1008	727	41.9	219	1954
1994	889	762	46.2	225	1876
1995	1109	577	34.2	197	1883
1996	1126	615	35.3	128	1869
1997	1002	756	43.0	82	1840
1998	997	759	43.2	108	1864
1999	973	542	35.8	129	1644
2000	628	580	48.0	347	1555
2001	976	630	39.2	205	1811
Total	9650	6632	40.7	1966	18248

NC: Not Cancer

Table 3: Information on Cancer Institute deaths from VSD and hospital death register (1999)

	Cancer Institute death register			
V S D	Cause of death	Cancer	Not Cancer	Total
	Cancer	72	0	72
	Not Cancer	11	2	13
	Total	83	2	85

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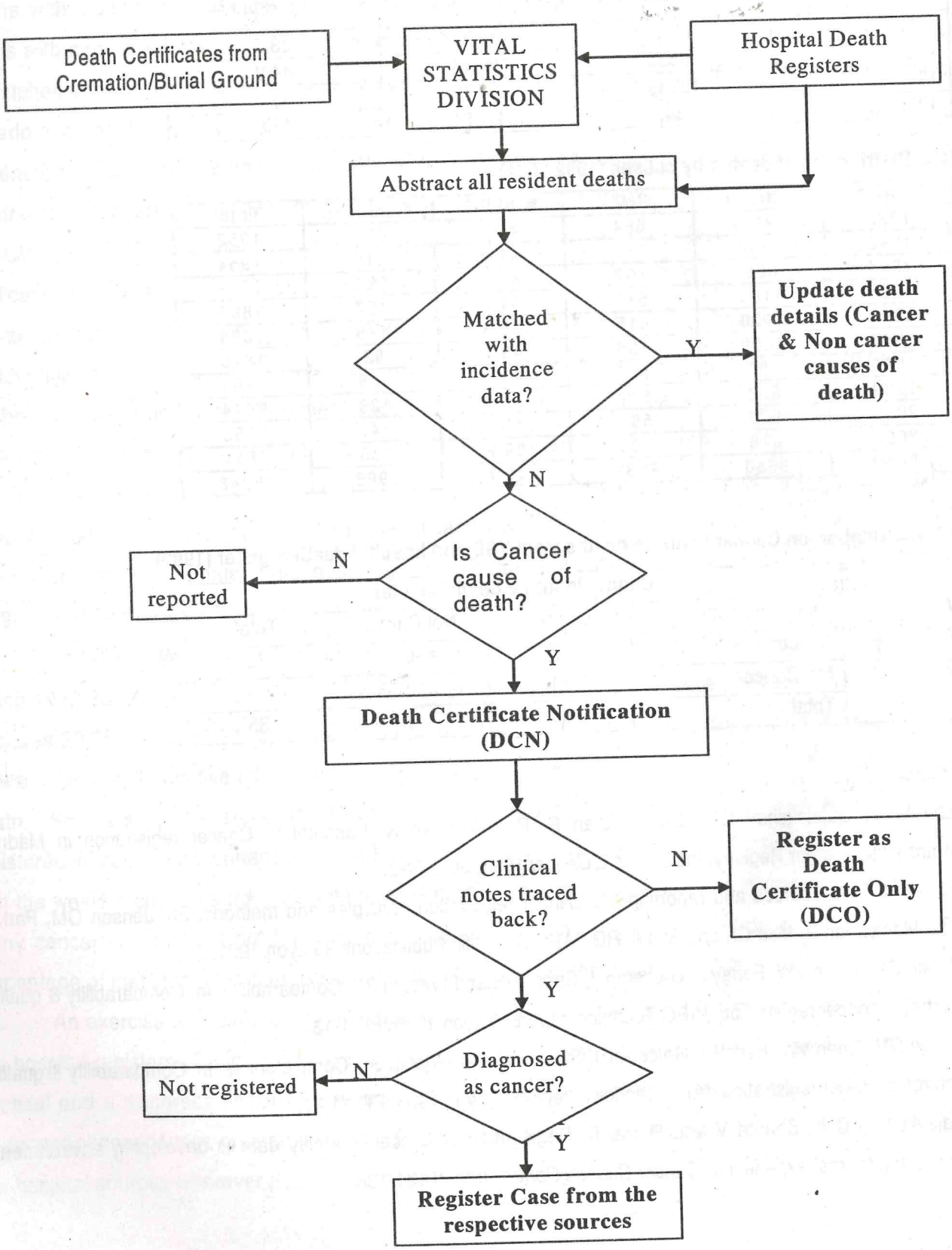
Flowchart: Method of mortality data processing



ALTERNATE METHODOLOGY FOR REPORTING OF CANCER MORTALITY IN INDIA (AN EXPERIENCE OF BHOPAL CANCER REGISTRY)

Atul Shrivastava & Sushma Shrivastava

The main objective of a Population Based Cancer Registry (PBCR) is to "generate reliable data on the magnitude and pattern of cancer morbidity and mortality in various segments of the population in different regions of the country". Thus the important features of a PBCR are the reporting of cancer morbidity and mortality pattern in its population. In many of the developing countries active registration of cancer cases and cancer deaths is done by personnel's visit to the various sources of registration. Normally registries in India collect cancer mortality data by noting down the cancer deaths from records of various hospitals and municipal corporation records. The mortality data is then matched with the existing cancer morbidity data. The matched deaths are then updated. The unmatched cancer deaths are traced back by house visits and scrutiny of medical records. Cases with no other details, other than those available on the death certificate, are registered as "Death Certificate Only".

Death registration at Bhopal

The death information available at the municipal records and department of vital statistics is incomplete and is not updated regularly. Medical records of various hospitals are also not up to the mark. Majority of death certificates issued do not mention the specific cause of death. In the absence of cause of death and complete information of the deceased both at the municipal records and hospital records, the cancer mortality data in the Bhopal registry is indicated an under registration.

Use of burial grounds and crematorium records

Records of the burial and crematorium were evaluated for availability of information of the deceased i.e. details of identity, proper address, demographical details along with the cause, and date of death. It was found that at many of these places there was proper recording of these details being done. Sources having better/complete information of the deceased were selected and the following methodology (similar to that used by Chennai PBCR) was adapted since the year 1997.

Methodology introduced by Chennai PBCR

Chennai cancer registry has overcome the problem of under registration and has improved its mortality data significantly by using the following methodology (being used since 1992)

- The registry records all the deaths regardless of cause of death from the vital statistics department registers and hospital records.
- The mortality data is then matched with the morbidity data recorded in the registry.

- Matched deaths are then updated to the morbidity data.
- Those deaths with cause of death as cancer and do not match with morbidity data are traced back by house visits and scrutiny of medical records.
- Cases for whom no other details, other than those available on the death certificate, are registered as "Death Certificate Only (DCO)".

Methodology followed in Bhopal PBCR

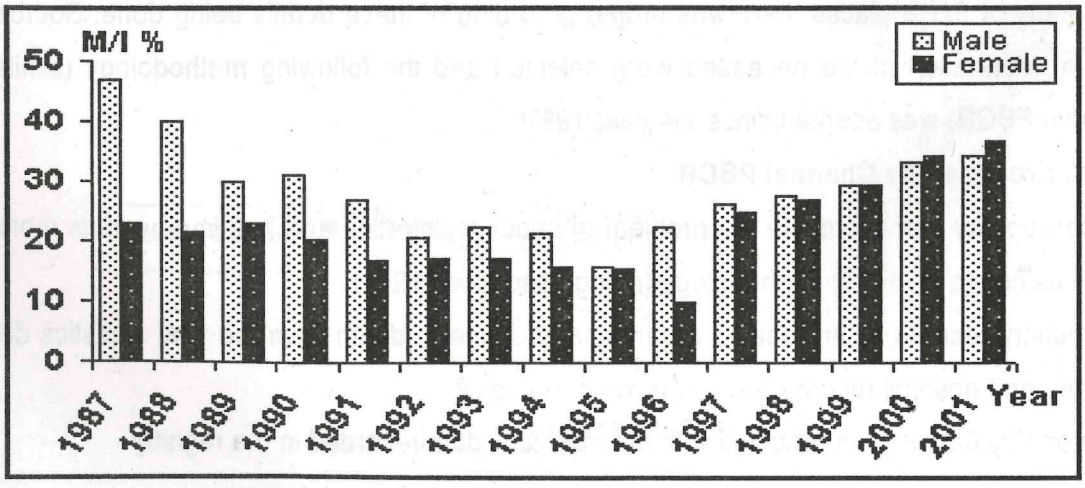
With proper recording of addresses, demographical details and cause of death at the new sources the following methodology was followed:

- All the deaths regardless of cause of death were noted from of the selected burial grounds and crematoriums.
- The mortality data was then matched with the morbidity data registered in the registry.
- Matched deaths were then updated in the morbidity database.
- Those deaths with cause of death as cancer and did not match with morbidity data were traced back by house visits and scrutiny of medical records.
- Cases for whom no details other than those on the death certificate were available, were registered as "Death Certificate Only (DCO)".

Results

With the use of death records of the selected burial grounds and crematoriums a significant improvement was recorded in the mortality data from the year 1997 onwards. The mortality/incidence (M/I) ratio has improved significantly from 15.62% to 35.85% and 13.99% to 36.22% among males and females respectively.

Mortality-Incidence ratio (M/I%) before & after the implementation of new method (1987 -2001)



OUR THANKS

THE UNIVERSITY OF TAMPERE, FINLAND HAS GIVEN ADVANCED TRAINING IN EPIDEMIOLOGY & BIOSTATISTICS FOR MANY CANCER REGISTRY WORKERS DURING THE PAST 15 YEARS.

We are grateful to Prof. Matti Hakama & faculty

Section II

We hereby present some of the lectures given to the registry workers during the last ARM in Sikkim by Tampere returnees.

Statistical methods in its several forms are the basis of medical science. Neither medical practice nor research can be properly planned, executed or assessed without some form of measurement or numerical quantities.

Dr. P. S. S. Sunder Rao

Dr. J. Richard

CASE CONTROL STUDY – DESIGN, CONDUCT AND ANALYSIS

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One of the important uses of a well organized cancer registry is to conduct research in epidemiology which includes conducting etiological studies. The main types of epidemiological study designs include the following:

1. Intervention (experimental studies) studies which include clinical trials and field trials
2. Observational (non-experimental studies) studies which include cohort studies, case-control studies, cross-sectional studies and routine data based studies.

Each of these study designs has been extensively used in medical research. This communication briefly describes the design, conduct and analysis of case-control studies.

A case-control study involves the identification of individuals with (cases) and without (controls) a particular disease or condition. The prevalence (or level) of exposure to a factor is then measured in each group. If the prevalence of exposure among cases and control is different, it is possible to infer that the exposure may be associated with an increased or decreased occurrence of the outcome of interest. The main features of a case-control study is that it proceeds from effect to cause to identify antecedents that led to the disease and it uses comparison group to refute/support an inference of a causal role for any particular factor. The main objective of a case-control study is to provide a valid, reasonably precise estimate of the strength of hypothesized cause-effect relationship and to provide the result in terms which have a biological meaning interpretation.

Historically, very few case-control studies were reported prior to 1920 and subsequently this study design has gained popularity and many discoveries have been made using this design and significant progress has been made in the development of new methodology to analyze and interpret the data from case-control study. The main advantages of this study design is

1. It is well suited to study rare diseases and diseases with long latency
2. It is quick to mount and conduct, inexpensive
3. Requires comparatively few subjects
4. Existing records can occasionally be used and there is no risk to subjects
5. Allows study of multiple factors

Further, this design is useful in the study of exposures that cannot be randomized for logistic or ethical reasons (eg. water hardness, alcohol consumption during pregnancy). However, it should be noted that this design has several inherent disadvantages as mentioned below.

1. It relies on recall records for past exposures
2. Collection of valid information is difficult / impossible
3. Most of the time, control of extraneous factors is incomplete
4. Selection of appropriate comparison group is often difficult
5. Rates of disease in exposed and unexposed individuals cannot be determined
6. Detailed study of mechanism is rarely possible.

Case-control studies allow the evaluation of a wide range of exposures that might relate to a specific disease (as well as possible interaction between them). eg. A case-control study to assess the relationship between cervical cancers and exposure to HPV, selected aspects of sexual and reproductive behaviour, use of oral contraceptive screening practices, smoking, and possible interaction between them.

Case definition

The case definition should be established in such a way that there is no ambiguity about types of cases and stages of disease to be included in, or excluded from, the study. The choice of cases should be guided more by concern for validity than for generalizability. An example is a study of breast cancer in which the cases (and controls) are limited to either pre-or-post menopausal women than by including women of all ages. The eligibility criteria should include not only a clear definition but also any other inclusion criteria.

The details of cases excluded along with the reasons for exclusion should be given. This allows us to assess the extent to which the results from the study may have been affected by selection bias. Use of incident cases is very common because of many advantages it has. Prevalent cases are also used as it is readily available, and occasionally decedent cases are also used.

Selection of Controls

The most difficult task in a case-control study is selection of controls. No one type of control is suitable for all studies and there are no firm criteria for an acceptable group. Although one control group best suited to the needs of a particular study is recommended, ratio of cases and controls vary according to circumstances. However, it is advised to stay within the bounds of 4:1 (at the most 4 controls per case) as the gain in statistical power is small if more than 4 controls per case is selected.

The controls can be selected from different sources viz. hospital patients as they are readily available, have time to spare and co-operative, have mental balance similar to cases with respect to determinants of hospitalization. However, it should be noted that these controls may be in the hospital for condition which has etiological features in common. The other sources of controls may be general population

which is very appropriate when population based cases are selected. Restricted population group (for eg. neighbourhood of the cases) may also be a source for selection of controls.

Matching

Individual matching refers to the procedure whereby one or more controls are selected for each case on the basis of similarity with respect to certain characteristics other than the exposure under investigation. It is to be noted that matching is restricted to confounding factors and is not performed for the exposure under investigation. Matching is normally chosen for factors which are known to be strong confounders such as age, sex, place of residence or socioeconomic factors. The main purpose of matching is to control confounding and to increase information per observation in the post stratification analysis. Caution should be exercised to avoid over matching. The concept of over matching can be understood better with the following example.

Suppose we wish to examine the relationship between smoking and lung cancer in a population where smoking levels are positively correlated with alcohol intake, i.e. the more some one drinks, the more he/she is likely to smoke. In this example, matching on alcohol intake would result in overmatching because controls would be made similar to the cases not only in relation to their alcohol intake but also in relation to their smoking habits, which is the exposure of interest in the study.

Data Collection

Collection of data entirely depends on the place where study is done and the source of information. The source of data collection may be through direct interview, postal questionnaire or referring to medical or other type of records. Good quality data can be ensured by:

i) Adequate training and supervision of field worker (ii) Checking samples of data collection forms to assess their completeness and accuracy (iii) Assessing interviewer's performance by watching / listing to interview (iv) Re-interview a random sample of subjects wherein the second interview may be conducted by the supervisor, another interviewer, or by the same interviewer. Assess the reliability of the data obtained in the two interviews.

Data Analysis

The purpose of analysis of data from a case-control study is to:

1) Assess random variation 2) Obtain effect estimates 3) Control confounding and 4) Evaluate interaction

The analysis depends on the design of the study.

Unmatched (and frequency matched) studies

The first step in the analysis of an unmatched case control study is to construct a table showing the frequency of the variables of interest separately for cases and controls. In an unmatched study, the numbers of cases and controls found to have been exposed and not exposed to the factor under investigation can be arranged in a 2 X 2 table as shown below:

	Exposed	Unexposed	Total
Cases	a	b	n_1
Controls	c	d	n_0
Total	m_1	m_0	N

In case control studies, it is not possible to directly estimate disease incidence in those exposed and those unexposed, since people are selected on the basis of having or not having the condition of interest and not on the basis of their exposure status. However, it is possible to calculate the odds of exposure in the cases and controls.

Odds ratio (OR) of exposure can be calculated as

$$OR = \frac{\text{Odds of exposure in the cases}}{\text{Odds of exposure in the controls}} = (a/b)/(c/d) = ad/bc$$

Calculation of confidence interval (C.I.)

SE (ln OR) $= \sqrt{(1/a+1/b+1/c+1/d)}$ (SE: standard error; ln OR is the logarithm of OR)

	Exposure		
	Yes	No	Total
Cases	457 (a)	26 (b)	483 (n_1)
Controls	362 (c)	85 (d)	447 (n_0)
Total	**819 (m_1)**	**111 (m_2)**	**930 (N)**

OR = (457/26)/ (362/85) =4.13

ln OR = ln 4.13=1.42

SE (ln OR) $= \sqrt{(1/457+1/26+1/362+1/85)}$=0.23

95 % C.I. (ln OR) =1.42 $\pm$ (1.96 * 0.23) =0.97 to 1.87

Taking antilogarithm

95% C.I. (OR) = $e^{0.97}$ to $e^{1.87}$ = 2.64 to 6.49

Individual matched studies

Individual matched studies require a special type of analysis in which the 2 X 2 table takes a different form. As an example for one control per case.

