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Cancer Registration in Madras Metropolitan Tumour Registry, India

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The Madras Metropolitan Tumour Registry (MMTR) was established at the Cancer Institute (WIA), Madras, in 1981–1982. Cancer is not a notifiable disease in India, and hence registration per force has to be active. The MMTR covers a population of 3.8 million. Mortality statistics are obtained from the Department of Vital Statistics, death registers in hospitals and by active follow-up of registered cases. A total of 28 980 (13 012 males, 15 968 females) cases were registered during 1982–1991. The average annual world-standardised age-adjusted rates (AAR) per 100 000 are 104.2 in males and 129.0 in females. The lifetime cumulative risk (0–74 years) of cancer in Madras is one in eight. Stomach (AAR:15.2) is the leading site of malignancy among males, followed by cancers of the lung (AAR:9.8) and oral cavity (AAR:9.4). Among females, cancer of the cervix (AAR:44.0) is the commonest, followed by breast (AAR:21.7) and oral cavity cancers (AAR:9.8).

Key words: Madras, cancer, registry, population, active registration, incidence, mortality, rates, active follow-up, patterns

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INTRODUCTION

THE NATIONAL Cancer Registry Programme (NCRP) of the Indian Council of Medical Research (ICMR), Government of India, augmented the Population-based Cancer Registry (PBCR) in Bombay, which was established in 1963 as a unit of the Indian Cancer Society, and established two new PBCRs, one each at Kidwai Memorial Institute, Bangalore, and the Cancer Institute (WIA), Madras in 1981–1982. In 1986, two more urban PBCRs at Delhi and Bhopal were commissioned. The urban population coverage of NCRP is 12.8% [1]. The principal objectives of the NCRP are (i) to generate authentic data on the magnitude of the cancer problem in India, (ii) to undertake epidemiological investigations and advise control measures and (iii) to promote human resource development in cancer epidemiology.

METHODS AND MATERIALS

The PBCR in Madras is called the Madras Metropolitan Tumour Registry (MMTR). The coverage of MMTR is confined to the boundaries of the Madras Corporation, with an area of 170 km^2 and covers a population of 3.8 million as of 1991 [2]. The male–female population ratio in Madras is 1:0.93. The registry commenced data collection from 1 January 1982.

Cancer is not a notifiable disease in India. Hence, cancer registration is completely active. Data collection is done by social investigators using a standardised proforma, which includes particulars on socio-demographic characteristics, date and methods of diagnosis of cancer, site, laterality, sequence of cancer, type of treatment given and information on mortality. The sources of data include all government hospitals, private hospitals, clinics, nursing homes, pathology laboratories,scan centres, radiology clinics, and the Vital Statistics Division (VSD) of the Madras Corporation. The frequency of visiting different sources of intake to collect data on cancer patients depends on the number of cases registered from that source. Based on this, a time schedule is worked out for the social investigators to cover these sources as comprehensively as possible and register cases. Data on cancer morbidity are gathered by interviewing the patients and/or accompanying persons, and from the medical records maintained by the institutions. Only cancer patients who were residing in Madras city for at least 1 year at the time of diagnosis of cancer qualify for inclusion in the MMTR. This 'residential status' criterion is strictly adhered to in order to avoid registering cases from a floating population. Benign tumours and cancer *in situ* are not registered but filed separately. Information on cancer deaths are collected from the VSD of the Madras Corporation and hospital death registers. Population projections are performed by an exponential growth rate method based on census data of 1981 [3] and 1991 [2].

