Chapter 11

Survival from breast and cervical cancer in Mumbai (Bombay), India

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Introduction

The Bombay cancer registry was the first population-based cancer registry in India, established as a unit of the Indian Cancer Society in 1963, with assistance from the Biometry Branch of the National Cancer Institute, USA. The Department of Science and Technology, Government of India, supported this initiative from 1976 to 1980, and since 1981 it has been partially funded by the Indian Council of Medical Research through the National Cancer Registry Programme of India. The registry covers a population of more than 10 million residents in the entire urban area of Mumbai (Bombay) (603 km^2), which is the most important commercial and industrial centre in India. It is the capital of state of Maharashtra and is located on the west coast of India between latitudes 18°54′N and 19°16′ N and longitudes 70°47′E and 73°E (Fig. 1). Mumbai is the only district in India with a 100% urban population.

Figure 1. Map showing location of Mumbai (Bombay)

This registry has reported incidence data without a break since 1964, in Volumes II–VII of *Cancer Incidence in Five Continents* (Doll *et al.*, 1970; Waterhouse *et al.*, 1976, 1982; Muir *et al.*, 1987; Parkin *et al.*, 1992, 1997). It is one of the few cancer registries in the developing world with an incidence database spanning over 30 years to allow the study of trends in cancer incidence.

In this chapter we report the survival experience of breast and cervical cancer patients registered during 1982–86 in Bombay Cancer Registry.

Cancer registration

Information is obtained from 168 hospitals and clinics in the public and private sector using a structured form. The registry staff visit the data sources to abstract data on resident cancer cases. They interview cancer patients personally and then review records maintained by various services concerned with cancer diagnosis and management. The major source of data is the Tata Memorial Centre, the premier cancer hospital in Maharashtra state, where outpatient records are also scrutinized. Copies of death certificates mentioning cancer or tumour as the cause of death are obtained from the Vital Statistics Division of the municipal death register. These are matched with the registry cancer database. The unmatched cases are traced back to hospitals and residences. If this cannot be done, the cases are registered as 'death certificate only' (DCO).

The information obtained from these sources is merged together in the registry in order to complete the records and eliminate any duplicates. The forms containing the information are classified into three groups: resident, residence status not known and nonresident. People whose residence status is not known are checked against the electoral rolls, and if they are found they are treated as resident cases.

Data are coded using the manual of the National Cancer Registry Programme (National Cancer Registry Programme, 1987). The primary site and histology are coded using the *International Classification of Diseases for Oncology*, First Edition (WHO, 1976). The data are