Cases	**Controls**		
	Exposed	Unexposed	**Total**
Exposed	r	s	a
Unexposed	t	u	b
Total	**c**	**d**	**N/2**

The total of the entire table is N/2 pairs, where N represents the total number of paired individuals.

Matched OR = s/t (provided t<>0)

This OR calculation considers only the discordant pairs wherein either the case is exposed or its paired control is not exposed or vice versa.

Cases	**Controls**		
	Exposed	Unexposed	**Total**
Exposed	468 (r)	87 (s)	555 (a)
Unexposed	73 (t)	4 (u)	77 (b)
Total	**541 (c)**	**91 (d)**	**632 (N/2)**

Matched OR = 87/73 = 1.19

95 % C.I . for matched OR = 0.86-1.65

Calculation of C.I. and significance tests for matched case control study is explained by Breslow and Day (1980).

We know that confounding occurs when an estimate of the association between an exposure and an outcome is mixed up with the real effect of another exposure on the same outcome, the two exposures being correlated. One of the important objectives of analysis of data from case- control studies is to control for the confounding factors. There are two ways of dealing with confounding in the analysis. They are:

1) Stratification and 2) Statistical (regression) modelling

The estimate of OR obtained in the examples mentioned above is the OR obtained ignoring confounding which can at times lead to an over estimate or underestimate of the true association between exposure and outcome and can even change the direction of the observed effect.

The procedure of stratified analysis is to distribute the data into smaller subsets (mostly on the categories of confounding variables) and examining only stratum-specific estimates and using tests from multiway, contingency tables.

Usually, we are not much interested in the stratum-specific results perse and would rather have single overall estimates. In other words, we would like to be able to calculate a summary effect estimate which in contrast to the crude estimate would take into account the confounding effect of stratifying variable. Such adjusted estimates can be calculated by pooling results across the strata. Pooling takes this into account by giving greater weight to effect estimates from larger strata. The Mantal-Haenszel odds ratio gives a weighted average of the odds ratios in the different strata, where those from larger strata are given more weight. It should be noted that stratified analysis is worthwhile,

1. If there are sufficient numbers in all strata (each cell frequency >5)
2. If an appropriate choice of control variable can be made and,
3. If appropriate categories for each variable identified (meaningful categories and without residual confounding).

Regression modeling

Regression models summarize the relationship between an outcome (dependent) variable and several explanatory (independent) variables as a mathematical equation. There are many types of regression models. The choice of any particular model depends on the characteristics of the outcome variables (i.e. continuous or categorical) and on the way it is mathematically related to the explanatory variables. The main advantage of using regression models is that it does not require us to define which independent variable is the exposure and which ones are the potential confounders, since all explanatory variables are treated in the same way. The most frequently used regression techniques in the analysis of data from case-control studies are:

1. Logistic regression: Suitable for unmatched (or frequency method) case- control studies
2. Conditional logistic regression: Suitable for individually matched case control studies.

The Mantel–Haneszel method is a very useful technique to adjust for confounders, and this approach is often adequate for data with few confounders. However, to adjust for several confounders simultaneously regression methods may be necessary.

One of the main disadvantages of using regression modeling is that we lose sight of the data, so that it is often regarded as a 'black box' approach. Statistical modeling should not be used by people who are not familiar with it and who do not understand the assumptions upon which it is based.

Example: Odds ratios (with 95% CI) for esophagus cancer in males according to smoking habits (using conditional logistic regression)

Smoking status	Odds ratio	95 % CI
Non-smokers	1.00	-
Smokers	6.58	3.6-12.1
-Adjusted for chew	7.55	4.0-14.3
- Adjusted for chew, alcohol	6.45	3.3-12.4
Ex-smokers	5.00	1.1-22.8
- Adjusted for chew, alcohol	4.45	0.9-21.2
Current smokers	6.90	3.6-13.4
- Adjusted for chew, alcohol	6.50	3.2-13.3

To conclude, case-control studies are important research strategy commonly encountered in medical literature. When though fully designed and carefully executed, it provides important clinical information. However, "backward logic" (proceeding from effect to cause) is accompanied by several methodological hazards. Finally, conflicting or incorrect conclusions might be drawn which is directly attributed to methodological deficiencies.

Further readings

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STATISTICAL METHODS FOR CANCER SURVIVAL ANALYSIS

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Introduction

The life table, one of the basic tools in the description of mortality experience of a population, was first developed as early as 1693 by E. Halley in England. It forms the basis for the calculation of the life table estimate of the survivor function, which is being widely used even now in the analysis of data from epidemiological studies. Information on survival has long been recognized as an important component in monitoring cancer control activities (WHO/IARC, 1979). Like all other health indices, survival statistics are useful primarily as comparative measures. It is these comparisons that help us to suggest possible reasons for the variations and provide targets for improvement and means of monitoring progress towards them (Black et al., 1998). Survival data obtained from a population based cancer registry ideally portrays the average outcome of the disease in the pertaining region covered since it is based on an unselected series of incident cancer cases (Sankaranarayanan et al., 1998). The methods for routine cancer survival analysis have been published elsewhere (Black and Swaminathan, 1998). In this write-up, some newer approaches to cancer survival analysis apart from the routine ones are summarized.

Follow-up

An adequate and complete follow-up is a prerequisite for the conduct of a survival study. Lengthy periods of time may be required until the event of interest (say, death due to any cause) occurs in all cases studied and maintenance of surveillance on patients may be extremely difficult. Hence, a closing date for follow-up is typically imposed keeping in mind the adequacy of follow-up information needed to estimate the survival at a specified time. Complete follow-up is deemed to have been achieved when the vital status (alive/dead) at closing date is known for an individual. If not known, then the follow-up is incomplete.

With *passive follow-up*, information on deaths is routinely received either by law or an understanding from the vital statistics division. By this procedure, those patients for whom no information of death is received may be considered to be "alive" until that point of time. The main requirement for this method to work efficiently is that there is a high quality of registration of mortality data and unique data linkage possibilities which ensure the follow-up of cases to be complete with the exception of migration or rare losses.

Active follow-up is necessitated in the absence of a reliable health information system, and it may supplement the latter in case of incomplete passive follow-up. Most cancer registries in developing countries are

generally resorted to this method after the routine matching of the incident cancer cases with the available mortality information. The different ways by which this is accomplished are by repeated scrutiny of medical records in hospitals, enquiries with attending physicians, scanning the population registers (city directories), health registers of national health service, health insurance registers, electoral lists, postal/telephone enquiries and visits to the houses of the cases or persons known to them.

Censoring

It is impractical to continue follow-up until all cases under study are dead. With a closing date of follow-up in place, for the subjects who are withdrawn wilfully or getting dropped or lost from the study before this date and for those that are still alive at this date, only a lower bound on lifetime is available. This is not to conclude that no information is available on them, but the information on them is partial. This unique feature in lifetime data analysis which occurs when exact lifetimes until death are known for only a portion of the individuals in the study and known to exceed certain values in the remainder is called "*censoring*".

When censoring occurs either due to the termination of study at the closing date which is solely technical or due to loss to follow-up that is unrelated to death, it is said to be *random or non-informative censoring*. When censoring occurs due to loss of follow-up which is related to death, we encounter with *non-random or informative censoring*.

Test for random censoring

Little reliance can be placed on the estimated survival assuming random censoring when the magnitude of loss to follow-up is high. In this instance, it is desirable to investigate deviation from randomness of censoring. Logistic regression has been used in the literature for this purpose. However, it is constrained by grouping of survival time. This is overcome by using the Cox proportional hazard model. For this purpose, the outcome studied was the 'loss to follow-up' within a specified time from the index date. Since the survival is generally estimated at five years by most cancer registries, the time was fixed as 'five years'. All cases that were censored before the closure of study and having had a follow-up of less than five years constituted the group which experienced the 'outcome' and the rest of the cases who were either dead or known to be alive on the closing date of follow-up were treated as censored for this analysis to detect the presence of informative censoring. The variables or determinants that may be tested for association with loss to follow-up are age at diagnosis, gender and extent of disease, depending on the availability of data. An example of this type of analysis is given in Table 1. A statistically significant differential pattern of risk to loss to follow-up was observed. This suggests the presence of non-randomness of loss to follow-up and the survival estimates

assuming random censoring have to be interpreted with caution. Loss adjusted survival methods have bee proposed (Ganesh, 1995) but scarcely used (Swaminathan et al., 2002; Supannee et al., 2004).

Actuarial method of estimation of absolute survival probability

It is rare to find a closed group of subjects in a survival study without censoring except possibly in an artifici situation such as the construction of a life table. The actuarial method of estimating survival probabili handles censoring by assuming it to be random. This method involves the construction of a life table whic permits the calculation of the cumulative probability of survival at time t_{i+1} from the conditional probabilities survival during consecutive intervals of follow-up time up to and including t_{i+1}. This method is commonly use to estimate the absolute survival probability. The lay out and method of calculation of the elements of a lif table (Cutler and Ederer, 1958) are illustrated in Table 2.

For each time period t_i *to* t_{i+1}, n_i is the number of subjects at risk of outcome at the beginning of th time interval. The number of cases censored during the interval because they are loss to follow-up withdrawn alive at the end of the follow-up period is shown as w_i. The symbol d_i denotes subjects wh experienced the outcome during each interval. The effective number of subjects at risk during each interval i calculated as

$$N_i = n_i - (w_i / 2)$$

In this way, subjects who are alive and at risk of experiencing the outcome during the interval t_i *to* t_{i+1}, but wh are censored at some point of time during the interval, are assumed to have been followed up for, o average, half of the interval. This actuarial assumption is based on censoring being independent of th outcome studied. Now, the probability of occurrence of the outcome during the interval is given by

$$q_i = d_i / N_i$$

The probability of survival during the interval beginning t_i is then calculated as $p_i = 1 - q_i$ from which th cumulative probability of survival up to time t_{i+1} is derived from the product of the p_i's

$$P_{i+1} = \prod_{j=0}^{i} p_j$$

This quantity P_{i+1} is often multiplied by 100 to give the "percentage survival" at time t_{i+1}.

There are several approaches to estimate the absolute survival at a given time by varying th registration and follow-up periods of time. These are discussed below and illustrated in figure 1.

Cohort analysis

The simplest way of computing survival probability is to compute the ratio or percentage of the number o subjects alive at the end of, say, 5 years from the index date by the total number of subjects in the study a

the beginning of the study excluding those who have not had a chance to be followed for 5 years after diagnosis. For this purpose, only subjects potentially under observation for at least 5 years and potentially having a complete follow-up of five years are taken into consideration. This approach, called "cohort analysis" (Brenner and Gefeller, 1997) has the disadvantage that even the most recent survival estimates are exclusively based on patients diagnosed many years ago. For example, with a database that includes patients diagnosed between 1989 and 1999 and has a closing date of follow-up at the end of 1999, a cohort estimate of 5-year survival could be obtained from patients diagnosed in 1994 or earlier years only, because patients diagnosed in later years could not possibly be followed for 5 years until the end of 1999. This approach is illustrated by the black solid frame in figure 1.

Complete analysis

In this approach, there is no restriction on the potential follow-up time to equal, say, five years from the index date for which the survival is estimated. Rather, all subjects who are diagnosed as incident cancers until the closing date of the follow-up period qualify for inclusion in the analysis. Apart form the subjects with a complete follow-up of five years, those under observation for a variable period of time and having an incomplete follow-up of less than five years are included (Brenner and Gefeller, 1997). In the example given above, all patients diagnosed in 1995-1999 could be included in addition to those diagnosed in earlier years for the derivation of a complete estimate of 5-year survival. This approach is illustrated by the black dashed frame in figure 1.

Semi or partially complete analysis

It is this approach that is widely practised in the estimation of survival by cancer registries. Here, not all patients diagnosed until the closing date of follow-up are included. Rather, only patients who have had some minimum potential follow-up time at the closing date of follow-up, such as two or three years, are included. In our example, a partially complete estimate of 5-year survival may be obtained from patients diagnosed in 1997 and earlier years, who have had a minimum of two potential years of follow-up at the end of 1999. This approach is in between the pure cohort and pure complete analysis and is illustrated by the black dotted frame in figure 1.

Period analysis

This is an alternative approach formulated by Brenner and Gefeller (1996) to derive more up-to-date estimates of cancer patient survival by exclusively utilising the survival information pertaining to the most recent incidence and follow-up periods. The period of interest could be a single calendar year or more. Period

analysis exclusively reflects the survival experience of subjects within the most recent calendar 'period' f which the follow-up is available. This is achieved by left truncation of observations at the beginning of th period in addition to censoring at its end (Brenner et al. 2002).

In our example, assume that a period estimate of 5-year survival is to be derived for the 1995-199 period, the most recent period for which pertinent data are available. Then all observations are left truncate at the beginning of 1995 in addition to being censored at the end of 1999. The 5-year period estimate survival would be obtained from patients diagnosed in 1990-1999 for whom some proportion of 5-year follow up might have fallen in the 1995-1999 period. With this approach, which is illustrated by the grey solid fram in figure 1, different parts of the survival function would be derived from patients diagnosed in variou calendar years. Survival during the 1st year following diagnosis would be estimated from patients diagnose in 1994-1999, survival during the 2nd year following diagnosis would be estimated from patients diagnosed i 1993-1998, and so on, until survival experience during the 5th year following diagnosis which would b obtained from patients diagnosed in 1990-1999. These conditional survival probabilities are then combined i the usual way to come up with 5-year cumulative survival estimates for the period 1995-1999. It has bee shown that period analysis is the approach that clearly provides the most up-to-date estimates of cance patient survival, and that period estimates of survival for some given period quite closely predict surviva experience of patients diagnosed in that period (Brenner and Hakulinen 2002). It has been conclusivel shown that period analysis has come to stay and should be the approach to be followed in survival analysis i future (Shanta et al., 2004).

Relative survival

Berkson (1942) introduced the concept of 'relative' survival. The relative survival *(R_i)* for a group of patients a the end of an interval beginning at time t_i is defined as

$$R_i = \frac{S_i}{S_i^*}$$

where S_i is the absolute survival for subjects with a particular cancer and S_i^* is the expected survival of a group of individuals with the same demographic characteristics (age, gender, etc.) who are at risk of death only from causes of death other than the cancer under study (Ederer et al., 1961). Berkson and Gage (1950) have suggested that the observed proportion of survivors of cancer can be compared with an expected proportion of survivors derived from similar people from the general population, most of whom do not have the disease under study. The concept of relative survival methodology has primarily been designed for cancer survival studies.

Estimation of expected survival probabilities

Expected survival probabilities are usually estimated from age and sex specific (sometimes also race specific) life tables of the general population for the registry area. At least three different methods have been proposed to estimate expected survival, the so-called Ederer I (Ederer 1961), Ederer II (Ederer and Heise 1959) and Hakulinen (Hakulinen 1982) method. For follow-up times up to 5 years (as reported in this paper) they generally give very similar results.

Age standardisation of survival

Most biological phenomena are related to age; there is no reason to expect that survival is not. It is important to note that use of relative rather than absolute survival does not make age standardisation unnecessary. For many types of cancer, the risk of dying as a result of the cancer itself is clearly associated with a subject's age at diagnosis. The ages at diagnosis of cases of any cancer in the developing and developed countries are vastly different (Parkin et al., 2002). When comparing survival in different groups of patients from different regions, there is a definite need to standardise both absolute and relative survival estimates for age.

For this purpose, direct standardization of survival estimates has been advocated (Parkin & Hakulinen, 1991). This is commonly done by using direct standardization of age specific survival estimates to derive summary statistics called "Age-standardised Absolute Survival (ASAS)" or "Age Standardised Relative Survival (ASRS)". For example, ASAS at the end of some follow-up period 'i' is given by

$$ASAS_i = \frac{\sum_x a_{ix} st_x}{\sum_x st_x}$$

where the a_{ix} are age specific absolute survival estimates at the end of follow-up period t_i and st_x are the age specific proportions used as "standard or weight" for standardisation. The st_x could be arbitrary. Traditionally, the weights have been chosen to reflect the age distribution at diagnosis of some standard cancer population, such as the world standard cancer population (Black and Bashir 1998).

Software used

While absolute survival can be estimated with a large number of commercially available statistical software packages, there are only few specialised programs for relative survival analysis. Analyses can be done using the publicly available SAS macros "periodh" (age specific and crude analysis) or "adperiodh" (age adjusted analysis) to calculate both absolute and relative survival (Hakulinen & Ederer II methods) with either the cohort, complete, semi-complete or period approaches (Brenner et al., 2002).