Collection and processing of morbidity data: (*Figure* 1)

Data abstracted from the medical records of cancer patients (without interviewing them) are usually devoid of information on 'duration of residence in the MMTR area'. The required data on such newly diagnosed cancer cases are obtained by field visits and/or letter writing and/or verifying voters' lists. The precoded proformae completed by the social investigators are submitted for scrutiny by statisticians for checking of coding errors, inconsistencies and duplication of cases (manually), using index cards which have name, age, sex, address and site of cancer

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details. Current information on duplicate cases are updated in the original proformae as applicable. ICD O [4] and ICD 9 [5] are used to code topography and morphology. They are then scrutinised by the Medical Officer and any inconsistencies detected are rectified. If any clarification is sought on any item in the proforma, the social investigators, if necessary, even trace the original records of the patients from the concerned hospital and verify them. After scrutiny by the medical officer, the proformae are sent for data entry into the computer. Specially developed programmes with range and cross-checks are used for data entry to minimise data entry errors. The data are then checked for duplication, consistency and typographical errors by using specially developed computer programmes. Inconsistencies, if any, are rectified, and the data are then subjected to statistical analysis.

The performance of the social investigators is monitored through spot checks in the field. The data abstracted from each source are cross-checked periodically for possible missing ones. Regular lectures on cancer registration and medical aspects are delivered by the doctors to the registry personnel, in addition to a variety of training programmes.

Collection and processing of mortality data

Madras city is divided into 155 corporation divisions. The divisional offices of the VSD form the major source of mortality data for the MMTR. Prior to 1989, all deaths that occurred at the place of residence within Madras city were registered by the birth and death clerks in the respective divisional offices, as per the information provided by the relatives of the dead. Since 1989, death information is collected on the prescribed form by the clerk delegated to the respective burial/cremation ground, which is duly signed by the informant, and sent to corporation divisional offices. The death certificate is now insisted upon for all deaths at the time of the disposal of the body. If there was no medical attention at the time of death, then signs, symptoms, duration of illness etc. are collected from the relatives at the time of the disposal of the body. The corporation medical officer will arrive at the probable cause of death based on the above information. Registers are maintained for entering information for each division. All information available in the death registers are not computerised by the VSD of the Madras Corporation and, therefore, the social investigators abstract the mortality data on a standardised mortality proforma from the registers maintained in the respective divisional offices which mention 'tumour' or 'cancer' as the cause of death.

These mortality data of cancer patients are checked for matching with the morbidity data of cancer cases registered in the MMTR from 1982 onwards. Those which do not match with any of the existing cases in the database are termed "death certificates only" (DCO) for which the date of diagnosis is the same as the date of death. Their residential status and particulars about hospitals attended and treatment are collected by writing letters and/or field visits, in order to convert them to morbidity cases with mortality information.

Since 1985, the registry made a special effort to collect mortality information on cancer sites with poor survival, such as stomach, lung and oesophagus, and those with better prognosis, such as cancers of the cervix and breast, by active follow-up (writing letters/field visits). In 1991, the active follow-up to determine the vital status had been extended to cover all cancer cases registered since 1982.

RESULTS

A total of 28980 cancer cases (13012 males; 15968 females) were registered in the MMTR during 1982–1991 with a male–female ratio of 1:1.23. Government hospitals accounted for 64.7%, private institutions for 29%, and DCO 6.3% of the total registered cases during this period. The average annual crude incidence rate (CIR) per 100000 population ranges from 57.8 to 80.5 among males and from 81.0 to 99.0 among females. The age-adjusted rate (AAR), which is standardised to the world population [6], ranges between 83.2 and 121.1 in males, and 112.1 and 137.2 in females. The lifetime (0–74 years) cumulative risk per cent (CR%) [6] of cancer in Madras is 11.47 among males and 13.25 among females. Thus, one in nine males and one in eight females stand a life-time risk of acquiring cancer in Madras. Cancer incidence appears to be higher among females than in males in Madras, India (Table 1).

Figure 2 shows the average annual AAR of selected and classified sites (ICD 9 : 140–208) in MMTR during 1982–1991 for both sexes. Cancers of the oral cavity and oropharynx are classified according to the UICC norms [7]. Cancer of the stomach emerges as the commonest cancer (AAR 15.2) among males followed by cancers of the lung (AAR 9.8) and oral cavity (AAR 9.4). Among females, cancer of the cervix is the commonest (AAR 44.0), followed by cancers of the breast (AAR 21.7) and oral cavity (AAR 9.8).