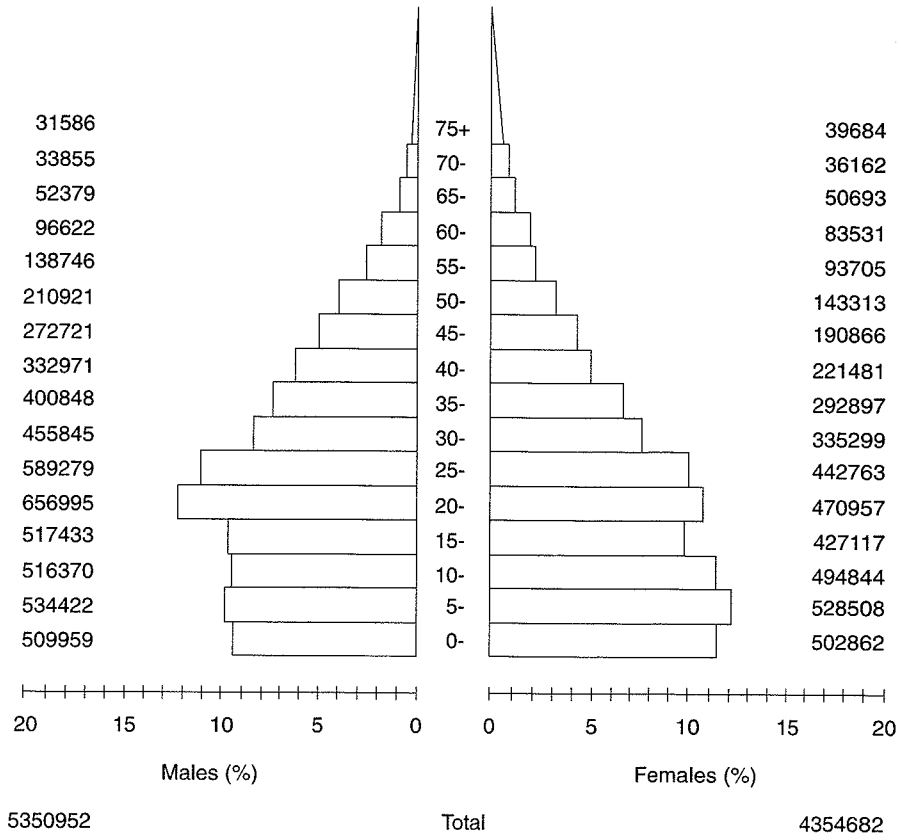

Figure 2. Average annual population of Mumbai (Bombay), 1988–92

reported using the *International Classification of Diseases, Ninth Revision* (ICD-9) codes (WHO, 1978). For several years, data were processed manually, but personal computers are now used. Internal quality control measures are regularly applied to ensure completeness and reliability of the collected data (Yeole & Jussawalla, 1988). Incidence data from the registry are reviewed annually in a review meeting of the National Cancer Registry Programme and any discrepancies are rectified.

The registry is supervised by a deputy director, and the registry staff include a biostatistician, a programmer, a computing assistant, 12 medical social workers, six research assistants and three clerks. The registry staff regularly attend the training programmes conducted by the National Cancer Registry Programme in various locations in India.

Cancer incidence in Bombay

Details on cancer incidence during the period 1988–92 are given in Table 1. Fig. 2 shows the age structure of the resident population. The average annual crude and age-adjusted incidence rates for all sites during the above period in males were 70.7 and 133.1/100 000 person-years, respectively; the corresponding rates in females were 77.1 and 126.6, respectively.

The major cancer sites among males were lung, oesophagus, hypopharynx, larynx, stomach, mouth and tongue, which together accounted for 45% of all male cancers. Among females, cancers of the breast, uterine cervix, ovary, oesophagus and mouth predominated. Annual reports on cancer incidence are published.

Because data have been available since 1964, it has been possible to study time trends in incidence. There has been a significant increase in breast cancer incidence (Yeole *et al.*, 1990; Coleman *et al.*, 1993; Parkin, 1994). The average annual increase in the age-standardized incidence rate for breast cancer during the period 1964–87 was 1.2% (Parkin, 1994). The rise in breast cancer incidence is seen in all age groups, except in the very old. A small but steady decline is observed in the incidence of cancers of the

cervix, tongue, hypopharynx, colorectum and larynx (Jayant & Yeole, 1987; Yeole *et al.*, 1989; Coleman *et al.*, 1993; Parkin, 1994). Higher age at marriage, fewer childbirths and improvements in socioeconomic status have largely contributed to the decline in cervical cancer incidence and the increase in breast cancer rates. Lung cancer rates have remained fairly stable and the risk is still low compared with that in the developed world. There has even been a nonsignificant decrease in incidence in females (Coleman *et al.*, 1993).

Health services

The state government of Maharashtra and the Bombay Municipal Corporation are mainly responsible for the organization of public health and medical services in the city. More than 100 hospitals in Bombay, which include the Tata Memorial Centre (the premier comprehensive cancer centre in the country) and four medical schools, have the infrastructure for diagnostic facilities for cancer. However, both diagnostic and treatment facilities are concentrated in certain hospitals. Cancer surgery is undertaken in all the major public and private hospitals. Megavoltage radiotherapy using cobalt machines or linear accelerators is available in six hospitals; orthovoltage deep X-ray therapy in 10 hospitals, and brachytherapy in six hospitals. Cancer chemotherapy is administered in over 10 hospitals. Hospices and palliative care facilities are widely available. There is a focus on psychological and vocational rehabilitation of cancer patients, under the leadership of the Indian Cancer Society. Support services, such as ostomy care, counselling, homecare and hospices, have been widely developed under the patronage of dedicated organizations.