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Table 1: Example to test for randomness of loss to follow-up: Cox proportional hazards model

Registry	:	
Site of cancer	:	Female breast
Period of registration of cases	:	1992-94
Period of follow-up	:	1992-99
Event studied	:	Loss to follow-up before 31st December 1999 and having a follow-up of <5 years
% Loss to follow-up	:	10.9%

Determinants of loss to follow-up	Loss to follow-up		Relative hazard of loss to follow-up $	
	No.	%	Hazard ratio	95% CI
Age at diagnosis				
<=44 years	53	6.9	1.00	-
45-54	75	10.4	1.63	1.14-2.31*
55-64	89	16.2	2.47	1.76-3.47*
65-74	47	13.7	2.25	1.52-3.33*
75+	9	7.4	1.26	0.62-2.56
Extent of disease				
Localised	129	14.6	1.00	-
Regional	98	8.2	0.54	0.41-0.71*
Distant metastasis	1	0.4	0.05	0.01-0.35*
Unknown	45	26.9	2.40	1.70-3.38*

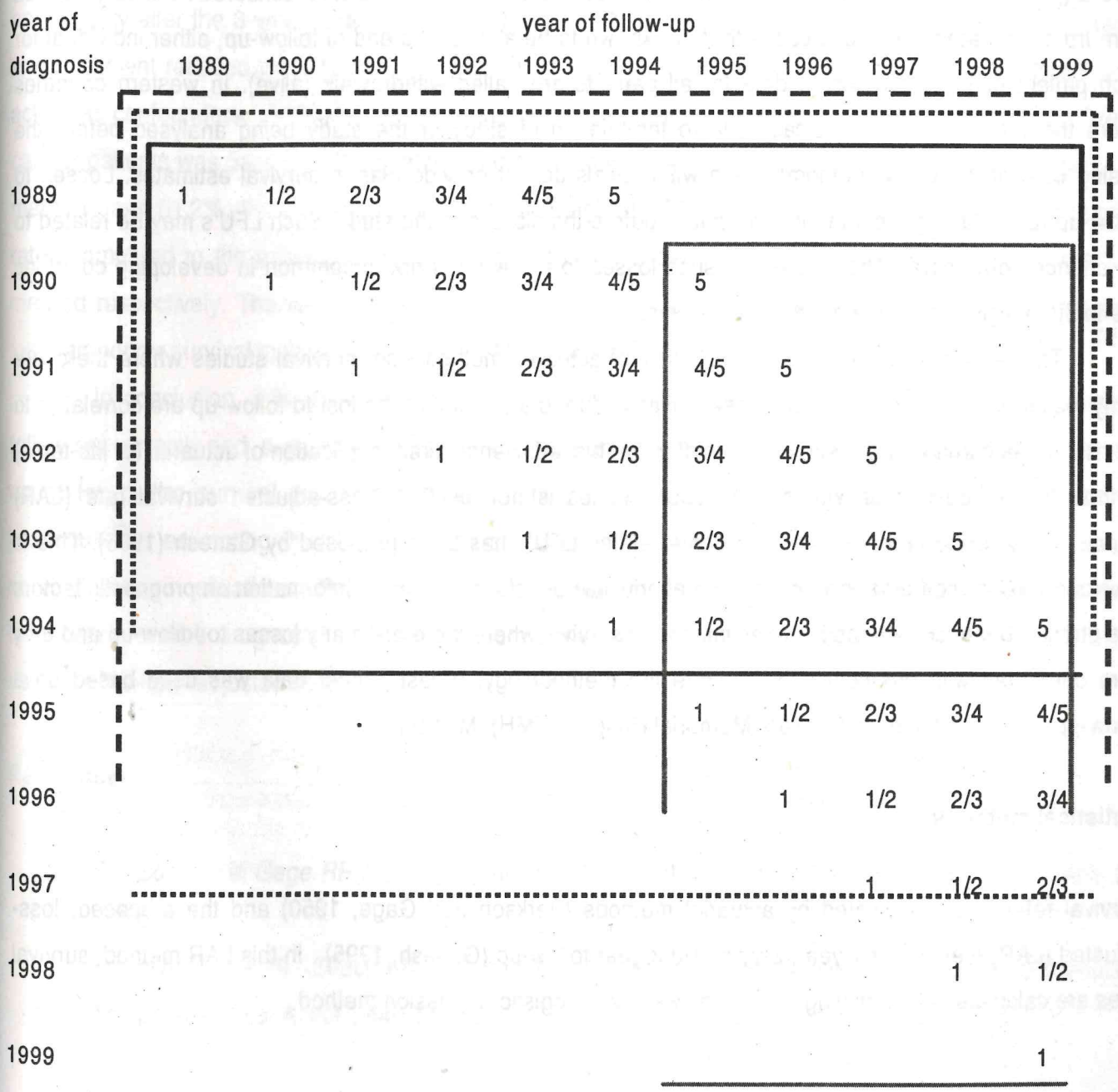
*CI: Confidence interval; * p<=0.05; $ Each factor is adjusted for the other in the table*

Table 2: Illustration of life table & calculation of cumulative survival probability by actuarial method

Interval	Alive at beginning of interval	Last known alive during interval (censored)	No. of deaths during interval	Effective no. at risk	Conditional probability of death	Conditional probability of survival	Cumulative probability of survival (to end of interval)
$t_i - t_{i+1}$	n_i	w_i	d_i	N_i	q_i	p_i	P_{i+1}
0-1	3289	166	365	3206.0	0.114	0.886	0.886
1-2	2758	275	301	2620.5	0.115	0.885	0.784
2-3	2182	37	278	2163.5	0.128	0.872	0.683
3-4	1867	30	191	1852.0	0.103	0.897	0.613
4-5	1646	20	106	1636.0	0.065	0.935	0.573

Figure 1

Illustration of the different types of analysis for deriving up-to-date 5-year survival estimates based on data of patients diagnosed in 1989-1999 and followed until the end of 1999:
Cohort analysis: solid black frame; complete analysis: dashed black frame; semi or partially complete analysis: dotted black frame; period analysis: solid grey frame.
The numbers within the cells indicate the years since diagnosis



EFFECT OF LOST TO FOLLOW-UP IN ESTIMATING SURVIVAL RATES: PROBLEMS & ITS SOLUTION

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Survival is the main measure /indicator of the disease outcome. Actuarial method (Berkson and Gage, 1950) of survival estimation allows utilization of all information independently of the length of follow-up. Patients that have a (potential) follow-up shorter than the time of estimated survival are called 'censored'. Censored cases stem from two categories those cases that are known to be alive at the end of follow-up, either individual for each patient or common closing date for all patients are called withdrawals (alive). In western countries where the withdrawals are basically due to termination of study or the study being analysed before the closing date of the study (random). Such withdrawals do not provide bias in survival estimates. Losses to follow-up (LFU) take place if the follow-up fails before the closure of the study. Such LFU's may be related to the chances of survival. The problem of such losses to follow-up is not uncommon in developing countries due to the deficiencies in the health infrastructure.

The results obtained by the application of actuarial method from survival studies where there are many losses to follow-up tend to be biased. This is due to the fact that the lost to follow-up are correlated to the risk of death and thus the survival estimates are biased. Hence direct application of actuarial (or life-table) method for computing survival rates in such studies is not justified. Loss-adjusted survival rate (LAR) estimation by taking into account of outcome related LFU's has been proposed by Ganesh (1995). This is developed within the framework of the general principle of actuarial method. Information on prognostic factors was utilized to reduce the bias in the estimation of survival where there are many losses to follow-up and they were correlated with prognosis. To illustrate the methodology, breast cancer data was used based on a follow-up study conducted at the Tata Memorial Hospital (TMH), Mumbai.

Statistical methods

Survival rates were calculated by actuarial methods (Berkson and Gage, 1950) and the proposed, loss-adjusted (LAR) method for 1-year, 2-year and 3-year follow-up (Ganesh, 1995). In this LAR method, survival rates are calculated by stratifying method as well as by logistic regression method.

Results

There was a marked difference between the LAR, adjusted for factors such as age, stage of disease, place of residence and treatment and the rates estimated by the crude (actuarial) method (Table 1). The differences became more evident with the step-wise introduction of each of the confounding factors into the adjustment procedure. There was a 1.7% reduction in 3-year survival rate (LAR) compared to the crude rate when adjusted for place of residence though the introduction of age as a confounding factor into the model did not appreciably alter the 3-year survival rate (LAR). Further adjustment for lost to follow-up by stage of disease and treatment reduced the LAR survival rates. This indicated that the stage of disease and treatment were acting as confounders. The 3-year survival rate, adjusted for age, stage, residence and treatment for breast cancer patients was 59.5% by the stratified method and was 54.5% by the regression method. As the crude method gave 61.2%, the estimates are biased suggestively. Thus the LAR yielded a decrease in survival rates compared to the actuarial rates to the extent of 4.7% and 6.7% by stratified method and regression method respectively. The results obtained by the adjustment procedure suggested that patients who were lost had poorer survival than those who were still under observation.

In conclusion, it is stated that the loss-adjusted method provides a way to classify the 'losses to follow-up' correctly and suggest a solution to compute an unbiased survival rate which are closer to the 'real' estimates of the survival rate since prognostic factors have been taken into account in the adjustment procedure for estimating the rates. The proposed method (LAR) could well be a solution for estimating survival rates in situations where lossess to follow-up are quite large and are related to the outcome. Information on the prognostic factors which are associated with the loss to follow-up can be utilized to estimate the loss–adjusted survival.

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Table 1. Number of cases, deaths & 3-year survival rates (%) estimated by actuarial & LAR methods among breast cancer patients diagnosed at TMH, Mumbai in 1985.

Prognostic factor	No. of cases	No. of deaths	Survival -actuarial	LAR*
Age (in years)				
< 45	101	34	60.1	51.5
45-54	117	42	56.7	48.7
55-64	77	20	67.7	62.3
65+	41	12	65.4	58.5
Residence				
Residents (Bombay)	169	60	59.4	56.2
Non resident	167	48	63.2	54.4
Stage of disease				
I	21	2	92.2	93.2
II	160	36	74.4	71.2
III	126	55	41.2	31.8
IV	21	15	0	0
Treatment				
No chemotherapy	194	39	76.6	71.2
Chemotherapy	142	69	38.1	28.2

** Loss-adjusted survival adjusted by logistic regression model for the other prognostic factors*

TIME-TREND STUDIES WITH EMPHASIS ON CANCER

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Introduction

Examination of incidence and mortality of a disease have been changing over time is of interest for several reasons. These may lead to three questions; how the disease risk has been changing? Why? and what is likely to happen in the future? From these questions a fourth one naturally arises, namely, what can be done to reduce the likely future burden of the disease? A society is often confronted with the question of whether or not a particular disease is on the rise in its population. Addressing this issue requires a careful look at patterns of disease incidence and/or mortality over time considering the demographic changes in the population during the same period. A thorough assessment of temporal trends will account for long latent periods between the exposure and the onset of a disease, the changing age-specific incidence or mortality rates of the disease over time, and specific periods in time affecting the risk of disease as well as changing exposure to various risk factors. Epidemiological studies examine disease incidence and moratality rates over time in relation to varying demographic patterns in the population. Such time trend studies can offer hypotheses for further research including the investigation of etiological factors, the impact of treatment on survival and the efficacy of screening tests.

Often time-trend studies are more exploratory in nature and offer a first glance at the relevant issue or confirm suspicions of an alarming trend (e.g. increasing incidence of esophageal adeno carcinoma in the U.S.). In other cases, these studies are more analytic and are carried out to review a large body of evidence between an exposure and disease, often with the purpose of determining health policy planning. For example, well conducted studies in the Nordic, North American and European countries have influenced health care policies with respect to cervical cancer and Pap smear, breast cancer and mammography screening, lung cancer and tobacco smoke exposure as well as melanoma and exposure to the sun. Researchers from developing countries have conducted time trend studies on cancer, highlighting the increasing burden of this disease in these societies and the distinct site-specific patterns observed in their population (Yeole BB 1997).

Conducting a study on temporal patterns of cancer required the existence of a comprehensive and stable cancer registration system, one which has had systematic methods of data collection in place over an extended period of time, for a defined geographic population. Reliable census information on the base geographic population (or population at risk) in 5-year-age- and sex-specific groups is equally important. The most critical factor in implementing such a study is the interpretation of data, often limited by the level of detail available at the population level (i.e. on risk factor distributions). It is difficult to discern whether any observed

changes in disease frequency are attributed to variation in risk factor exposure, different biological processes, improved detection or diagnostic methods, increased awareness in the population or changes in health care policy. Despite the difficulties in interpreting time trend data, conclusions can be made regarding the probability of whether observed trend is likely due to a variation in risk over calendar time, across age groups and/ or between persons born in successive generations using a temporal analysis of data often referred to as age, period, cohort effects analysis.

Methods of time trend analysis

There are various methodological approaches to analyze epidemiological data on temporal trends. The use of the method underscores the intent of the analysis. Descriptive studies rely solely on the use of graphical displays of data while analytic studies focus on the quantitative contribution of age versus calendar period effects through the use of age-period-cohort modeling. The optimal approach will utilize multiple strategies for representing, analyzing and interpreting the data.

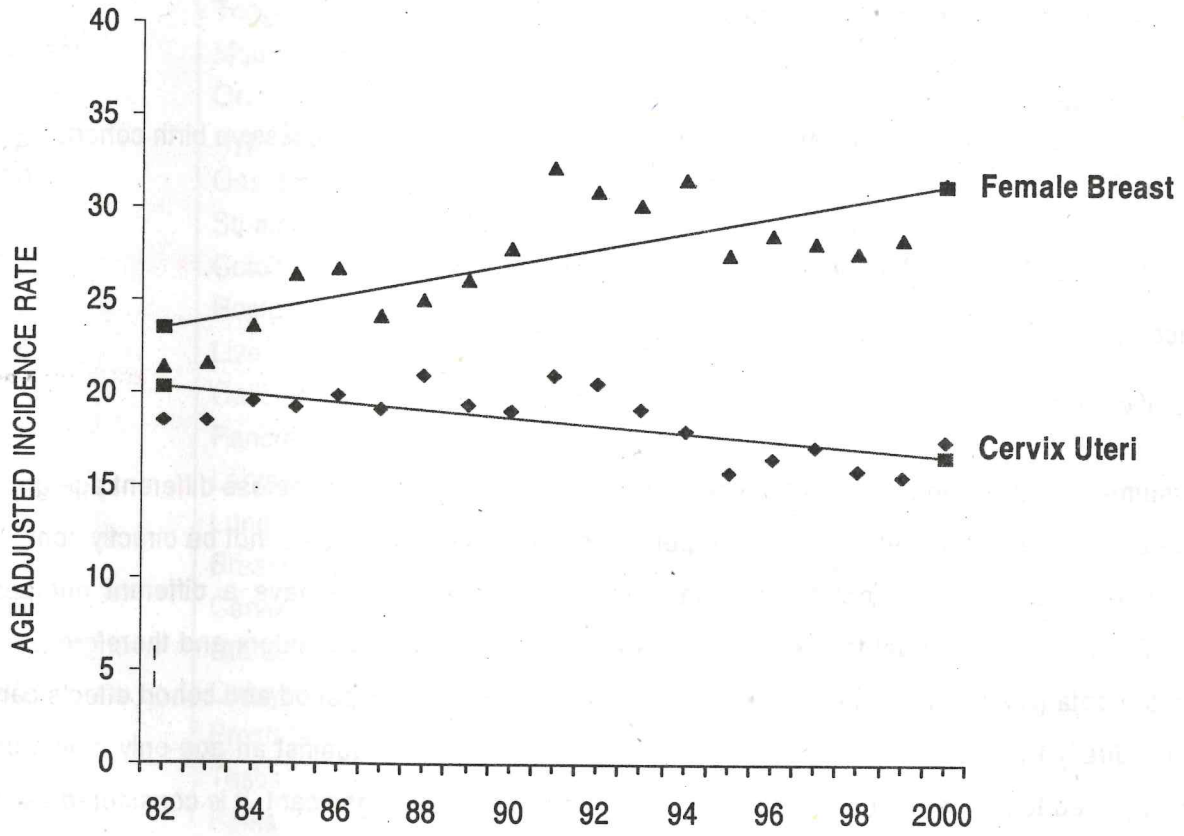
The major methods used for conducting time trend analyses include graphical displays, (Fig.1) the mean annual percentage rate of change (APC) in age-standardized rates (Table 1) and modeling of age, period and cohort effects (Table 2). While one should not underestimate the importance of representing data in graphical form, the sole use of this method is insufficient and can lead to erroneous interpretations. For example, early descriptive analyses of smoking and lung cancer among U.S. males graphed lung cancer mortality rates by age in 1980 and showed that the age specific mortality rates continued to increase to 70-79 years, after which age the rates declined. Some incorrectly interpreted these data to suggest that after a certain age, the risk of developing lung cancer from smoking actually decreased- that is, if a smoker could survive beyond the peak age-specific risk, he/she has a higher chance of surviving from lung cancer. A more in-depth analysis revealed changing patterns in smoking among generations of smokers whereby persons born in earlier cohorts were less likely to smoke, thereby explaining the lower mortality rates observed in 1980. Graphical displays of data include cross-sectional snapshots of age-specific rates at different points in time and longitudinal representations across different birth cohorts, yielding additional information about the effects of calendar time and generation on observed rates.