A total of 11983 deaths due to cancer were registered in MMTR during 1982–1991 from the VSD of the Madras Corporation, death registers in the hospitals and by active follow-up. The average annual crude death rate (CDR) per 100000 population ranges between 17.1 and 43.9 in males and 12.1 and 53.0 in females. The average annual age-adjusted death rate (AADR) ranges from 24.9 to 68.6 among males and from 16.6 to 78.0 among felames. The average annual death rates (adjusted to world population) seen in the prime period of life (35–64 years) are 91.5 per 100000 males and 112.9 per 100000 females in the population (Table 2).

Cancer cases registered in the MMTR based on a DCO during 1982–1991 account for 6.3% (n = 1824). Table 3 gives figures for DCOs over the years which have decreased from 11.4% in 1982 to 4.3% in 1991. Of the total matched deaths (n = 10159), the death information of 3670 (36.1%) cases was received from the VSD of the Madras Corporation and the rest (n = 6489; 63.9%) by active follow-up [8]. There has been an increase in the death rate in recent years compared to 1982 as a consequence of the efforts taken by MMTR to collect information on vital status by active follow-up.

Table 1. *Number of cases and average annual incidence rates per* 100000 *population in MMTR: 1982–1991*

	Male	Female	Male + Female
Frequency	13012	15968	28980
%	44.9	55.1	100
CIR	70.4	92.7	81.2
AAR	104.2	129.0	114.9
TR (35–64 years)	192.8	301.7	242.5
CR%	11.47	13.25	12.22
Ratio at risk	1:9	1:8	1:8

CIR, crude incidence rate; AAR, age-adjusted rate; TR, truncated rate, (AAR and TR are adjusted to standard world population); CR%, lifetime (0–74 years) cumulative risk per cent.

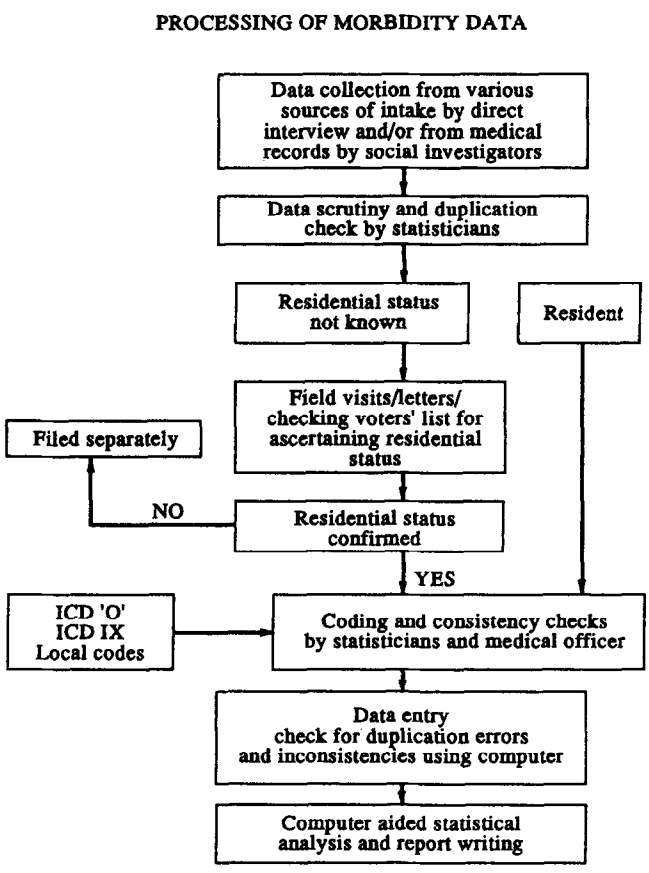

Figure 1. Processing of morbidity data.