Early detection activities

There are no organized screening programmes in Bombay. However, the Indian Cancer Society and the Preventive Oncology Division of the Tata Memorial Centre have early detection clinics. Cytology services are widely available on demand. There are programmes to improve professional awareness of cancer diagnosis and therapy.

Survival analysis

Subjects

A total of 2973 breast and 2426 cervical cancer cases were registered during the period 1982–86 (Table 2), four-fifths of which had histological confirmation. A number of cases were excluded from the final survival analysis: 168 cases which were registered as DCOs, three cases with invalid ICD-9 codes and two cases without information on age. This left 2872 breast cancer cases (96.6% of the incident cases) and 2354 cervical cancer cases (97.0% of the incident cases) for survival analysis. Details on marital status, mother tongue, religion, education and clinical extent of disease were available for these cases.

Follow-up methods

The closing date for follow-up was 31 December 1993. The incident cases were matched with death certificates mentioning cancer or tumour as cause of death up to 1993. For the unmatched cases, telephone enquiries were made for those with telephone numbers, and reply-paid letters sent to the remainder. If no reply was received, home visits were carried out. When home visits were not successful, the case-records from reporting hospitals were scrutinized to determine the date of the last visit and the person's vital status (alive/dead).

The outcome of follow-up is given in detail for both sites in Table 3. Vital status was known for 69.0% of breast cancers and 72.4% of cervical cancers. For cases lost to follow-up before the closing date, partial information was available for varying periods of time from the diagnosis date. Overall, complete information on vital status was available for three-quarters of the subjects five years after diagnosis.

Analytical methodology (see Chapters 2, 3 and 5)

The index date for calculation of survival time was the incidence date. The survival time for each case was the time between the index date and the date of death *or* date of loss to follow-up *or* 31 December 1993. Cumulative observed and relative survival probabilities were calculated using Hakulinen's method (Hakulinen, 1982; Hakulinen *et al.*, 1994). The expected survival for a group of people in the general population similar to the patient population with respect to age, sex, and calendar period of observation was calculated using the abridged life tables of the urban Indian population (Registrar General of India, 1995). Age-standardized relative survival (ASRS) was calculated for all age groups and for the age group 0–74 years by directly standardizing site-specific and age-specific relative survival to the site-specific age distributions of the estimated global incidence of major cancers in 1985 for comparison with results from other countries.

Table 1. Annual average cancer incidence per 100 000 person-years in Mumbai (Bombay), India, 1988–92

	MALES			FEMALES		
Site	Number	Crude rate	ASR	Number	Crude rate	ASR
Lip	54	0.2	0.4	37	0.2	0.3
Tongue	950	3.6	6.5	287	1.3	2.3
Salivary gland	97	0.4	0.6	48	0.2	0.3
Mouth	1023	3.8	6.2	584	2.7	4.6
Oropharynx	482	1.8	3.5	57	0.3	0.5
Nasopharynx	120	0.4	0.7	39	0.2	0.3
Hypopharynx	1167	4.4	8.3	262	1.2	2.0
Oesophagus	1383	5.2	10.8	962	4.4	8.3
Stomach	1010	3.8	7.7	462	2.1	3.8
Colon	522	2.0	3.7	354	1.6	3.0
Rectum	537	2.0	3.9	330	1.5	2.7
Liver	506	1.9	3.9	226	1.0	1.9
Gallbladder	249	1.1	2.3	324	1.5	2.7
Pancreas	302	1.1	2.3	214	1.0	1.8
Larynx	1093	4.1	8.2	163	0.7	1.4
Lung	1867	7.0	14.5	432	2.0	3.7
Bone	200	0.7	0.8	105	0.5	0.6
Connective tissue	239	0.9	1.3	156	0.7	1.0
Melanoma of skin	53	0.2	0.4	43	0.2	0.3
Other skin	244	0.9	1.7	159	0.7	1.2
Breast	75	0.3	0.6	3864	17.7	28.2
Cervix uteri				2828	12.9	20.2
Corpus uteri				296	1.4	2.5
Ovary				989	4.5	7.2
Prostate	764	2.9	7.9			
Testis	229	0.9	0.9			
Penis	219	0.8	1.5			
Bladder	554	2.1	4.8	132	0.6	1.2
Kidney	301	1.1	2.0	130	0.6	0.9
Brain	660	2.5	3.3	357	1.6	2.2
Thyroid	133	0.5	0.8	326	1.5	2.1
Hodgkin's disease	283	1.1	1.3	107	0.5	0.6
Non-Hodgkin lymphoma	696	2.6	4.1	377	1.7	2.7
Multiple myeloma	158	0.6	1.2	103	0.5	0.9
Lymphoid leukaemia	324	1.2	1.6	194	0.9	1.1
Myeloid leukaemia	416	1.6	2.0	254	1.2	1.5
All sites	18904	70.7	133.1	16785	77.1	126.6
All sites except skin	18660	69.7	131.4	16626	76.4	125.4