One statistical approach that is often used is the overall or average annual percentage change (e.g. AAPC) in age-standardized rates (ASR). The calculation is derived from a linear regression model whereby calendar time (y) is used to predict the natural logarithm of the age-standardized rate according to the following formula:

$$y = \alpha + \beta x \qquad y=\ln(ASR)$$

The AAPC is then estimated as 100*(e $^{\beta}$ -1). The null hypothesis is that the slope of the line (β) is equal to zero (DE Vries et al 2003). An important assumption underlying this approach is that the change in logarithm of the rates is constant over time or that the age specific incidence curves of successive time periods are parallel on logarithmic scale. If the ASR tends significantly vary from one age group to another, such an analysis could yield misleading results. An alternative strategy to this scenario is to examine trends in age-specific rates only, but the limitation of this approach is the difficulty in providing a summary of the data. This can be especially problematic for large, heterogeneous populations or for comparisons across multiple countries.

Figure 1. Trends in age-standardised incidence rates of female breast & cervix cancers, Mumbai, 1982-2000



In terms of providing a statistical summary of the data, the age-period-cohort (APC) modeling approach offers a superior alternative to the others as it summarizes and quantifies the statistical significance of time –related factors on three dimensions- the age, calendar period and birth cohort scales. The well-known limitation in APC modeling is the problem of 'non-identifiably' whereby different sets of parameter values can lead to identical descriptions of the data (Clayton and Schiffler, 1987). Below we consider three models including age for the analysis of temporal variations of age-standardized rates of a disease.

1. Age-period model

In the age-period model, the age-specific curves are parallel across different time periods on a logarithmic scale (Clayton and Schiffler, 1987).

$Y_{ap} = \alpha_a + \delta_p (p-p_0)$

Y_{ap}= logarithmic rates of Y for the a^{th} group during the p^{th} period

p_o= reference period

α_a = age-specific rates

Standard errors and confidence intervals corresponding to the estimates can be calculated to assess the reliability of the estimates. Curves that are shifted upwards for later periods in time are interpreted to mean that calendar time has an effect on increasing the age-specific incidence rates. The assumption is that the change in effect between two successive time periods is constant between the two age groups or that the ratio of age-specific rates is constant across calendar time.

2. Age-cohort model

In the age-cohort model, the logarithmic age-specific rates are parallel across successive birth cohorts.

$Y_{ac} = \alpha_a + \delta c (c-c_0)$

Y_{ap} = logarithmic rates of Y for the a^{th} group during the c^{th} birth cohort

C_0 = reference birth cohort (should be a central cohort with reliable data)

α_a = age-specific rates

Here, the assumption is that the change attributable to a cohort effect is constant across different age groups and therefore assumes no period effect. The age-period and age-cohort models cannot be directly compared against one another as they are not hierarchical and they will necessarily have a different number of parameters. The age-cohort model for example, will always contain more parameters and therefore provide a better fit of the data (Clayton and Shifflers, 1987). However, significance of period and cohort effects can be assessed individually by comparing the age-period and age-cohort models against an age-only model using deviance chi-squared tests. When both the period and cohort effects are significant, it is considered as 'drift' whereby the observed temporal variation of rates does not distinguish between cohort and period effects (Clayton and Schifflers, 1987) or alternatively that either model describes the data equally well.

3.The age-period-cohort model

In this model, the logarithmic rates are dependent on age, calendar time and birth cohort:

$Yacp = \alpha_a + \beta c (c-c_o) + \delta p (p-p_0)$

Here, hierarchical likelihood ratio tests can be conducted to compare each of the individual effects against the saturated age-period-cohort model and effectively, the age-period and age-cohort models can be compared with each other. But if both the period and cohort effects are significant, the identifiably problem of specifically ascribing 'drift' to either of these two effects will remain (Clayton and Schifflers 1987). One needs to be careful in interpreting the parameters and significance tests of age-period-cohort models as there can be multiple explanations for the same observed data, and therefore an ability to distinguish the relative importance of period or cohort influence over the other.

Table 1 : Regression Estimates of Average Annual Percentage Change in Age Adjusted Incidence Rates of Cancers by Site and Sex, Mumbai, (1982-) 2000

ICD9	Site	Average Annual % Change (APC)	
		Male	Female
141	Tongue	0.81 ns	-0.53ns
143-145	Mouth	-0.02ns	-0.18 ns
146	Oropharynx	-2.52**	-2.53ns
148	Hypopharynx	-3.83***	-2.96*
150	Oesophagus	-2.80***	-2.80***
151	Stomach	-1.99**	-2.58***
153	Colon	1.04 ns	0.81ns
154	Rectum	-0.72ns	-0.55ns
155	Liver	1.52**	1.00ns
156	Gallbladder	4.23**	4.42***
157	Pancreas	0.16ns	1.39 ns
161	Larynx	-1.43*	-2.44**
162	Lung	-1.55*	1.29ns
174	Breast	-	1.59***
180	Cervix	-	-1.11**
179 &182	Uterus	-	2.00***
183	Ovary	-	1.54**
185	Prostate	1.29*	-
186	Testis	-1.17*	-
187	Penis	-4.65***	-
188	U Bladder	1.62*	2.21*
189	Kidney	3.65***	4.01***
191-192	Brain	3.92***	4.60***
193	Thyroid	-0.35ns	1.12 ns
200-202	Lymphomas	3.96***	4.24***
204-208	Leukamias	1.14*	1.52***
140-208	All Site	-0.73ns	0.34ns

ns -not significant, * -significant at .05 level, ** -significant at 0.01 level, *** -significant at 0.001 level

Table 2. Age-period-cohort model employed for cancer sites by sex, Mumbai

Site	Sex	Final Model Employed*	Age Groups	Extrapolation** Cohort	Period
Tongue	M	A + C	30+	D	-
	F	A + C	35+	D	-
Mouth (Other)	M	A + P	35+	-	C
	F	A + C	25+	C	-
Oropharynx	M	A + C + P	35+	C	C
	F	A + C	45+	D	-
Hypopharynx	M	A + C + P	30+	C	C
	F	A	30+	-	
Oesophagus	M	A + C	25+	C	-
	F	A + C	25+	D	-
Stomach	M	A + C	25+	D	-
	F	A + C	30+	D	-
Colon	M	A+ C + P	35+	C	C
	F	A + C	30+	C	-
Rectum	M	A + C	25+	D	-
	F	A + C	30+	I	-
Liver	M	A + C + P	30+	I	C
	F	A + P	35+	-	C
Pancreas	M	A + C	35+	I	-
	F	A + C	45+	I	-
Larynx	M	A + C + P	35+	C	C
	F	A + C	35+	C	-
Lung	M	A + C	35+	C	-
	F	A	30+	-	-
Bone	M	A + C + P	10-64	C	C
	F	A + C	0-64	C	-
Connective tissue	M	A + C + P	20-74	I	C
	F	A + C	0-64	I	-
Skin	M	A + C	30-74	I	-
	F	A	35+	-	-
Breast	F	A + C	20-74	I	-
Cervixuteri	F	A + C	25+	D	-
Corpusuteri	F	A + C	35+	C	-
Ovary	F	A + C	15+	I	-
Prostate	M	A + C	45+	C	-
Testis	M	A + C	15-54	I	-
Penis	M	A + C	30-74	C	-
Bladder	M	A + C	30+	I	-
	F	A + C	30+	I	-
Kidney	M	A + C	35-74	C	-
	F	A	35-79	-	-
	F	A + C	0+69	I	-
Thyroid	M	A + C	30-74	I	-

Table 2 cont...

Site	Sex	Final Model Employed*	Age Groups	Extrapolation* * Cohort	Period
Thyroid	F	A + C	15-69	I	-
Hodgkin's disease	M	A + C + P	0-69	I	C
	F	A + C	0-69	I	-
Lymphomas	M	A + C + P	0-84	C	C
	F	A + C + P	0-74	C	C
Lymphatic leukaemia	M	A + C	0-84	C	-
	F	A + C	0-74	I	-
Myeloid leukaemia	M	A + C	0-84	C	-
	F	A + C	0-69	C	-
Other sites	M	A + C	0-84	C	-
	F	A + C	0-84	C	

* A = Age, C = Cohort, P=Period, ** D = Decreasing, I = Increasing, C = Constant, - = Not Applicable

Limitations and Errors

The information behind trends in incidence or mortality forms the scientific basis for planning and organization of prevention, diagnosis and treatment of a disease in a community. A trend, however, always represents a summary curve of changes that have occurred within different groups of people living under different conditions. An increase or decrease in incidence, to a large extent can arise from artifacts, such as changes in diagnostic accuracy, changes in coding practice, differences in autopsy rate, and in the percentage of cases examined microscopically etc. As a result, there are considerable limitations and errors in the evaluation of trends in incidence or mortality of a disease. Interpretation of trends can be effected correctly only after ascertaining their reliability.

When we study trends in incidence or mortality from a particular cancer registry, the data should be reliable and complete. From the diagnostic point of view, the cases registered over a period of time should have a high percentage of microscopic confirmation and a low percentage of cases diagnosed by death certificate alone. At all times all sources should be tried for collecting the required data.

Strict definition should be adopted for inclusion or exclusion of cancer cases throughout the entire period of study. Much attention should be given to this issue when trends are compared with other registries. For example, the difficulty in defining cancer is illustrated by the so-called carcinoma in situ lesions. In some geographical areas, these lesions are registered as malignant tumors. The classification problem of papillomas of the bladder is another example of difficulties in defining cancer. In some registries during some time periods papillomas are included and some times they are excluded in the incidence of urinary bladder cancer. Furthermore, in some registries and during the same time periods they are called carcinomas instead of papillomas. A significant difficulty in the interpretation of

cancer trends is created when tumors can be classified on two or more axes. During some time periods they may be classified topographically, during others, according to morphological or some other criteria. Tumors of lymphatic tissue provide a good example (Barekat et al, 1971: Saxen, 1979). In some series malignant lymphomas are grouped under tumors of the lymphatic tissue; in other series with reference to the primary site.

Observer variation is another great problem in the histologic classification of tumors. A considerable level of observer disagreement has been shown in studies dealing with lung cancer (Feinstein, 1973), cervical cancer, malignant lymphomas (Hakama et al. 1973; Symmers, 1968), and thyroid cancer (Saxen et al. 1978).

Mass examinations (screenings) have a definite effect on trend curves and also on the frequency of biologically different tumors included in the trends. The reason for this is simply that slow growing tumors are always more frequently diagnosed through mass examinations than they are under normal conditions.

There should be a practice of census at regular intervals of times for registry areas. Population figures by age and sex should be made available from the census department. Population estimates for required years should be made on a scientific way i.e. taking into consideration the population components such as fertility, mortality and migration.

While interpreting trends, changes in coverage areas under the period of study, problems with the starting registration system and difficulties in the registry conduction should also be taken into consideration.

Appendix

Incidence Trends

For evaluation of incidence trends we have 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., where the trends at different ages are examined.

The regression equation used is shown below:

$$Y=(A)\,(B)^x$$

Or $\log Y=a + bx$, where

Y = Estimated (expected) annual incidence rate per 100, 000 population.

x = Calendar year minus 1964

$a = \log y - b\,x$, where

y= observed annual incidence rates 1964 through 1972, and

$$b = \frac{\Sigma\,(x-\bar{x})\,(\log y - \log \bar{y})}{\Sigma\,(x-\bar{x})^2}$$

The variance of the regression coefficient b, is

$$S_b^2 = \frac{S^2}{\Sigma(x-\bar{x})^2} \text{ where}$$

S^2 , the variance around the regression line is defined by the formula

$$S^2 = \frac{\Sigma(\log y - \log \bar{y}) - b\,\Sigma(x-\bar{x})\,(\log y - \log \bar{y})}{n-2}$$

Here n is the number of observed incidence rates on which a given regression is based, i.e. n =9 years.

From the equation log y =a + b x follows $Y = (A)(B)^x$, where $A=10^a$ and $B= 10^b$. A thus represents the expected (estimated) incidence rate in 1964 and (B-1) 100, the average annual percentage change seen between 1964 through 1972.

Formally, the significance test for regression coefficient b is based on the "t" test with 8 degrees of freedom and is computed from the formula:

$$t = \frac{b}{S_b}$$

It can be demonstrated, however, that when b and S_b are small (of the order of 0.01), the b/s_b equals nearly the expression $\frac{10^b-1}{10\,S_b-1}$

This expression means:

Mean annual percent chance (in incidence)

Standard deviation of the annual percent changes (in incidence)

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Section III

Highlights from cancer registries

HOSPITAL BASED CANCER REGISTRY, MUMBAI

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Principal Investigator: *Dr. K A. Dinshaw*

Officer-in-charge: *Dr. B Ganesh*

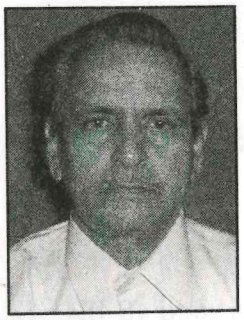
The Tata Memorial Hospital (TMH) established in 1941 is a pioneer institute in cancer diagnosis, treatment and research in India. Although TMH has compiled data since 1941, it joined the network of national cancer registry programme (NCRP) in 1984 and continues to submit data to the NCRP annually. During the year 2001, a total of 21,894 cases were registered at TMH of which the number of cancer cases were 16,154. Of these cancer cases, 9096 were males and 7058 were females. There were 7649 cases from the state of Maharashtra (Mumbai: 3037). Majority of other patients were from Madhya Pradesh (1220), Uttar Pradesh (1702) and Bihar (1376). The geographical distribution of cancer cases seen by TMH showed an increase in the cancer cases originating from the north-eastern states during this period. The average age at diagnosis was 56.7 years. Of the 16,154 cancer cases, 12,011 were new cases meaning that these were neither diagnosed nor underwent any treatment prior to visiting TMH. Around 92% of cases were diagnosed microscopically (including cytology and bone-marrow), 1319 (8.2%) by x-ray and other imaging techniques and only 6 patients (0.04%) were based on clinical status. More than one primary cancer was diagnosed in 24 cases and these cases were excluded from analysis.

The five leading sites of cancer among males were leukaemia, lung & bronchus, buccal mucosa, lymphoma and esophagus, and among females the leading sites were breast, cervix, ovary, leukaemia and esophagus. Among males, there was an increase in the number of prostate cancer cases over the years. Among females, besides noting an increase in breast cancer cases, there has been an increase in the number of gall bladder cancer reported at TMH over the years. System-wise distribution of cancer showed that head and neck cancer constituted 24% (n=3870), gastro-intestinal tract 14.0% (n=2269), respiratory 9.2% (n=1486), genito-urinary 16.7 %(2673), bone & soft tissue 3.9% (n=626) and lymphoma & leukaemia 14.0% (n=2265). In the pediatric group (0-14 yrs), there were 820 cases of whom 550 were boys and 270 were girls. Leukemia, lymphoma, nervous system and bone tumors formed 72.2% of all pediatric cancers.

Of the 12,011 new cases, 5399 cases received treatment, either as a single modality or as a multimodal treatment. Of these new cases, 27% were treated by surgery alone, 16% by radiotherapy alone, 20% by chemotherapy alone and 37% received combination therapy.

Retirements

Mr.Rao & Mrs.Pushpa Mangalvede who worked in cancer registry, TMH, Mumbai & retired on 31 October, 2004.



Mr.D.Nagaraj Rao (Photograph)

Mr. D. Nagaraja Rao joined the Tata Memorial Hospital as junior statistician in 1971. After 34 years of service he retired on October 31, 2004. It was during his tenure the medical records and statistics division of TMH entered the era of electronic data processing. It was a challenge and Mr. Rao whole heartedly involved in this and devoted his entire energy and services to make use of the IT technology in medical data processing. Some of the contrivances used in the seventies for such work may be found only in museums now. For cancer data processing there was the 40 column IBM punch cards, punching machine and a card-sorting machine, which probably expressed disapproval through the consistent noise it made during its working. Then came the 80-column punch card. This enlarged the data storage capacity. The data after coding was keyed in on to the 80-column card and data sorted by an electrical sorting machine. In TMH, 80-column card-punching machine was available. But the sorting machine was available only in Tata Institute of Fundamental Research (TIFR) in Colaba. Mr. Rao ardently took upon the job and for several days and months he transferred the punched data cards in boxes to TIFR and back. The travel from Parel to Victoria Terminus was by sub-urban train and then by taxi or by bus to TIFR. He could use the sorting machine as and when available. It was an ardous task, physically and scientifically but Mr. Rao did not give up. Later in early 80's the electronic data processing was introduced in TMH and the medical records and statistics department was the first to use the technology. Mr. Rao and his colleagues produced several monographs and annual registry reports using the electronic data processing capabilities. Monographs on head and neck cancer and breast cancer are some of the outstanding statistical contribution in this regard. His diligence, sincerity and commitment to the work and the statistical skill he acquired have earned credits to the TMH and to the department of medical records and statistics.