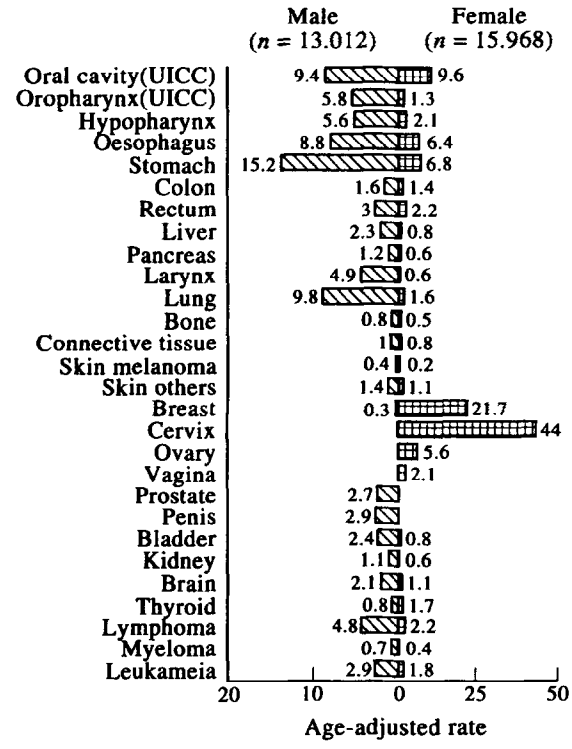

Figure 2. Average annual AAR of selected sites among males and females in MMTR: 1982–1991.

Table 2. Number of deaths and average annual death rates per 100 000 population in MMTR: 1982–1991

	Male	Female	Male + Female
Number	6000	5983	11 983
%	50.1	49.9	100.0
CDR	32.4	34.7	33.5
AADR	49.4	50.9	49.8
TDR	91.5	112.9	101.3
DIP (%)	46.5	37.6	41.6

CDR, crude death rate; AADR, age-adjusted death rate; TDR, truncated death rate (AADR and TDR are adjusted to standard world population); DIP, death in period, i.e. mortality/incidence ratio.

DISCUSSION

Parkin and colleagues [9] have estimated that the number of new cancer cases that occur in the world annually is 7.6 million, 52% of which occur in the developing countries. In India, based on the average annual CIRs observed in Bangalore, Madras and Bombay and the projected population of India for the year 2001 AD, the number of incident cancer cases that will occur in the year 2001 is estimated to be around 0.8 million with a male:female ratio of 1:1.2 [1–3].

The male–female ratio is 1:0.93 in the Madras population. It is interesting to note a female preponderance in the proportion of cases registered in Madras (male:female 1:1.23), unlike Bhopal in Central India (1:0.89) and Bombay in western India (1:0.85) [1]. This female preponderance may be attributed to the higher incidence of cervical cancer in Madras and Bangalore. A similar pattern is seen in Georgia, U.S.A. and Columbia, South America. However, the female population is higher than the male in Georgia, U.S.A. (white 1:1.02; black 1:1.14) and Columbia, South America (1:1.14) [6]. The risk of cancer in a lifetime of 0–74 years in Madras is one in nine among males, one in eight among females, and one in eight when both sexes are taken together. The corresponding risk in the developed countries is one in three, when both sexes are combined [10]. The incidence rates for all sites together (CIR and TR) among females in Madras are the highest compared to all registries in India [1, 8]. However, in Madras, the AAR of cancer of all sites (males 104.2; females 129.0) are much lower than in U.S.A.-SEER (white; males 330.4; females 277.0, black; males 351.3; females 227.1), Canada (males 318.1; females 253.4) and other developed countries. With improvement in the control of communicable diseases, which may increase the life expectancy of an Indian adult, and adoption of a western life style which may increase the incidence rates, the proportion of deaths attributed to cancer in future should increase.