ASR: Age-standardized incidence rate (world population)

Table 2. Cases of cancer registered and data quality indices, Mumbai (Bombay), India, 1982–86

Site	ICD 9	No. of cases registered	Data quality indices		Cases excluded from analysis		Cases included for survival analysis	
			% DCO	% HV	DCO	Others	No.	%
Breast	174	2973	3.3	78.5	99	2	2872	96.6
Cervix	180	2426	2.8	83.0	69	3	2354	97.0

DCO : Death certificate only; HV : Histological verification

Table 3. Details of outcome of follow-up of cases in Mumbai (Bombay)

Site	Vital status known	Cases with partial follow-up information		
		≤ 1 year	2–4 years	≥ 5 years
Breast	1981 (69.0%)	179 (6.2%)	533 (18.6%)	179 (6.2%)
Cervix	1704 (72.4%)	181 (7.7%)	447 (19.0%)	22 (0.9%)

Table 4. Cumulative observed and relative survival, Mumbai (Bombay), India, 1982–86

Site	ICD 9	Number included	Observed survival			Relative survival		
			1 yr	3 yr	5 yr	1 yr	3 yr	5 yr
Breast	174	2872	84.2	61.9	51.1	85.5	64.7	55.1
Cervix	180	2354	81.0	56.0	47.7	82.0	58.0	50.7

Table 5. Site-specific and age-specific number of cases, five-year relative survival and ASRS, Mumbai (Bombay), India, 1982–86

Site	ICD 9	Number of cases by age group						% Relative survival (RS) at 5 years						RS	ASRS%	
		≤34	35–44	45–54	55–64	65–74	75+	≤34	35–44	45–54	55–64	65–74	75+		All ages	0–74
Breast	174	281	744	837	589	307	114	59.5	56.1	53.7	53.7	55.8	49.6	55.1	54.0	55.1
Cervix	180	253	624	735	511	181	50	66.5	57.4	42.3	46.3	44.5	20.9	50.7	46.0	49.5

ASRS: Age-standardized relative survival

The Cox proportional hazard model was used to elicit the main effects in univariate and multivariate analysis of risk factors (Cox, 1972).

Results

The one-year, three-year and five-year observed and relative survival rates and the five-year relative survival rates by age group are shown in Tables 4 and 5, respectively. The five-year relative survival was 55% for breast cancer and 51% for cervical cancer. There was a decreasing trend in relative survival with age in cervical cancer; no effect of age was evident in the case of breast cancer.

Figs. 3 and 4 show the observed survival until five years from diagnosis by different categories of clinical extent of disease for breast and cervical cancers, respectively. The information on clinical extent of disease was available for 91.1% of breast cancers and 94.8% of cervical cancers. An inverse relationship between clinical extent of disease and survival is observed.

Table 6 shows the five-year observed survival for breast and cervical cancers according to age group, religion, marital status and clinical extent of disease. On univariate analysis, age group ($p < 0.001$), marital

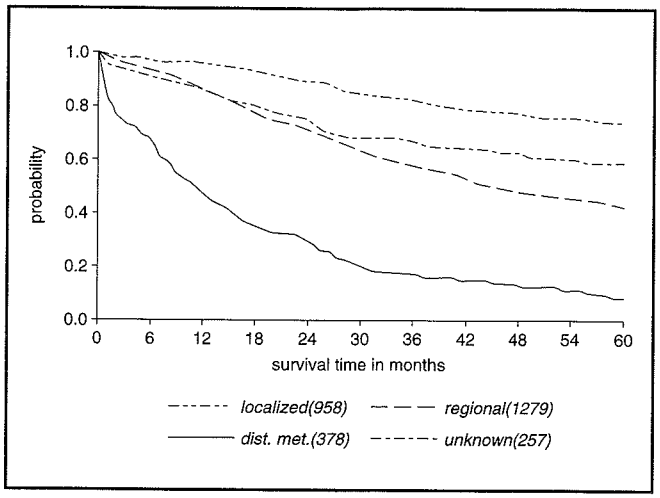

Figure 3. Survival from breast cancer by clinical extent of disease in Mumbai (Bombay), India