Mrs.Pushpa Mangalvede

Mrs.Pushpa Mangalvede retired from the services of Tata Memorial Hospital on 31st October 2004. Mrs.Mangalvede joined the TMH in 1969 and worked as data processing assistant for 36 years in the medical records and statistics department. She was handling cancer registry data processing, abstracting, coding, follow-up etc.

A conscientious worker, she earned respect and regard from all her colleagues through hard work, pleasant manners and cordial relationships.

Wishing all the best in the retirement years.

(Information given by Mr. P. Gangadharan who had earlier worked along with Mrs. Pushpa Mangalvede)

Workshops/ Seminars organized

1. One-Day Seminar on 'Medical Records Management, Biostatistics and Epidemiology'

This course was hosted at the department of medical records, biostatistics and epidemiology (Organizing Secretary: Dr B.Ganesh) on 26 October 2004 at Tata Memorial Hospital, Mumbai. The seminar was represented by eminent speakers from different specialties like Dr. PC Gupta, Dr. Suhas Prabhu, Dr. SS Shastri and Dr. R Badwe. The topics covered areas such as ideal medical record management for good patient care, current status of epidemiological research, an orientation on basic statistical concepts and functions and purpose of cancer registries. The department participated in delivering lectures on cancer registry and application of statistics etc. The seminar was well attended and encouraging.

2. An International Course: Introduction to Public Health Research Methods

This course was held between 21-24 March 2005 at TMH, Mumbai (Course Director: Dr. B.Ganesh). The course instructors were Dr. James Hebert, ScD, University of South Carolina, Arnold School of Public Health,

Dr.Glorian Sorensen, PhD, Harvard University School of Public Health and Dr. PC Gupta, ScD, Healis-Sekhsaria Institute of Public Health.

The course objectives were to:

1. Understand how to apply the criteria used for judging causality relationships between health outcomes and putative risk factors.
2. Understand and be able to apply basic principles of study design in public health.
3. Be able to identify the research design most appropriate for a given public health research question.
4. Be able to identify threats to validity in study design/ interpretation of results (e.g., confounding, bias, random error, misclassification).
5. Be able to distinguish between confounding and effect modification.
6. Be able to interpret study results using odds ratios, relative risks, and other measures of association.
7. Begin to develop the basic skills needed for writing research proposals.

The course was a combination of lectures, discussions, and student presentations. Students participated in a group assignment aimed at designing a study; each group presenting their study within the context of class discussions. It is proposed to hold such courses on a periodical basis. This course was attended by doctors and research workers from Mumbai as well as from other parts of India.

Meetings/ Workshops/Conferences attended

Mr. Nagendra G Shastri, Statistical asst., Mumbai Cancer Registry, attended the International Summer School Programme on cancer registration and application in epidemiology organized by International Agency for Research on Cancer, at Lyon, France, from 27th June to 15th July-2005.

POPULATION BASED CANCER REGISTRY, MUMBAI

Indian Cancer Society, Parel, Mumbai – 400 012.

Principal Investigator:	*Dr. A.P. Kurkure*
Co-investigator	*Dr. B.B. Yeole*

Honors and Distinctions

Dr. B.B. Yeole

1. Worked as Advisory Committee Member of the Indian Council of Medical Research (ICMR), New Delhi for the project on "Assessment of Burden of Non-Communicable Diseases" on 18th October 2004 and for the project on "Cancer ATLAS in India" on 12th May 2005.
2. Invited lecture, Seminar on "Current Issues in Public Health in India" organized by "School of Public Health, Pune and delivered lecture on "Epidemiological Assessment of Cancer in Maharashtra, India" 23-24 March 2005.
3. Invited lecture, Workshop on "Epidemiological Studies" organized by Reactor Safety Division of Bhaba Automatic Research Centre (BARC), Mumbai and delivered lecture on "National Cancer Registry Programme (NCRP)" on 10th June 2005.
4. Invited to attend Workshop to discuss a report on Tobacco control in India organized by Tata Institute Fundamental Research, (TIFR), Mumbai on 23-25 August 2004.
5. Faculty member, Training programme on cancer case abstracting, staging and coding organized by National Cancer Registry Programme (NCRP) of Indian Council of Medical Research (ICMR) in collaboration with National Cancer Institute, USA at Gangtok 6-10 December 2004.

Meetings/ Workshops/Conferences attended

Dr. B.B. Yeole

1. Attended the Annual Review Meeting of cancer registries and Workshop at Gangtok, Sikkim during 1-4 December 2004. Presentations (i) Findings of the Mumbai Cancer Registry data for the year 2001 and (ii) Historical background and findings based on the data collected by Pune, Nagpur and Aurangabad registries.
2. Invited to attend 3rd APOCP Regional conference on Asia Pacific Organization for Cancer Prevention, 25-27 April 2005 at Rasht, Iran. Chaired the "Symposium 1: Lower GI Cancers" and delivered a lecture on "An Epidemiological Assessment of Gastro-intestinal cancers".

3. Invited to attend 26th Annual Meeting of the International Association of Cancer Registries, Beijing, China, during 14-16 September 2004 and delivered a lecture on "Population-based survival from cancers having a poor prognosis in Mumbai (Bombay), India".
4. Invited to attend the Workshop on Prevention and early detection of cancer in Asia, organized by Indian Cancer Society in collaboration with Tata Memorial Hospital, UICC, Mumbai during 28-29 August 2004.

Training Programmes attended

1. Mr.Santosh Dubal, Mr.Kishor Salvi, Mr.Dilip Bansode, Mr.Vivek Daunde, Ms.Madhuri Khandekar, Ms.Mandakini Pagare, Ms.Reshma Kalamkar, staffs of the registry attended the Seminar on Medical Records, Biostatistics and Epidemiology organized by Tata Memorial Hospital, Mumbai on October 26, 2004.
2. Mrs. Mandakini Pagare (Mumbai), Mrs.V.V.Jahagirdar (Pune), Mrs.Ratnamala Kamble & Mrs. Varhade (Nagpur), Mr.Waghmare (Aurangabad) participated in the workshop on cancer registration at Gangtok, Sikkim organized by the National Cancer Registry Programme (NCRP) of Indian Council of Medical Research (ICMR).
3. Mr. Atul Pawar attended International Course on "Epidemiological Practices in Cancer for Beginners/ Investigators" organized by Tata Memorial Hospital, Mumbai during 21-24 March 2005.

Appointments

1. Mr.K.K.Gavit, has been appointed as "Medical Social Worker" since 1st February 2005.
2. Mr. Harish Upadhyay, has been appointed as "Medical Social Worker" since 30th March 2005.

Foreign Visitors

1. Dr.Daniel Roseanbarg, PhD, MPH, Director, Asia Pacific Epidemiology, Singapore, visited on 7th January 2005.
2. Dr.John G Well, MD, MRCP, MFPHM, Sr. Director BDS, Worldwide Epidemiology, Essex, United Kingdom, visited on 7th January 2005.
3. Dr.Deven Parmar, MD, Sr. Medical Advisor, Glaxo Smith & Kline Pharmacutical Ltd, visited on 7th January 2005.
4. Dr.James R Hebert, MSBH, ScD, Director, Cancer Prevention and Control, South Carolina Cancer Center, Columbia, USA, visited on 22nd February 2005.

5. Glovian Sorenson, PhD, MPH, Prof., Harvard School of Public Health, Boston, USA, visited on 22nd February 2005.
6. Ritu Vidhani, Product Research Executive, Emmellen Biotech Pharmacutical Ltd, Mumbai, visited on 26th February 2005.
7. Lovelina D'Souza, Manager, Mckinesy & Company, Mumbai, visited on 30th March 2005.
8. Jindal Tyagi, Marketing Manager & D. Mohan Product Manager, Novartis-Oncology, visited on 16th February 2005.
9. Dr.Ketan Shah, Dr.Reddy's Laboratory's Hyderabad, visited on 27th September 2004.
10. Dr.Sankaranarayanan, Scientist, International Agency for Research on Cancer, Lyon, France, visited on 28th December 2004.
11. Jerome W. Yates, MD, MPH, National Vice President, Research, American Cancer Society, visited on 16th November 2004.
12. Nathan Grey, National Vice President for International Affairs Special Assistant to the CEO, American Cancer Society, visited on 16th November 2004.
13. Linda Wang, Marketing Manager, Kodak (China) Company Ltd, Beijing Office, visited on 20th October 2004.
14. Leena Chandrashekhar, General Manager, Kodak India Ltd., visited on 20th October 2004.

Current Projects

1. Population based survival rates for major cancer sites registered during 1995-1999 in Mumbai Cancer Registry (Collaborator: International Agency for Research on Cancer, Lyon, France).
2. "Development of Cancer Atlas in India"
   (Collaborator: National cancer registry programme (NCRP), Indian council of medical research).
   Data collection on non-resident cancer cases registered from 2001 to 2004 in Mumbai (except for cancer cases registered in Tata Memorial Hospital, Mumbai), Pune, Nagpur, and Aurangabad Cancer registries.
3. Coding and data entry of Aurangabad Cancer Registry data using CANREG-4 software.
   (Collaborator: International Agency for Research on Cancer, Lyon, France).
4. Entering Name (first, Middle, Surname) for all the incidence cases for the year 1964-85 of Mumbai Cancer Registry (Collaborator: International Agency for Research on Cancer, Lyon, France).

Post-doctoral programme

Dr.Preet Dhillon from Fred Hutchinson Cancer Research Center, Seattle, Washington, is working as a post-doctoral fellow under the supervision of Dr.B.B.Yeole, Mumbai Cancer Registry. Her topic is on cancer incidence trends in Mumbai for major sites for the period 1976-2000.

Research Publications

1. BB Yeole, AV Kumar. Population-based survival from cancers having a poor prognosis in Mumbai (Bombay), India. Asian Pacific J Cancer Prev, 5,175-182, 2004.
2. Lizzy Sunny, BB Yeole, R Shiri, S Mathews, Falah Hassani K, SH Advani. Decreasing trend in the incidence of stomach cancer in Mumbai, India, during 1988 to 1999, Asian Pacific J Cancer Prev, 5(2), 167-172, 2004.
3. Lizzy Sunny, BB Yeole, M Hakama, R Shiri, PSRK Sastri, S Mathews, SH Advani. Oral cancers in Mumbai, India: A fifteen years perspective with respect to incidence, trend and cumulative risk, Asian Pacific J Cancer Prev, 5(3), 294-300, 2004.
4. BB Yeole, Venkata Ramana Kumar, Arun Kurkure, Lizzy Sunny. Population-based survival from cancers of breast, cervix and ovary in women in Mumbai, India. Asian Pacific J Cancer Prev, 5(3), 308-315, 2004.
5. Lizzy Sunny, BB Yeole , M Hakama, AP Kurkure, S Mathews, NG Shastri, SH Advani. Cumulative risk and trends in prostate cancer incidence in Mumbai, India, 1986 to 2000. Asian Pacific J Cancer Prev, 5(4), 401-405, 2004.
6. AV Ramana Kumar and BB Yeole. Coping mechanisms among long-term survivors of breast and cervical cancers in Mumbai, India. Asian Pacific J Cancer Prev, 6(2), 189-194, 2005.
7. AV Ramana Kumar and BB Yeole. Assessing cancer burden in rural India: An analysis by cause of death statistics. Asian Pacific J Cancer Prev, 6(2), 221-223, 2005.
8. BB Yeole. Epidemiology of cancer in particular reference to India. In Cancer: A cytogenetic and molecular approach. (ed) V. Rai, Alahabad, 29-38, 2005.
9. AP Kurkure, BB Yeole, Lizzy Sunny, SS Koyande. Cancer incidence and mortality in Greater Mumbai, 2001, published by Indian cancer society, Mumbai, 2005.

HOSPITAL BASED CANCER REGISTRY, BANGALORE

Kidwai Memorial Institute of Oncology, Bangalore

Principal Investigator : *Dr. P.S. Prabhakaran*

Co-investigator : *Dr. K Ramachandra Reddy*

Associate Professor : *Dr. C. Ramesh*

Cancer registration system at Kidwai Memorial Institute of Oncology (KMIO), Bangalore, has been in existence since the inception of this institute in June 1973. However, the Indian Council of Medical Research has included the hospital based cancer registry (HBCR) in its net work programme of the National Cancer Registry Programme (NCRP) in the year 1984. Since then, the registry has been sending data in the pre-devised format on all cancer patients to the co-ordinating wing of the NCRP. The HBCR of KMIO has been the main source of registration for the population based cancer registry (PBCR), Bangalore. About 40% of the cases registered in the PBCR are from KMIO. The HBCR records about 15,000 new cases annually.

During the period from 1984–2002, a total number of 203,961 new cases were registered, out of which, 133,032 (65.2%) cases were diagnosed as cancer cases. Though a steady increase is observed in the newly registered cases, a noticeable decline in the proportion of confirmed cancer cases is observed over the years. One of the possible reasons for such a decline could be several hospitals that have come up in the registry area with specialized facilities for cancer diagnosis and treatment. KMIO being a government funded hospital, the diagnosis and treatment charges are considerably low and patients who could afford might have gone to the private hospitals.

During the year 2002, a total number of 14,229 new cases were registered, of which 8,141 cases were confirmed as cancer cases accounting for 57.2%, with the male /female ratio of 1:1.21. Paediatric malignancies (0-14 years) accounted for 5.2% of total cancers. Sites of cancers that are common among males are cancer of the pharynx followed by oesophagus, leukaemia, stomach and lymphoma. Among females, cancers of cervix and breast continue to be the leading ones with a decreasing trend in the percentage of cervical cancers and increasing trend in the percentage of breast cancers. Other common cancers among females are cancers of the mouth, oesophagus and ovary. Tobacco related cancers (TRC) accounted for 45% of all cancers in males and 22% of all cancers in females. When proportions are considered among the TRCs, about 32% of them are pharyngeal cancers followed by cancers of the oral cavity (23%), oesophagus (19%). In females, more than fifty percent of the TRCs are oral cancers (51.1%) followed by cancer of the oesophagus (29.6%) and pharynx (11.4%). Together in both sexes, the TRCs accounted for 32.5% of the total cancers.

Research Activities – Projects

1. Cancer Atlas Project: The Hospital Cancer Registry has involved in the Cancer Atlas Project of th WHO, ICMR under taken by the NCRP and providing information on all non-resident case registered at KMIO for the year 2002-2004.
2. Case-Control Study of Oral Cancers: A case control study on oral cancers has been undertaken b Mr. Mani. The data collection is completed and data analysis is in progress. This is a part of h Doctoral Thesis work to be submitted to Tampere School of Public Health, Tampere, Finland.
3. Case-Control Study of Pharyngeal cancers: Mr.D.J.Jayaram has taken up a case-control study o pharyngeal cancers as part of his Doctoral Thesis to be submitted to Tampere School of Publ Health, Tampere, Finland.

Doctoral Degree

Dr. Ramachandra Reddy has been awarded doctoral degree from the Tampere School of Public Healt Tampere, Finland during 2004 for his thesis work entitled "The role of socioeconomic status and reproductiv factors in breast cancer".

Participation in Conferences/ Seminars/ Workshops

Dr. K. Ramachandra Reddy

1. 4th Annual National Medical Records Conference (Med recon-2004) held at Nimhans, Bangalo during 20-21 Feb 2004 and gave a lecture on Role of Medical Records in an autonomous Institutio
2. Participated in several training programmes as faculty at KMIO and also peripheral cancer centres Mandya and Gulbarga and imparted training in Epidemiology & Biostatistics.

Dr. C. Ramesh

1. Presented a lecture on "Treatment Compliance Strategies" and Coordinated the Main discussion o "Reasons for non-compliance to treatment and methods to ensure compliance" held at Bangalo during Jan 19-24, 2004.
2. Participated in Pre- Annual Review Meeting Workshop and XX Annual Review Meeting of Nation Cancer Registry Programme (ICMR) held at Gangtok, Sikkim on 1-4 December 2004 and presente lectures on (i) Case-control studies; design, conduct and analysis and (ii) Utility of hospital base cancer registries and (iii) Quality control exercise and pattern of care studies in cancer of cervix.

EXPERIENCE OF AN ACADEMIC YEAR IN FINLAND

D. J. Jayaram, Sr. Investigator, Cancer Registry, Kidwai Memorial Institute of Oncology, Bangalore

During the academic year 2003-2004, I was deputed to undergo training programme in Epidemiology at the Tampere School of Public Health, University of Tampere, Finland, under the bilateral fellowship programme between India and Finland. The training at the school of public health is quite different from the training imparted to students in our country. During the course every student is made to think clearly than memorize unknowingly. Communication and interaction with the staff members of the school were excellent. They were extremely kind, friendly and punctual. It was a very good experience to be with many learned professors. Every teacher was unique in his teaching (class room sessions, practical, seminars, group discussions, assignments and examinations). Also, we had a few get together at the school and outside the school with our co- students and teachers. They were very keen to know more about Indian culture.