Cancer patterns observed in Madras are different to those in Bombay and Bangalore. The commonest site of cancer among males is the stomach in Madras (AAR 15.2) and Bangalore, (AAR 10.9) and the lungs (AAR 11.2) in Bombay. The second and third most frequent cancers are the lungs (AAR 9.8) and oral cavity (AAR 9.4) in Madras, lungs (AAR 9.5) and oesophagus (AAR 8.6) in Bangalore [11] and oesophagus (AAR 8.8) and hypopharynx (AAR 7.6) in Bombay [12]. It must be highlighted that only after the establishment of a population-based cancer registry in Madras, did it become evident that stomach is the leading site of cancer among males in Madras and not the oral cavity, which is the most frequent cancer in the hospital-based cancer registry at the Cancer Institute (WIA),

Table 3. Trend of number of deaths from VSD and active follow-up and number of incident cases in MMTR: 1982–1991

Year	Deaths from VSD			Matched deaths by active follow-up	Total deaths	Incident cases
	DCO		Matched			
	n	%	*n*	*n*	*n*	*n*
1982	262	11.4	216	13	491	2305
1983	175	6.9	394	73	642	2556
1984	195	7.6	359	287	841	2558
1985	208	7.8	398	492	1098	2683
1986	208	7.1	342	623	1173	2932
1987	161	5.3	436	1132	1729	3054
1988	168	5.3	298	924	1390	3163
1989	161	5.0	364	1227	1752	3197
1990	144	4.4	473	866	1483	3245
1991	142	4.3	390	852	1384	3287
Total	1824	6.3	3670	6489	11983	28980

VSD, vital statistics division; DCO, death certificates only.

Madras. Stomach cancer constituted 13.9% of male and 5% of female cases seen in Madras. It ranks fifth among females and third (9%) when the two sexes are combined. Parkin and colleagues [9] have estimated that stomach cancer is the second most frequent cancer in the world among males (12.3%) and in both sexes combined (9.9%). Lung cancer is the commonest among males (17.6%) and in both sexes combined (11.8%), and ranks fifth among females (5.8%) in the world. The incidence of lung cancer has been increasing in females, and the reverse trend is seen among males in the developed countries because of change in the prevalence of smoking among both sexes. In Madras, however, lung cancer ranks second among males, and does not emerge within the top 10 cancers among females.

Among females, cancer of the cervix (AAR 44.0) is the commonest, followed by breast cancer (AAR 21.7) in Madras, as well as in Bangalore, while cancer of the breast (AAR 24.4) followed by cervical cancer (AAR 19.4) are the commonest in Bombay [8, 11, 12]. The incidence of cancer of the cervix in Madras is higher than in Bangalore and Bombay, and its truncated rate (116.8) is the highest in the world [8, 13]. Among females, breast cancer (19.1%) is the commonest cancer, followed by cervical cancer (11.6%) in the world [9]. When both sexes are combined, cervical cancer ranks first in Madras and fifth in the world and breast cancer is second in Madras and third in the world [8, 9].

The prevalence of tobacco use in India is estimated from the data on annual consumption of tobacco in the country as 50% smokers in males and 2.5% in females, and 10% chewers in both sexes [14]. Cancers of the oral cavity, oropharynx, oesophagus, pancreas, larynx, lung and urinary bladder are related to tobacco habits, and hence preventable. They constitute 43.6% of male and 16.8% of female cancers in Madras [8]. Parkin and colleagues [9] estimate that a minimum of 1.3 million cancers were caused by tobacco in 1985. In India, cancer cases related to tobacco habits, per year, are 151900 (48.2%) in males, 66400 (20.1%) in females and 218300 (33.8%) for both sexes [1]. Cancers of the cervix, breast and oral cavity in females constitute 58.3% of total female cancers, and oral cavity in males comprises 8.7% of total male cancers in Madras. These cancers can be cured if detected early.