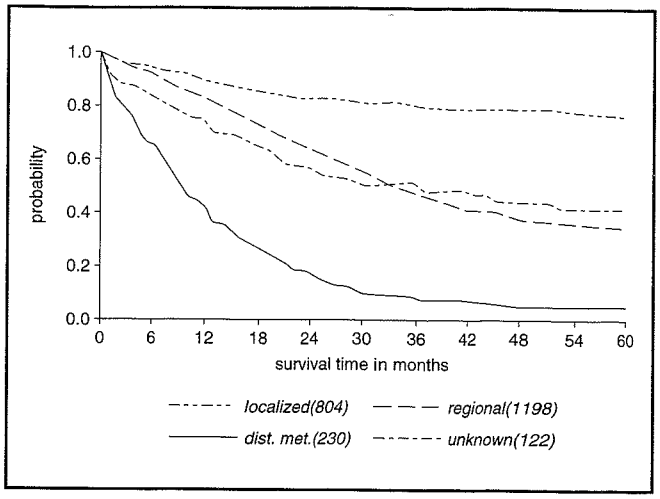

Figure 4. Survival from cervical cancer by clinical extent of disease in Mumbai (Bombay), India

status ($p < 0.001$) and clinical extent of disease ($p < 0.001$) emerged as significant factors affecting survival in breast and cervical cancer. On multivariate analysis, all of these emerged as independent predictors of survival for breast cancer (Table 7). For cervical cancer, age group ($p < 0.001$), and clinical extent of disease ($p < 0.001$) were independent predictors of survival with both the factors showing an inverse relationship (Table 8). The most important prognostic factor for both cancers seems to be the clinical extent of disease at presentation. The risk of dying was three times higher for regional disease and 10 times higher for distant metastatic disease compared with localized disease in breast cancer. The relative risk of death was 3–4 times higher for regional and 11–12 times higher for distant metastasis compared with localized disease in cervical cancer. The relationship of age with survival from breast cancer did not reveal any trend, although people aged 75 years and over had a significantly lower survival rate than those aged under 35 years. On the other hand, an increasing hazard with age was evident among cervical cancer cases.

Discussion

The results of our analysis represent an average prognosis from breast and cervical cancers in Bombay, in view of the very low number of cases excluded from the final analysis. Information on prognostic factors such as clinical extent of disease was available for over 90% of the cases. Every effort was taken to obtain information on the vital status of patients, and complete follow-up information was available for over 70% of patients at the closing date.

The clear downward gradient in survival with advanced disease indicates that the classification of the clinical extent of disease was reasonably accurate. It is generally recognized that it is often not possible for population-based registries to obtain reliable information on various clinically important factors such as stage, clinical extent of disease and treatment in view of the variety of sources from which data are obtained and the wide variation in staging and treatment practices, as well as record-keeping and accessibility, between these centres. Moreover, a reasonably well developed health care infrastructure is essential for the various investigations which are required for accurate staging. Despite these difficulties, we were able to collect information on clinical extent of disease from several sources and classify it according to the categories defined by the manual of the National Cancer Registry Programme (National Cancer Registry Programme, 1987). Our results indicate that, if the lesions are diagnosed at an early stage and appropriate treatment can be ensured, satisfactory survival can be achieved in developing-country settings.

Marital status emerged as an independent predictor of survival for breast cancer in our study. This can be considered as a surrogate for socioeconomic status. The poor survival observed among widowed or divorced or separated women indicates the influence of socioeconomic factors and their bearing on general health, nutritional status, attitudes and health behaviour. The adverse effect of poor socioeconomic status on cancer survival has been well established (Kogevinas *et al.*, 1991; Mackillop *et al.*, 1997). Religion did not contribute to differences in survival.