The subjects studied during the course. (1) Introduction to Computer Environment and Statistical Computing (2) Introduction to Epidemiology (3) Multilevel Analysis in Health Service Research (4) Epidemiology of Infectious Diseases (5) Cancer Epidemiology – I (6) Epidemiological methods-I (7) Meta Analysis (8) Cost of Illness (9) Advanced Biometry and Statistical Computing (10) New Perspectives for Health Promotion Evaluation (11) Logistic Regression (12) Cancer Epidemiology-II (13) Liner Models for Correlated Data (14) Population Based Survival Analysis (15) Clinical Trails and Survival Analysis (16) Screening for Diseases (17) Methods of Health Economics (18) Introduction to Occupational Health (19) Epidemiology-II (20) Longitudinal Data Analysis (21) Diabetes and Cardiovascular Epidemiology (22) Methods in Evaluation of Screening Programmes and (23) Molecular Epidemiology.

As a part of my doctoral dissertation: The topic of my study is "An epidemiological study of pharyngeal (oropharynx, hypopharynx, and pharynx unspecified) cancers, Bangalore, South India". Pharyngeal cancer is the leading cancer in the Kidwai Memorial Institute of Oncology, Bangalore, constituting 16.2% of all cancers, and it is the third leading cancer in males with the age-adjusted incidence rate 8.5 per 100,000 males in the population based cancer registry, Bangalore.

The objective of the study is to test the hypothesis that:

1. Smoking and/or chewing enhance the risk of pharyngeal cancers.
2. Dietary practices such as consumption of spicy food may enhance the risk of pharyngeal cancer.
3. Exposures to wood stove smoke in women may enhance the risk of pharyngeal cancer in women.

Research Activi

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vill be conducted at the Kidwai Memorial Institute of Oncology (KMIO),
f Karnataka in Southern India. The KMIO is a comprehensive centre
state and is one of the 22 Regional cancer centers in India. The
irected treatment such as surgery, radiotherapy, chemotherapy and
m all over the state and also from the adjoining areas of the neighbouring
, Andhra Pradesh and other regions also come to this institute for cancer care, 93% o
d 95% of the females among proved cancers are microscopically confirmed.

Selection of cases

A total number of 500 cases confirmed either by histology or by cytology will be included in the study
Advanced cases and cases with non-microscopic diagnosis will be excluded from the study.

Selection of controls

A total number of 500 age-matched controls will be selected among the attendants of cancer patients staying
at the Dharmashala - Ambulatory patient home. Dharmashala provides an accommodation for 250 cancer
patients who require prolonged and continuous cancer care and who could not get an inpatient bed in the
hospital. In the Dharmashala one attendant per patient is permitted to stay with the patient.

Data Collection

The data on smoking, chewing, and alcohol drinking as well as dietary habits will be collected in a pre-coded
questionnaire. The data that is collected will be computerized.

Data analysis

Data entry will be done using Dbase III programme, then the range checks and consistency checks will be
carried out after data entry. One way and multi way frequency tables will be carried out by SPSS and EPI
statistical software and multiple logistic regression methods using EGRET.

Reporting of Results

Preparation of the manuscript will be under taken in India and after obtaining approval, the findings will b
presented as doctoral dissertation for public discussion at the University .of Tampere, Finland

Study design and area

It is a case-control study. The study will be conducted at the Kidwai Memorial Institute of Oncology (KM Bangalore, the capital city of the state of Karnataka in Southern India. The KMIO is a comprehensive ce for cancer research and treatment in the state and is one of the 22 Regional cancer centers in India. institute offers all modalities of cancer directed treatment such as surgery, radiotherapy, chemotherapy hormone therapy. Patients from all over the state and also from the adjoining areas of the neighbo states of Tamil Nadu, Andhra Pradesh and other regions also come to this institute for cancer care, 93 the males and 95% of the females among proved cancers are microscopically confirmed.

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HOSPITAL & POPULATION BASED CANCER REGISTRIES, CHENNAI

Cancer Institute (W.I.A.), Chennai

Principal Investigator	*Dr. V Shanta*
Co- Investigator	*Dr. R Swaminathan*

On going projects *(apart from the PBCR and HBCR)*

1. "Development of an Atlas of Cancer in India: Year 2004" – A project of National Cancer Registry Programme (ICMR).
    a) Registration of non-Chennai cancer cases from Madras Metropolitan Tumour Registry (MMTR), a Population Based Cancer Registry, Chennai – about 7,500 cases each year.
    b) Registration of non-Chennai cancer cases from Hospital Cancer Registry, Cancer Institute (W.I.A.) – about 6,500 cases each year.
2. "Population-based cancer survival study of common cancers in Chennai – Year 1990-1999" – Collaborator: International Agency for Research on Cancer, Lyon, France.
3. "Hospital based cancer survival study of top ranking cancers treated at the Cancer Institute (W.I.A) during the period 1960-1999". –Collaborator: International Agency for Research on Cancer, Lyon, France.
4. "Dindigul Ambilikkai Cancer Registry (DACR)" – Collaborator: International Agency for Research on Cancer, Lyon, France.
5. "Population screening program for cancers of cervix, breast and oral cavity in Thiruvanmiyur area in Chennai" – Undertaken by the Preventive Oncology Unit, Cancer Institute (WIA), Chennai - Dr. R.Swaminathan, Co-Investigator.
6. "Hereditary Cancer Registry Project" – A population based registry covering the city of Chennai based in the Department of Molecular Oncology, Cancer Institute (W.I.A) - Dr. R.Swaminathan, Co-Investigator.
7. "A retrospective survey of presentation features of breast cancer and risk factors for treatment outcome" – Collaborator: International Network for Cancer Treatment and Research (INCTR), Brussels, Belgium – Mrs.R.Rama, Principal Investigator & Dr.R.Swaminathan, Co-Principal Investigator.

Workshop/Observation Training on "Cancer Registration, Principles and Methods" organized b Division of Epidemiology and Cancer Registry

1. Mr. Partha Protim Saikia from Population Based Cancer Registry, Assam Medical College, Dibr underwent a comprehensive training on population and hospital registry data managemen compiling reports: Sep 30 - Oct 2, 2004.
2. Mr Ram Dayal, Statistical Assistant, National Institute of Communicable Diseases, New Delhi and Mallika Kothandaraman, Assistant Medical Record Officer, JIPMER, Hospital, Pondicherry, unde a WHO In-Country Fellowship Training Program in Cancer registration under the Biennium 2004- 31st Dec 2004 – 30th March 2005.

Meetings/ Workshops/ Seminars/ Courses attended by registry staff

1. Mr Devarajan, Systems Analyst attended the Data Manager Training Course on "Treatmen Characterization of the Acute Lymphoblastic Leukemia in children, adolescents and young adul the Clinical Trial Office, International Network for Cancer Treatment and Research (INCTR), Brus Belgium during November 15-19, 2004.
2. Mrs R. Rama, Statistical Assistant, Chennai HBCR, attended the Workshop on "Clinical Res Methodology" held at the Tata Memorial Hospital, Mumbai during November 18-19, 2004.
3. NCRP XX Annual Review Meeting & Workshop held at Gangtok, Sikkim during December 1-4, 20 Dr.R.Swaminathan, Senior Bio-Statistician, MMTR spoke on (i) Recent advances in Cancer Su Analysis, (ii) Data Quality in MMTR: A self-appraisal and (iii) Dindigul Ambilikkai Cancer Re (DACR).

   Dr.Nalini, Tutor, MMTR, gave a lecture on "Data collection norms followed in cancer registration".

   Mrs.R.Rama, statistical assistant spoke on (i) Optimizing Cancer Mortality Statistics: Methods results and (ii) Features of Hospital Cancer Registry (1998-2002) and Patterns of Care & Su Studies.

   Other participants of this Meeting from the department were

   Mr.P.Thangavel, Senior Investigator, DACR, Mr.R.Selvakumaran, Field Supervisor, M Mr.J.Murugaiyan, Mr.S.Sivakumar of MMTR, Mr.S.A.S.Rajagopal of HBCR and Mr.K.Ravichandr DACR, Social Investigators.
4. Dr. R. Swaminathan, senior Bio-statistician, was invited to speak on "Cancer Surveillance" i Seminar on "Health Security: Disease Surveillance, Challenges and Responses in Peninsular I Centre for Security Analysis, Chennai, on December 14, 2004.

5. Ms M. Kavitha, Statistical Assistant, MMTR, presented a paper on "Cancer Incidence and Trend in Chennai 1998-2001" in 22nd Annual National conference of Indian society for Medical Statistics (ISMS) held at JIMPER, Pondicherry from Jan 19th-23rd 2005.
6. Ms.Joan of Arc, Medical Record Clerk, Cancer Institute 9WIA), Chennai, attended the 5th annual Medical Record Conference held at Pondicherry from Jan11th and 12th 2005.
7. Mrs. R Rama was awarded the ICRETT Fellowship from 3rd – 27th May, 2005, under the guidance of Dr. R. Sankaranarayanan in the Screening Group, Pathogenesis and Epidemiology Cluster, International Agency for Research on Cancer, Lyon, France on "Training in the design and analysis of clinical trials in cancer prevention and control".
8. Dr.R.Swaminathan visited the International Agency for Research on Cancer, Lyon, France, in his capacity as an Editor of the second volume of the IARC Monograph on Cancer Survival in Developing Countries for data analysis and to finalize the chapters between July 10 and August 18, 2005.
9. Dr.R.Swaminathan attended the advanced course on Analysis of Temporal trends in Cancer conducted as part of the Summer Course on Cancer Registration and Epidemiology at the International Agency for Research on Cancer, Lyon, France, during July 18-22, 2005.

Publications

1. Shanta V, Swaminathan R and Kavitha M. Cancer incidence and mortality in Chennai, India, Year 2002. Madras Metropolitan Tumour Registry, National Cancer Registry Program, Cancer Institute (WIA), Chennai, 2005.
2. Shanta V, Swaminathan R and Rama R. Annual Report, 2003. Hospital Cancer Registry, National Cancer Registry Program, Cancer Institute (WIA), Chennai, 2005.
3. Rama R, Swaminathan R, Shanta V and Venkatesan P. Covariate analysis of childhood cancers using survival models. Abstract, XXII Annual National conference of Indian society for Medical Statistics (ISMS), JIMPER, Pondicherry, 2005, pp 128.
4. Kavitha M, Swaminathan R and Shanta V. Cancer incidence and trend in Chennai 1998-2001. Abstract, XXII Annual national conference of Indian society for medical statistics (ISMS), JIMPER, Pondicherry, 2005, pp 67.
5. Krishnan Nair M, Varghese C and Swaminathan R. Cancer: Current scenario, intervention strategies and projections for 2015. National commission on macroeconomics and health (NCMH) background papers - burden of disease in India, Ministry of Health and Family Welfare, New Delhi, 2005, pp 219-225.

POPULATION BASED RURAL CANCER REGISTRY, BARSHI

(Barshi, Paranda and Bhum) ***Under - Tata Memorial Hospital, Mumbai***

and **Nargis Dutt Memorial Cancer Hospital, Barshi**

Principal Investigator	*Dr. K.A. Dinshaw, Director, TMH, Mumbai*
Co-Principal Investigator	*Dr. B.M. Nene, Chairman, NDMCH.*

Visitors from abroad

1. Dr.Helen Sancho Garnier, Strategic Leader, UICC Executive Committee, Prevention and Ea Detection of Cancer and Ms. Maria Stella de Sabata from UICC, Geneva, Switzerland during their v to Nargis Dutt Memorial Cancer Hospital Barshi on 24th – 25th August 2004. They attended the Hea Education Programme organized at Indapur, (Bhum Tehsil) and Cancer Clinic organized at Washi (Bhum Tehsil) by the Rural Cancer Registry. Both of them were impressed with the methodolo followed for Cancer Registration which was tailored to suit the prevailing conditions in the rural areas.
2. Dr. Buncha Palanawong, Director of Bungkan Hospital Nong Khai, Thailand visited the registry on 1 May 2004 as an observer from International Agency for Research on Cancer Summer School.

Meetings/ Conference/ Courses attended

1. Mr.N. S. Panse, Registry Manager attended the International Course on Cancer Epidemiologi Practices for Beginners held from 21-24 March 2005 at Tata Memorial Hospital, Mumbai.
2. Mr.A.M.Budukh, Statistician, was in Finland, from 20 June 2004 to 4 November 2004 to complete work on doctoral thesis.

POPULATION BASED CANCER REGISTRY, BHOPAL

Department of Pathology, Gandhi Medical College, Bhopal.

Principal Investigator	:	*Dr. V. K. Bharadwaj*
Research Officers	:	*Dr. Sunil Surange & Mr. Atul Shrivastava*
Field Supervisor	:	*Dr. Rajesh Dikshit*

A chemical disaster caused by the leakage of toxic gases from the factory of Union Carbide in Bhopal on the night between 2nd and 3rd December 1984 led to a variety of medical problems in the city. Methyl isocyanate (MIC) was supposed to be the major content of the toxic gases, which caused the disaster. Immediately after this tragedy, Indian Council of Medical Research initiated many studies to evaluate the ill effects of the toxic gases among the gas-exposed population. Along with these studies, a Population Based Cancer Registry was established at Bhopal to ascertain the magnitude of cancer problem in central India and to evaluate the carcinogenic effects of MIC, if any, on the gas exposed population. The registry started working from 1st January 1986.

Over the years, the registry has observed a very high incidence of tobacco related cancers among males. The age-adjusted rate of cancer of the tongue is highest in the world, while a rising trend of oral cavity and lung malignancies has also been observed. Among females, high incidences of breast and genital malignancies have been recorded, with cancer of the breast as the leading site with a rising trend.

Meeting/ Workshops/ Training

1. Dr. V.K. Bharadwaj presented a paper entitled "Trends of cancer in Bhopal" at the XXVI Annual Meeting of International Association of Cancer Registries 2004 held at Beijing, organized by the Chinese Academy of Medical Sciences, September 2004
2. Mr. Atul Shrivastava attended the Pre Annual Review Meeting workshop held at Gangtok, Sikkim and spoke on experiences of mortality registration, Bhopal.
3. NCRP XX Annual review meeting held at Gangtok, Sikkim during 1-4 December 2004.
   Dr.V.K. Bharadwaj & Mr. Atul Shrivastava attended the meeting.
   Mr. Atul Shrivastava presented the reports on
   i. Cancer in MIC affected & un-affected area of Bhopal.
   ii. Improvement of mortality data of PBCR Bhopal.

4. Workshop on "Problem Based Oncology Teaching for Medical Graduates" held in August 2004. Mr. Atul Shrivastava gave lectures on Patterns of Cancer in India & Rising trends of Tobacco Related Cancers in Bhopal.
5. Mr. Atul Shrivastava attended meeting of coding manual and finalization of intercensal estimates of populations from 1981-2010 for PBCR areas held at NCRP office, Bangalore from 15th –17th June 2005.
6. Dr. Sunil Surange attended the Summer School In Cancer Epidemiology organized by IARC at Lyon, France, June 2005.
7. Mr. Atul Shrivastava attended the Western Region Consultation on Edustat (Educational Satellite) Utilization organized by Indian Space Research Organization, Ahmedabad. Presented a paper entitled "Present situation, needs & requirements of Satellite Education in Medical Education".

Ongoing Projects/ Studies

1. Development of an atlas of cancer India, Year 2004
2. Estimation of survival rates of major cancer sites
3. Case-control study of breast cancer in rural and urban woman
4. Improvement of cancer mortality data of PBCR Bhopal.

HOSPITAL BASED CANCER REGISTRY, THIRUVANANTHAPURAM

Regional Cancer Centre, Thiruvananthapuram, 695 011

Principal Investigator : *Dr. B Rajan*

Officer-in charge : *Dr. Aleyamma Mathew*

The hospital based cancer registry (HBCR), Regional Cancer Centre (RCC), Thiruvananthapuram, started in 1982 under the network of Indian Council of Medical Research. It collects information on cancer patients attending the Regional Cancer Centre, Thiruvananthapuram. The HBCR data have been largely utilized by the two population-based registries located in Thiruvananthapuram and Karunagappally and for the project on development of cancer Atlas in India. Further, the registry database has been widely used for a variety of analysis resulting in scientific publications.

During the year 2002, 8391 (males: 4386; females: 4005) patients with cancer were recorded in the HBCR. The mean age at diagnosis was 54 years in males and 50 years in females. Cancer of the oral cavity (15.8%) was the leading site among males followed by lung cancer (13.9%). Among females, cancer of the breast (28.8%) was the leading site followed by cancer of the uterine cervix (16.0%). Children (0-14 years) constituted 3.7%. 60.4% of all cancers were in the truncated age group (35-64 years). In children, leukemia (45.1% in males & 49.6% in females) was the predominant cancer in both sexes. In the 15-34 year age group also, leukemia was the predominant cancer in males (23.4%) and thyroid cancer in females (29.4%). In the 35-64 years age group, the leading cancer sites were oral cavity in males (17.6%) and breast in females (35.9%). In the 65+ age group, the leading cancer sites were oral cavity in both sexes (18.4% males and 19.7% in females). The proportion of tobacco related cancers (oral cavity, pharynx, esophagus, larynx, lung and urinary bladder) relative to all cancers was 46% in males and 14% in females.