The reliability indices used to evaluate the validity and completeness of cancer registration are (i) number of cases diagnosed by microscopic verification, (ii) number of DCOs, (iii) mortality to incidence ratio (M/I) with regard to death-in-period (DIP%) with known average survival rates [6]. The proportion of cases confirmed by histological methods are 70% in Madras and Bangalore, and 80% in Bombay. New cases registered every year by a death certificate alone constitute about 6.3% in Madras [8], 8% in Bombay [12] and 12.8% in Bangalore [11]. DCOs in MMTR are on the decline thus reflecting an improvement in completeness of registration, as evident from Table 3. Active follow-up of registered cases in MMTR has enhanced the M/I ratio from 19% (based on data received from VSD and hospital death registers) to 41%. DIP cannot be treated as one of the reliability indices for the Madras registry because the method of collecting mortality data in Madras is not satisfactory. Hence, we have started collecting data on all deaths (regardless of cause of death) from the VSD and death registers in the hospitals. This exercise is expected to increase DIP% in Madras, making it closer to Western figures.

Data on cancer incidence generated by PBCRs in the network of NCRP paved the way to ICMR-sponsored case–control studies on gastric cancer in Madras, Bombay and Trivandrum, and oesophageal cancer in Bangalore. A comprehensive district cancer control programme has started in the district of South Arcot (near Madras), Tamilnadu. Its area is 130000 km^2 and the population is about 48393000. This programme envisages early detection of cancers at accessible sites: cervix, breast and oral cavity. At the same time, public health education is given to increase the awareness of the health hazards of tobacco use.

Demographic registries are certainly a pioneering effort in a developing environment. The success of the programme, therefore, demands constant vigilance, persistent endeavour and motivation among the registry personnel. Since cancer is not a notifiable disease in India, the practical difficulties of collecting data from multiple sources by active methods are formidable. Because of the establishment of the population-based cancer registries in India, we are able to compute the burden of cancer in our country, carry out analytical studies to identify the risk factors for common cancers, and launch cancer control

programmes to prevent and detect cancer at an early stage. The advantages of having the registry outweigh the difficulties and problems we have in operating the registry successfully.

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Estimating the Incidence of Cancers in Switzerland: 1983–1987

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Estimates have recently been made of the incidence of cancers in the countries of the European Community. Similar estimates are given for Switzerland, based on data from the six Swiss cantonal cancer registries, all of which have been operating for at least 12 years. These registries cover Basel, Geneva, Neuchatel, St Gall and Appenzell, Vaud and Zurich, which account for about 50% of the Swiss population as a whole. Two different methods were used to extrapolate from the incidences observed in the regions covered by cancer registration to the entire country. The first method is based solely on the distribution of populations according to the country's main linguistic groups, whereas the second relies on mortality data. Estimates obtained by the second approach are presented and their reliability is discussed. Comparison of the age incidence curve with that of Denmark tends to confirm the validity of the estimations. Estimated standardised rates (world population) for all sites except non-melanomatous skin cancer are 294.3 for males and 214.2 for females. Comparisons with other European countries show that in males, lung cancer is relatively less common in Switzerland, whereas in females, breast cancer is relatively more frequent.

Key words: cancer incidence, Switzerland, methodology, EC
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INTRODUCTION

IN SWITZERLAND, about 30% of deaths in males and 25% of those in females are attributed to cancer. These figures are obtained from death certificates which are collected by the Swiss Federal Statistical Office. Numbers and rates of incident cases would be useful in order to enable international and interregional comparisons, to monitor trends over time, to provide essential background for aetiological research as well as to evaluate prevention efforts. Such information is available only in regions covered by cancer registries whose primary objectives are to monitor incidence.

Nonetheless, it is possible to make estimates of the number of new cases occurring in an entire country through careful use of data combined from all the areas "covered" by registries. The accuracy of such estimates depends on the extent to which the areas of cancer registration are representative of the whole