The five-year age-adjusted relative survival observed for breast cancer in our population is on the

Table 6. Five-year observed survival by selected patient and disease characteristics in Mumbai (Bombay), India, 1982–86

Factor	Breast cancer % (no. of cases)		Cervical cancer % (no. of cases)	
Age group				
< 35 years	59.0	(281)	65.9	(253)
35–44	55.0	(744)	56.6	(624)
45–54	51.3	(837)	40.9	(735)
55–64	48.6	(589)	42.4	(511)
65–74	43.3	(307)	34.4	(181)
75+	29.3	(114)	12.4	(50)
Religion				
Hindu	51.0	(1974)	47.3	(1871)
Muslim	49.9	(399)	51.0	(240)
Christian	54.1	(239)	57.4	(88)
Parsi/ neo-Buddhist	48.2	(132)*	36.6	(101)**
Others	54.5	(121)	52.0	(46)
Marital status				
Married	53.6	(1959)	49.0	(1557)
Widowed/divorced/separated	44.6	(468)	40.0	(566)
Single	49.4	(108)	63.2	(15)
Unknown	45.4	(337)	57.2	(216)
Clinical extent of disease				
Localized	74.4	(958)	77.4	(804)
Regional	43.0	(1279)	35.0	(1198)
Distant metastasis	9.5	(378)	5.6	(230)
Unknown	59.5	(257)	41.8	(122)

* Parsi only; ** neo-Buddhist only

higher side of the range of survival rates reported from India and other developing countries (Gajalakshmi *et al.*, 1997; Nandakumar *et al.*, 1995a; Sankaranarayanan *et al.*, 1996). The corresponding rate for cervical cancer is higher than in Bangalore, India (Nandakumar *et al.*, 1995b) and is in the middle of the range from developing countries (Sankaranarayanan *et al.*, 1996). The figures for both cancers were lower than for the whole of Europe (Berrino *et al.*, 1995) and the USA in the late 1960s (Sankaranarayanan *et al.*, 1996). Bombay has a level of health services which allows patients reasonable access to diagnostic and therapeutic services. Moreover, one-third of patients in both cancer sites presented at localized clinical stages. These two factors may have contributed to the good survival observed in Bombay. However, there is considerable scope for improving the outcome by early diagnosis and treatment, and it would be prudent to consider ways of achieving this at minimal cost. With the prevailing incidence rates of breast cancer, it is unlikely that an organized screening programme would prove cost-effective, given the infrastructure needed and the cost of mammography. The incidence of cervical cancer is slowly, but steadily, declining owing to changes in socioeconomic status and childbearing practices. It seems, for both cancers, that a programme of health education to improve awareness and to promote early detection among high-risk groups is the most feasible approach to control.

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Table 7. Independent predictors of survival from breast cancer in Mumbai (Bombay), India

Factor	Hazard ratio	95% CI	χ^2 value	*p* value
Marital status			7.6	<0.05
Married	1.00			
Widowed/divorced/separated	1.24	1.05–1.45		
Single	1.19	0.89–1.57		
Age group			19.26	<0.005
<35 years	1.00			
35–44	0.87	0.69–1.09		
45–54	0.98	0.78–1.23		
55–64	0.97	0.76–1.23		
65–74	1.10	0.84–1.44		
75+	1.79	1.26–2.53		
Clinical extent of disease			604.1	<0.0001
Localized	1.00			
Regional	2.98	2.55–3.47		
Distant	9.93	8.28–11.90		

CI: Confidence interval

Table 8. Independent predictors of survival from cervical cancer in Mumbai (Bombay), India

Factor	Hazard ratio	95% CI	χ^2 value	*p* value
Age group			37.55	<0.001
<35 years	1.00			
35–44	1.29	1.00–1.67		
45–54	1.68	1.31–2.16		
55–64	1.62	1.25–2.10		
65–74	1.97	1.46–2.68		
75+	2.38	1.59–3.56		
Clinical extent of disease			516.45	<0.0001
Localized	1.00			
Regional	3.43	2.89–4.07		
Distant	11.62	9.40–14.36		

CI: Confidence interval

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