Diagnosis by microscopic verification was available in 95.2% of patients. Around 61% of patients had disease extending or spreading beyond the primary site of cancer (excluding previously treated patients). Around 18% of males and 40% of females had undergone partial or complete treatment elsewhere before reporting to RCC. Among the previously untreated patients (n=5969), intent to treat was radical for 56.3% and 69% of males and females respectively. Seventy four percent of males and 78.9% of females completed cancer directed treatment at RCC (excluding previously treated patients). Radiotherapy alone or in combination with other modalities was the predominant form of treatment in both males (51.5%) and females (50.4%).

Conferences/ Workshops attended and Papers presented

Dr. Aleyamma Mathew

1. Guest lecture on Statistical modeling in medical field, UGC Academic Staff College, University of Kerala, 26th September 2004, Kariavattom, Thiruvananthapuram.
2. Guest lecture on "Cancer Epidemiology in Kerala", Achutha Menon Centre for Health Science Studies of the SCTIMST, Trivandrum, for Master of Public Health (MPH) students, 27th September 2004.
3. Attended the annual conference of Indian Association of Cancer Research, NOIDA, Uttar Pradesh, February 2005, and presented a paper entitled "A correlation study of organochlorine levels in serum, breast adipose and gluteal adipose tissue among breast cancer cases in Kerala, India".
4. Guest lecture, "Breast Cancer Epidemiology in India", Organized by Indian Medical Association, Kerala Chapter on Women's day, 8th March 2005.
5. Invited to attend Asia Cohort Consortium meeting at Fred Hutchinson Cancer Research Centre, Seattle, Washington, US, 14-15 April, 2005, presented a paper entitled "Central obesity, insulin resistance and physical activity in Indian women and its relation to cancer".
6. Attended Core-committee meeting in M.Sc. Bio-statistics as Convenor – Mahatma Ganghi University, Kottayan on 17-06-2005.
7. Selection committee meeting for MSc. Bio-statistics as Subject expert –St.Thomas College, Palai, Kottayam, Kerala on 22-08-2005.
8. Presented "Implementation of DCCP – RCC proposals –submitted to the Govt. of India, In the Seminar on District Cancer Control Programme, organized by Regional Cancer Centre, Thiruvananthapuram, in association with WHO & DGHS, 25th August 2005.
9. Guest lecture, "Introduction to Biostatistics" for the UGC Sponsored refresher course in Bio-informatics, UGC-Academic Staff College, University of Kerala, Thiruvananthapuram, 3rd October 2005.
10. Guest lecture, "Role of statistics in Bio-medical research", for the UGC sponsored refresher course in Bio-statistics, University of Kerala, Thiruvananthapuram 19-20, October 2005.

Dr. MC. Kalavathy

1. Co-ordinator of the WHO sponsored Seminar on District Cancer Control Programme conducted at the Regional Cancer Centre, Thiruvananthapuram 25th August 2005. Delivered lecture on DCCP experience at Ernakulam, Kerala.
2. Conducted – several awareness classes on Primary and secondary prevention of cancers among lay public in the Trivandrum city.

Mrs. Jajaja Kumari and Mr Jayakumar

Participated in the Workshop on Cancer Registration at Gangtok, Sikkim, organized by National Cancer Registry Programme (NCRP) of Indian Council of Medical Research (ICMR), 1-5 December 2004.

Training on Cancer Registration and Epidemiology

1. Providing one-year training to Mr. Shiva Hari Sapkota, B.P. Koirala Memorial Cancer Hospital, Nepal, March 2005 – February 2006.
2. Provided training on Epidemiology and cancer registration to Master of public health (MPH) students, Achutha Menon Centre for Health Science Studies, Sree Chitra Thirunal Institute of Medical Sciences, Trivandrum.

Other relevant information

1. Dr. Aleyamma Mathew, Editor, Newsletter (CRAB) of the National Cancer Registry Programme of India.
2. Dr. Aleyamma Mathew, Research guide in Epidemiology under the University of Kerala and Mahatma Gandhi University, Kottayam.
3. Dr. Aleyamma Mathew, Convenor of MSc. Biostatistics core committee, Mahatma Gandhi University, Kottayam.
4. Dr. Aleyamma Mathew, Selection committee member, MSc. Biostatistics, St. Thomas College, Palai, Kerala.
5. Dr. Aleyamma Mathew, IRB-Scientific Review Committee member, Regional Cancer Centre, Thiruvananthapuram.
6. Dr. M.C. Kalavathy, Co-ordinator, Thiruvananthapuram Corporation Cancer Control Programme,.
7. Mrs. Anita Nayar, Associate Editor, Newsletter (CRAB) of the National Cancer Registry Programme of India.

Ongoing Research Projects

1. Population-based cancer registry, Thiruvananthapuram (urban and rural) taluk.
2. Case-control study of breast cancer comparing rural and urban women.
3. Follow-up of Pre-Cancer cases Registered in the Early Cancer Detection centre, (ECDC) Palakkad of the Regional Cancer Centre, Thiruvananthapuram.
4. Development of Cancer ATLAS in India

Ongoing Doctoral Programme

Diet and risk of breast cancer: A multivariate analysis by Binukumar B under the University of Kerala, Guide - Dr, Aleyamma Mathew.

Cancer Awareness Classes and Cancer Detection Camps.

Cancer control programmes in the Thiruvananthapuram corporation area are in the second phase. Twenty four cancer awareness classes and 32 cancer screening campaigns were conducted during the reporting period.

Organized a WHO sponsored seminar on District Cancer Control Programme – Revised Guidelines by Govt. of India, August 25 2005. Co-Ordinator: Dr.M.C. Kalavathy.

Publications

1. B Binukumar and Aleyamma Mathew. Dietary fat and risk of breast cancer, World Journal of Surgical Oncology 2005, **3**:45-58.
2. Aleyamma Mathew and B Rajan. Epidemiology and prevention of cancer in India. In Marsh RW and Samuel J (editors). The essentials of clinical oncology, Jaypee Brothers Medical Publisheres (p) ltd., Haryana, 2005 pp: 42-60.
3. Jennifer A Rusiecki, Aleyamma Mathew, Susan Sturgeon, Rashmi Sinha, Edo Pellizzari, Tom Zheng and Dalsu Baris. A correlation study of organochlorine levels in serum, breast adipose and gluteal adipose tissue among breast cancer cases in India, *Cancer Epidemiology Biomarkers and Prevention*, 2005; 14 (5):1113-24.
4. Aleyamma Mathew, B Vijayaprasad, P Jayakumar and P Thankamony Amma. Cancer incidence and mortality, Population Based Cancer Registry (urban and rural), Annual report for the year 2001-2002, Published by Regional Cancer Centre, Thiruvananthapuram 2005.
5. Aleyamma Mathew, G Padmakumari Amma, NM Asha, Jalaja Kumari, Anita Nayar, Hospital Based Cancer Registry, Annual report for the year 2002, Published by Regional Cancer Centre, Thiruvananthapuram 2005.

6. Aleyamma Mathew (editor). Cancer Registry Abstract, Newsletter, Volume XI, National Cancer Registry Project of India, Published by the Hospital Based Cancer Registry, Regional Cancer Centre, 2004.

7. Aleyamma Mathew. Development of information system for cancer control (editorial). In Cancer Registry Abstract, Newsletter, Volume XI, National Cancer Registry Project of India, Published by the Hospital Based Cancer Registry, Regional Cancer Centre, 2004 pp 1-2.

8. Aleyamma Mathew and B Vijayaprasad. Cancer incidence rates in India: Pooled analysis. In Cancer Registry Abstract, Newsletter, Volume XI, National Cancer Registry Project of India, Published by the Hospital Based Cancer Registry, Regional Cancer Centre, 2004 pp 13-24.

9. Aleyamma Mathew, NM Asha, Jalaja Kumari, Anita Nayar, Hospital Based Cancer Registry, Annual report for the year 2000, Published by Regional Cancer Centre, Thiruvananthapuram 2004.

10. Aleyamma Mathew, NM Asha, Jalaja Kumari, Anita Nayar, Hospital Based Cancer Registry, Annual report for the year 2001, Published by Regional Cancer Centre, Thiruvananthapuram 2004.

11 Aleyamma Mathew, B Vijayaprasad, P Jayakumar and P Thankamony Amma. Cancer incidence and mortality, Population Based Cancer Registry (urban and rural), Annual report for the year 2000, Published by Regional Cancer Centre, Thiruvananthapuram 2004.

12. Elizabeth M Iype, Manoj Pandey, Aleyamma Mathew, Gigi Thomas, Krishnan Nair M. Squamous cell cancer of the buccal mucosa in young adults. *Br J Oral Maxillofac Surg.* 2004, 42:185-9.

13. Manoj Pandey, Aleyamma Mathew, Elizabeth K Abraham, B Rajan. Primary sarcoma of the breast. J *Surg Oncol.* 2004; 87 (3):121-5.

14. Rachel C Koshy, Renju Kuriakose, Aleyamma Mathew, Naveen Chandran. Cancer pain intensity measurements in outpatients. Preferences and comparison of pain scales among patients, caregivers, physicians, and nurses in southern India. *Journal of Pain & Palliative Care Pharmacotherapy*, 2004, 18 (3): 5-13.

15. Kalavathy MC, Follow-up of cancer patients registered in a rural Early Cancer Detection Centre, Kerala, (abstract), published by Indian Society of Oncology in ONCOLOGY 2004, Bangalore.

POPULATION BASED CANCER REGISTRY, KOLKATA

Chittaranjan National Cancer Institute, Kolkata

Head	*Prof. Indira Chakraborty*
Scientific officer	*Dr. Karabi Datta*
Statistical officer	*Dr. S.S. Mandal*
Senior Investigator	*Dr. Soma Roychowdhury*

Population Based Cancer Registry (PBCR), Kolkata, is one of the PBCRs in eastern India set up with active collaboration between Chittaranjan National Cancer Institution, Kolkata and Cancer Center Welfare Home & Research Centre, Thakurpukur, Kolkata. The report of PBCR, Kolkata during the period of 1997-2001 shows that the overall age adjusted incidence rates (AAR) are 102.1 per 100,000 males and 111.5 per 100,000 females. Among males the highest incidence is found in lung cancer-16.3% followed by cancers of oral cavity (7.1%), pharynx (5.7%), larynx (5.7%); among females the highest incidence rate is seen in breast cancer (22.7%), followed by cancer cervix (17.5%), gallbladder (6.4%) and ovary (5.8%). The cancer patterns indicate that tobacco (both smoking and chewing) control measures and early detection of head and neck, breast and cervical cancers are of importance for cancer control in this region (Tables 1 & 2).

Table 1: Incidence rate of Tobacco Related Cancers (1997-2001)

Incidence rates	Male	Female
Total cases	6805 (45.4%)	1803 (13.6%)
Crude incidence rate	38.8	12.8
Age-Adjusted incidence Rate	50.1	16.8
Truncated incidence (35-64 years) Rate	172.14	61.9

Table 2: Distribution of Tobacco Related Cancers (1997-2001)

	Males		Females	
Site	%	CIR*	%	CIR
Lung	16.0	13.7	3.9	3.7
Oral cavity	7.9	6.8	3.3	3.4
Pharynx	6.9	5.9	1.2	1.2
Larynx	5.5	4.7	0.7	0.6
Oesophagus	4.0	3.4	2.5	2.4
Urinary Bladder	3.1	4.2	0.7	0.6

*CIR: Crude incidence rate

Ongoing Studies

1. Development of Cancer Atlas in India (Collaborators: NCRP,ICMR, WHO)
2. Case- control study of Breast Cancer in Women of South Asia
   (Collaborator: Unit of Environmental Epidemiology, IARC, Lyon)

Meetings attended

XX Annual review meeting & Pre ARM Workshop on cancer registry of ICMR on 1-4 Dec 2004 was attended by the Senior Investigator and three Social Investigators, accompanied by Dr. M.N. Bandyopadhyay of CCWH.

Publications

1. Report of Population Based Cancer Registry – Kolkata for 1997-2001.
2. Tobacco control practices in 25 schools of West Bengal, Indian Journal of public Health, Vol-48,3,128-131, 2004.
3. Bhattacharya N, Chunder N, Basu D, Mandal S, Majumder J, Roychowdhury S, Panda CK (2004): Three discrete areas within the chromosomal 8p 21.3-23 region are associated with the development of breast carcinoma of Indian patients. Experimental and Molecular Pathology. Vol. 76, pp-264-271.
4. Chunder N, Mandal S, Roy A, Roychoudhury S, Panda CK (2004): Analysis of different deleted regions in chromosome 11 and their interrelations in early- and late- onset breast tumors: Association with cyclin D1 amplification and survival. Diagnostic Mol. Pathology. Vol. 13, No.3, pp.172-182.
5. Chunder N, Mandal S, Roy A, Roychoudhury S, Panda CK (2004): Differential association of BRCA1 and BRCA2 genes with some breast cancer associated genes in early- and late- onset breast tumors. Annals of Surgical Oncology. Vol. 11, No.12, pp.1045-1055.
6. Ray K, Mandal S (2004): Knowledge about cancer in West Bengal – a Pilot Survey. Asian Pacific Journal of Cancer Prevention. Vol. 5. pp.204-211.
7. Mandal S (2004) : The present status of Cancer Statistics in this Region. Science and Culture. Vol. 70. pp.151-153.
8. Singh RK, Dasgupta S, Bhattacharya N, Chunder N, Mondal R, Mandal S, Roychowdhury S, Panda CK (2005): Deletion in chromosome 11 and Bcl-1/Cyclin D1 alterations are independently associated with the development of uterine carcinoma. J. Cancer Res. Clin. Oncol. Vol.131, pp.395-406.

Cancer Centre Welfare Home & Research Institute, Thakurpukur, Kolkata

Cancer registry Investigators: *Dr Saroj Gupta*
Dr M N Bandyopadhyay

This Institute is a philanthropic non-Government organization that runs mostly on donations from common people. The Institute was born in 1973 with the formation of a registered society. The aim of the society was to provide a home for the people who come to Kolkata for treatment of cancer in different city hospitals. The first 25-bedded "Welfare Home" came up in 1976 on a 6.5 acres of land donated by family members of a cancer victim. With continuous support and donations, this "Welfare Home" turned into a "Cancer Center" in 1981 with establishment of Surgical Unit, Radiotherapy Unit, Diagnostic Units and more than 100 indoor beds.

The center has now become one of the largest cancer hospitals in eastern India with an annual new registration of more than 7,000 patients. The number of indoor bed is more than 250. This Institute is recognized by the WHO and UICC. Apart from being a comprehensive cancer Institute, this center is also engaged in academic and research activities. The Institute is recognized as a training center for DNB in radiation Oncology, Surgical Oncology and Radio-diagnosis. This center is also recognized by the University of Calcutta (Kolkata) for PhD programme in Oncology and allied subjects. The Department of Science & Industrial Research (DSIR), Ministry of Scientific & Industrial Research, Government of India recognizes the Institute as a Scientific & Industrial Research Organization (SIRO). The institute collaborates with various other renowned Institutes for basic research on cancer.

Cancer Registry Activities

1. This Institute maintains an in-house (Hospital Based) Cancer Registry on its own initiative and funding since its inception. For each registered patient, the institute maintains a case file. The summary data about identification, diagnosis and primary treatment modalities are stored in a computer. A brief summary of such data is published every year in the Annual Report and Scientific Bulletin of the organization.
2. This Institute is the largest contributor of Population Based Cancer Registry (PBCR) of Kolkata. [Ref: Official Publication of PBCR, Kolkata, 1997; no further publications have been made so far]. This center had extended its full co-operation to CNCI, Kolkata since the inception of PBCR, Kolkata in 1996-97.

3. The institute collaborates with ICMR in the project "Development of an Atlas of Cancer in India" since 2001. The project is still continuing. *[A report about our contribution has been published by ICMR in the First All India Report (2001-2002), vide Vol II, pp 308-309]*
4. The institute had collaborated with ICMR in a pilot study about pattern of care in some specified cancers.
5. The institute collaborates with ICMR for the PBCRs of the NE states in providing filled-in proformas of patients who come from north-eastern states of India and get registered at this Institute.

POPULATION BASED RURAL CANCER REGISTRY, AHMEDABAD

The Gujarat Cancer & Research Institute, (M.P. Shah Cancer Hospital), Ahmedabad

Principal Investigator: Dr.Pankaj M Shah, Hon. Director

Co-Investigator:: Dr.Shilin N. Shukla, Hon.Deputy Director (Education & Research)

The Population Based Rural Cancer Registry, Ahmedabad, is functioning in the Department of Community Oncology and Medical Records. Rural Cancer Registry, Ahmedabad District, has completed 1st year successfully. Data of the year 2004 were sent to the Co-ordinating unit of NCRP, Bangalore, for verification.

In the XX Annual Review Meeting of National Cancer Registry Programme at Gangtok from 3-4 December 2004, on behalf of Dr.Pankaj M. Shah, Hon.Director, Dr. Parimal J. Jivarajani, Asst. Professor & Head of the Department presented a report on the progress of the Rural Cancer Registry-Ahmedabad District during the last one year. He also requested that the urban PBCR to be included under the NCRP network.

Meeting / Workshop attended

Dr.Parimal J. Jivarajani, Assistant Professor and Ms. Ankita Shah, Biostatistician attended Pre-Annual Review Meeting Workshop and Annual Review Meeting of National Cancer Registry Programme at Gangtok from 1-4 December 2004.

Ongoing Research Projects

Development of Cancer Atlas in India (Collaborators: NCRP, ICMR & WHO)

Visitors

Dr. A. Nandakumar, Officer in charge, NCRP-ICMR, on 24th February 2005.

Publication

Report of Hospital Based Cancer Registry, The Gujarat Cancer & Research Institute (M.P. Shah Cancer Hospital) Ahmedabab for the year 1999-2001, July 2004.

POPULATION BASED CANCER REGISTRY, SIKKIM

S.T.N.M. Hospital, Gangtok – 737 101

Principal Investigator — *Dr. Yogesh Verma*

Co-Investigator — *Dr. Prakash Pradhan*

The National Cancer Registry Programme (NCRP) decided to hold the Pre-Annual Review meeting workshop (1-2 December, 2004) and XX Annual review meeting (ARM) of the NCRP at Gangtok from 3-4 December, 2004. The population based cancer registry (PBCR), Sikkim, was given the honour of hosting the meet. The registry had just started in the year 2003. The PBCR is thankful to the Indian Council of Medical research for reposing faith in us.

This meeting provided a rare opportunity to develop human resources in cancer registration and epidemiology along with insight into the patterns of cancer in the state of Sikkim along with that of the country. This would help in developing appropriate strategies in the form of planning, monitoring and evaluation of activities under the programme.

In the Pre ARM workshop, the participants were the staff of different cancer registries who were given a hands on training on cancer registry data collection and analysis strategies.

Mr S.M Limboo, Political Advisor to the Chief Minister, inaugurated the Annual review meeting.

The participants included many directors of major cancer hospitals of the country. It also included steering/ monitoring committee members of NCRP, and from ICMR headquarters and Principal Investigators of cancer Registries.

In Sikkim, cancer is a major cause of concern and forms a major bulk of the referrals outside the state. A comprehensive plan needs to be drawn out in the future to combat this dreaded disease. This is just the beginning. After the registry was started a retrospective collection of data was also done and prospective collection of data has begun but a lot needs to be done regarding analysis of data. This workshop shall definitely help in doing so.

The state of Sikkim has a population of approximately 0.6 million and is among the smallest states in the Indian Union.

Earlier no accurate data on the status of various forms of cancer was available in the State of Sikkim. In the year 2003 (July 2003) a Population Based Cancer Registry (PBCR) was established in the State of Sikkim under the Indian Council of Medical Research (ICMR) in which active collection of data was undertaken. The PBCR is presently located in the Pathology Department of the S.T.N.M hospital, Gangtok.

Though the geographic area and population covered by the population based cancer registries are small compared to the vastness of India and its population, it does give a fair idea of the cancer problem in the country.

The common cancers seen among males are esophageal and stomach cancer and among females are breast and cancer of the cervix. Certain cancers like hepatocellular carcinoma and nasopharyngeal cancers are seen commonly especially among the tribal population. More work need to be done in this direction.

Cancer Registry Training Program (Cancer case abstracting, staging and coding)

This training program was held in Gangtok during 6-10 December, 2004. This program was organized by the PBCR, Sikkim, and sponsored by the National cancer Registry Programme, ICMR and National Cancer Institute (USA). The faculty included **Professor John Young, Department of Epidemiology, The Rollins School of Public Health, USA**, Dr Andrew Glass, Medical Oncologist and Medical Director, Healthnet of Oregon, Portland, USA, Dr A.Nandakumar NCRP, Mr P. Gangadharan and Dr. B.B. Yeole from the Bombay Cancer registry.

The participants were from the North-eastern states, Eastern states and North Indian states.

The training programme was exhaustive, very informative and hands on training were given on cancer case abstracting, staging and coding.

All the participants departed with a certificate of participation.

The PBCR staffs were trained in the various aspects. The training was attended by Dr Yogesh Verma, Dr Aden Bhutia (research officer), Ms Chunkula Bhutia and Mr Prakash Sundas, Social Investigators and Mr Saroj Sapkota -Computer Programmer

Other Programmes

The PBCR has now under taken two more ICMR projects named (i) Cancer in North East India - understanding the role of Tobacco and (ii) Cancer in North East India -understanding the Role of Pesticide This is a multi center research project and has begun only in April 2005.

Awards

Dr Yogesh Verma has been awarded Calum Muir Fellowship to undertake a project in the United Kingdom.

POPULATION BASED CANCER REGISTRY, GUWAHATI

Dr. B. Borooah Cancer Institute, Guwahati

Principal Investigator *Dr. Jagannath D Sarma*

The evolution of Population Based Cancer Registry (PBCR) -Guwahati has its origin in 'Atlas of Cancer in India' -a WHO supported ICMR -project, like five others in North-East India in July 2003. In response to data generated by the 'Atlas of Cancer in India project', the creation of PBCR -Guwahati can be considered a milestone in meaningful research in this part of the country which will rely on adequate quality data on cancer, provide guidelines for etiological research and will be monitoring cancer control activity.

PBCI -Guwahati is located at Dr. B. Borooah Cancer Institute, Guwahati a RCC, Comprehensive Cancer Centre for entire N.E., a referral hospital for all major hospitals of Guwahati city, Assam and many North-East states.

PBCR -Guwahati, covers the whole of Kamrup-urban with a population of 900,518 of which 490,772 are male and 409,746 are females (2001 census). Kamrup District covers an area of 4345.0 sq.kms. PBCR-Guwahati includes Guwahai city & adjoining urban areas of Kamrup District. Guwahati is the state capital of Assam and has been known as Gateway to North-East. Population is well spread on both sides of river Brahmaputra, on the foothills of Nilachal hill, the abode of Goddess Kamakhya, the seat of Sakti cult worshiping known from time immemorial. The name Kamrup has been symbolizing Kamakya Temple. Guwahati is also known as Pragjyoitshpur the eastern land of ancient Astrological research, symbolizing the presence of another Temple Navagraha (nine planets). Guwahati is situated in 26.11^0. north latitude and 96.46^0 east longitude, approximately 200 meter above sea level (ref New Horizon in Geography ~ Great World Atlas, Publisher Mc Millan, London).

The registry started functioning from July 2003. The process of data collection and competing core proformas started from July 2003 as per NCRP (ICMR) guidelines. Cancer is not a notifiable disease and process of registration has been as usual an active one.

Dr. B. Borooah Cancer Institilte, Guwahati is the major source of registration accounting for more than 70% of cases. Apart from this, there are 28 hospitals (Govt./Private) and 24 diagnostic centers.

Initial experience in PBCR-has been quite challenging as the process of registration has to be continuous, systematic and comprehensive. We have to keep regular contact with responding centres and keep sensitizing non-responders for seeking compliances. Social investigators (the backbone of any registry) interview all patients / attendants at PBCR -counter located close to hospital's reception counter, and fill up core proforma. There are three categories of patients that visit PBCR -counter.

(i) Some patients are referred from outside to Dr. B. Borooah Cancer Institute with an existing diagnosis of cancer.

(ii) Some come with clinical suspicion and for confirmation of diagnosis and cancer dircted treatment.

(iii) Some visit this centre half treated from other centres like TMH / Adayar etc. for completion of treatment and follow-up because Dr. B. Borooah Cancer Institute is a comprehensive treatment centre. So, depending on these factors, completion of Core proforma takes from 1-2 days to 7-10 days. Even at the end of the day, some patients are found to be missing at PBCR-Counter. They are apprehended by cross checking at Dr. B. Borooah Cancer Institute reception counter and interviewed accordingly with the help from attending clinicians at a later date. Field staff also visit other hospitals, diagnostic centres, referral board and mortality registry of urban health centres.

In diagnostic centres, a modified core proforma is filled up by receptionist (where diagnosis, residential address and duration of stay are stressed), here field staff do not interact with patients / attendants. In hospitals / nursing homes; sources are pathology lab and record room. Here management authority are initially motivated. The whole process is challenging and achieved through personal contacts with heads of managements and receptionist in outside centres, personal contacts (PI) with labs etc. Referring doctors are infrequently visited for knowing primary site and residential address as last resort.

Preliminary findings show that leading sites in male are of tobacco-related cancers, namely oesophagus, hypopharynx mouth, lung etc. In female, breast cancer is seen as topping the list and is followed by cervix.

Other research activity

(1) Multi disciplinary / multi centric approach of Ca -Oesophagus.

(2) Two projects on "Role of Tobacco and pesticides in understanding Cancer in North- East- multi centric with Dr. B. Borooah Cancer Institute, RMRC, Other NERCR, IOP and ICPO.

Workshop & Training

1. Dr. Jagannath Sharma, Principal Investigator- PBCR-Guwahati attended Summer Course of IARC at Lyon, France 2005.
2. Presented a paper on working of PBCR-Guwahati at ARM-Gangtok- Dec'04.
3. Participated in Pre ARM-Workshop Gangtok Dec'04 (with medical officer and social investigator).
4. Guest lecture by PI -on "Pattern of cancer in Assam -in the light of "Atlas of cancer in India - project in the conference of association of radiation oncologists of North-East India.
5. Ruma Bhattacharjee, the Statistician, attended Workshop "Cancer Registry training programme "C cancer cases abstracting, staging and coding at Gangtok, December 2004.

POPULATION BASED CANCER REGISTRY, MANIPUR

Regional Institute of Medical Sciences, Imphal.

Principal Investigator — Dr. Y. Mohen Singh, Prof & Head, Dept. of Pathology

Co- Principal Investigator — Dr. Kaushik Debnath, Assoc. Prof, Dept. of Pathology

The Population Based Cancer Registry (PBCR) functioning at the Regional Institute of Medical Sciences (RIMS), Imphal is one of the six cancer registries in the northeast India, functioning under the National Cancer Registry Programme (NCRP) of the Indian Council of Medical Research (ICMR) since January 2003. Initially, it covers only Imphal west district (out of 9 districts) with an area of 519 sq.km, has an estimated population of 4,39,532 and a sex ratio of 1147 females per 1000 males. Then, it started covering the whole of Manipur with total area of 22,327 sq. km and total population of 22,93,896 (2001 Census).

Following is the summary report of 2003-2005 and comparison of the five leading sites of tumour / cancer by sex.

Number of Cancer Cases: 2003-2005

Year	Area Covered	Male	Female	Total
2003	Imphal-West dist.	136	156	292
2004	Imphal-West dist.	162	211	373
2005 (upto June)	Manipur (All dist.)	>267	>278	>545

Comparison of Five Leading Sites of Cancer (in %) 2003-2005

Year / Sl. No.	Male			Female		
	2003	2004	2005 (Upto June)	2003	2004	2005 (Upto June)
1.	Lung (19.1)	Lung (23.1)	Lung (14.4)	Lung (17.9)	Breast (16.6)	Lung (20.5)
2.	Stomach (13.2)	Oesophagus (11.1)	Nasopharynx (9.3)	Cervix (15.4)	Lung (15.2)	Cervix (15.6)
3.	Leukaemia (5.9)	Nasopharynx (7.4)	Leukaemia (7.2)	Breast (12.2)	Cervix (14.2)	Breast (11.5)
4.	Lymphoma (5.9)	Leukamia (6.2)	Urinary Bladder (7.2)	Leukaemia (5.8)	Thyroid (5.7)	Gall Bladder (10.7)
5.	Colon (4.4)	Lymphoma (4.9)	Stomach (5.2)	Thyroid (4.5)	Gall Bladder (5.2)	Ovary (4.9)

Important Meetings, Training Programmes add workshops attended

(1). Dr. Y. Mohen Singh, Principal Investigator and PBCR staff attended Pre Annual and Annu Review Meeting held at Gangtok, Sikkim from 1-4 December 2004.

(2). Dr. Y. Mohen Singh, Principal Investigator attended workshop on "Prevention of Carcinoma- cer in North East India" held at Manipal Medical College, Tadong, Sikkim from 25-27 June 200 organized by Cancer Foundation of India in collaboration with Department of Science Technology, Govt. of India.

(3). Dr. O. Bijaya Devi, Statistician attended Cancer Registry Training Program held from 6- December 2004 at Gangtok, Sikkim organized by NCRP (ICMR) & National Cancer Institu (USA).

(4). Dr. H. Satyajyoti Singh, Medical Research Officer, presented the paper entitled "Pattern of Canc Incidence in Imphal West District, Manipur" in award session of XXth AMAMECON – 2004 held 11th &12th Dec. 2004 at Imphal, organized by Indian Medical Association, Manipur State Bran and bagged the prestigious 'TAMPAKLEIMA MEMORIAL AWARD'.

Staff of PBCR Imphal.

1.	Dr. H. Satyajyoti Singh	Medical Research Officer
2.	Dr. O. Bijaya Devi	Statistician
3.	Mr. R.K. Budhibanta Singh	Computer Programmer
4.	Mr. L. Bhopendro Mangang	Social Investigator
5.	Mr. Kh. Nabachandra Singh	Social Investigator
6.	Mr. M. Surjit Meitei	Social Investigator

POPULATION BASED CANCER REGISTRY, MIZORAM

Dept. of Pathology, Civil Hospital, Aizwal

Dr. Eric Zomawia, Principal Investigator

a Covered

ole of Mizoram state comprising of 8 districts. According to 2001 census, area is 21,087 Sq.Kms. and sity is 42 per Sq.Kms. Population is 8,88,573 (4,59,109 males and 4,29,464 females).

w Cases of Cancers Registered so far

ar	Male	Female	Total	Remarks
03	554	458	1012	(includes DCO's)
04	533	403	936	(excluding DCO's)
05 (Till 15th July)	281	199	480	(excluding DCO's)
tal (2003–15th July 2005)	1,368	1,060	2,428	

ining/ Meeting Attended

1. PI presented a paper on 'Cancer Registration' at IMA Mizoram Meet, 11th March 2004, Aizawl.
2. PI attended 'IARC Summer School on Cancer Registration and Applications in Epidemiology' during 19th April to 12th May at Lyon, France, and Chennai. PI was awarded ICRETT Fellowship by UICC for this.
3. PI and 3 staff attended Pre-ARM and ARM of NCRP during 1-4 December 2004 at Gangtok, Sikkim.
4. MRO attended 'NCI USA and NCRP Cancer Registry Training Programme', 6-10th December 2004 at Gangtok.
5. Co-Investigator presented a paper on 'Update on Mizoram Cancer data' at IMA State Branch Annual meeting on 15th December 2004 at Aizawl.
6. PI attended a meeting on proposed research project 'Cancer in NE India: Role of tobacco & pesticides on 1st October 2004 at ICMR Hqrs, New Delhi.
7. PI attended a meeting on 'Cancer in NE India: Role of tobacco & pesticides' 24-25th May 2005 at ROHC, Kolkata.
8. PI attended a meeting on 'Cancer in NE India: Role of tobacco & pesticides' 27-28th June 2005 at IOP and ICPO, New Delhi.

9. Co-Investigator attended 'Workshop on Cervical Cancer Prevention, NE India', 26-28th May 2005 at Gangtok.

Training/ Meeting Conducted

1. PBCR, with Department of Eco. & Statistics conducted training on 'Cancer Registration & Epidemiology and ICD-10' on 24th February 2005 at Civil Hospital, Aizawl. 46 Medical Officers, Statisticians, Medical Record personnel, nurses, PBCR staff etc. from all district hospitals, private hospitals/nursing homes, Registry of Birth & Deaths attended the training.
2. 'Press Meet' on findings of 'Development of an Atlas of Cancer in India, 2001-2002' conducted on 23rd June at Aizawl. High incidence of cancer in Mizoram was highlighted.
3. PBCR was also highlighted in various meetings of Health Dept. Seminars at Civil Hospital and district headquarters.

Paper Published

RK Phukan, E Zomawia, NC Hazarika, D Baruah, J Mahanta. 'High prevalence of stomach cancer among the people of Mizoram, a north eastern state of India' Current Science, "ah tihchhuah a ni bawk". Vol. 87, No. 3, 10 August 2004.

Cancer Research Projects

1. Atlas of Cancer in India Project 2001-2002
2. Atlas of Cancer in India Project 2003-2004
3. Stomach cancer and diet in Mizoram (2001-2004). This work has been accepted for publication by 'Cancer Epidemiology Biomarkers & Prevention'.
4. Cancer in NE India: Role of Tobacco
5. Cancer in NE India: Role of Pesticides

Investigators & staff: Principal Investigator: Dr. Eric Zomawia, Sr. Pathologist & Head of Pathology Dept. In addition, there are 3 Co-Investigators. Contractual staffs include 1 Medical Research Officer, 1 Statistician, 3 Social Investigators, 1 Computer Programmer/Operator

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