

Chapter 24

Cancer survival in Singapore, 1993–1997

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Abstract

The Singapore cancer registry is a national registry established in 1968. Cancer registration is done by passive methods. The registry contributed survival data on 45 cancer sites or types registered during 1993–1997. Data on 34 cancers registered during 1968–1997 were utilized for survival trend by period and cohort approaches. Follow-up was done by passive methods, with median follow-up ranging between 2–72 months for different cancers. The proportion with histologically verified diagnosis for various cancers ranged between 27–100%; death certificates only (DCOs) comprised 0–7%; 76–100% of total registered cases were included for the survival analysis. The top-ranking cancers on 5-year age-standardized relative survival rates were non-melanoma skin (96%), thyroid (90%), testis (88%), corpus uteri (77%), breast (74%), Hodgkin lymphoma (73%) and penis (70%). Five-year relative survival by age group showed either a decreasing trend with increasing age groups or was fluctuating. Localized stage of disease ranged between 18–65% for various cancers and survival decreased with increasing extent of disease. Period survival closely predicted survival experience of cancers diagnosed in that period, and an increasing trend in period survival over different periods indicated an improved prognosis for cancers diagnosed in those calendar periods.

Singapore cancer registry

The Singapore cancer registry is a national registry established in 1968 to obtain information on cancer patterns in the entire country. The registry has been contributing data to the quinquennial IARC publication *Cancer Incidence in Five Continents* since volume III [1]. Cancer notification is voluntary, and registration of cases is predominantly by passive methods with no personal contact with cases. The principal sources of information on incident cancer cases are the notification forms from all sections of the medical profession, pathology and hospital records [2]. The registry caters to a population of about 4.1 million with a sex ratio of 986 females to 1000 males in 2002, comprising major ethnic groups of Chinese, Malays and Indians. The average annual age-standardized incidence rate of all cancers and ethnic populations together is 235 per 100 000 among males and 200 per 100 000 among females in 1998–1999 [3].

The registry contributed data on survival from 45 cancer sites or types for the first time in this volume of the IARC publication on *Cancer Survival in Africa, Asia, the Caribbean and Central America*. In the present volume, the main tables pertain to the period 1993–1997. The data on survival for the years 1968–1992 are also utilized to elicit the trend in cancer survival using different approaches.

Data quality indices (Table 1)

The proportion of cases with histologically verified cancer diagnosis in the series varied from 100% for many cancers to 27% in liver cancer. The frequency of cases registered based on a death certificate only (DCO) range between nil among many cancers to 7% in unspecified leukaemia. Cases excluded from the study, due to lack of follow-up and other basic information, are in the range of 0% for mesothelioma and 24% for bone cancers. Thus, 76–100% of the total cases registered are included in the estimation of the survival probability.

Outcome of follow-up (Table 2)

The follow-up of cases has been completely carried out by passive methods. Since certification of death is virtually complete, the cancer mortality information received from the death certificate is matched with the incident cancer database. The vital status of the unmatched incident case is then collected by scrutiny of hospital records, and all such cases are presumed to be alive until the end of the calendar year for which the mortality data are fully available.

The closing date of follow-up was 31st December 2001. The median follow-up ranged from 2 months for liver cancer and unspecified leukaemia to 72 months for testicular cancer. The completeness of follow-up at 5

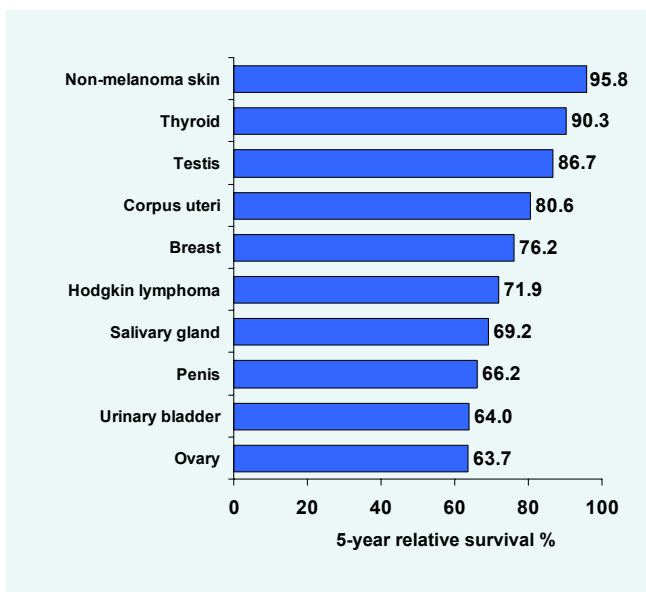
years from the incidence date was 100% for all cancers as there are no losses to follow-up.

Survival statistics

All ages and both sexes together (Table 3)

The top-ranking cancers on 5-year relative survival are non-melanoma skin (96%), thyroid (90%), testis (87%), corpus uteri (81%) and breast (76%). The lowest survival rate is encountered with cancer of the pancreas (4%), preceded by cancer of the liver (5%), oesophagus (6%) and lung (7%) and mesothelioma (9%). Salivary gland (69%) among other head and neck cancers and colon and rectum (50%) among gastrointestinal cancers have a higher survival rate than others in the category. Hodgkin lymphoma has a better survival rate than non-Hodgkin. The survival figures for haematopoietic malignancies are as follows: multiple myeloma (19%), lymphoid leukaemia (46%), myeloid leukaemia (18%) and unspecified leukaemia (9%).

Figure 1a. Top ten cancers (ranked by survival), Singapore, 1993–1997



The 5-year age-standardized relative survival (ASRS) probability for all ages together is observed to be less than or similar to the corresponding unadjusted one for a majority of cancers. Also, the 5-year ASRS (0–74 years of age) is generally higher than or similar to the corresponding ASRS (all ages) for a majority of cancers.

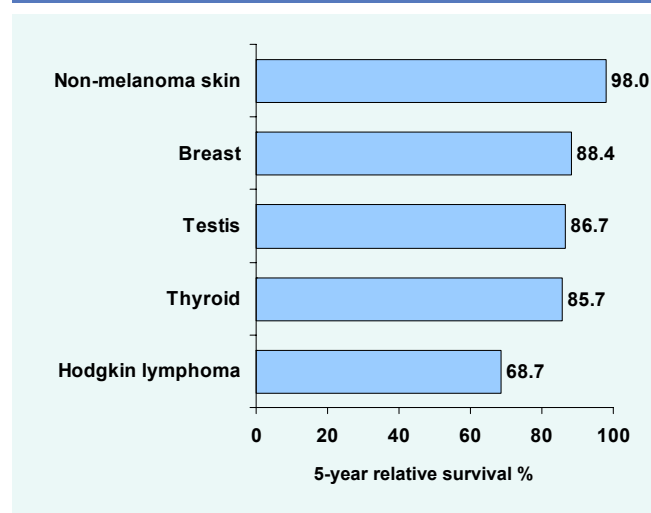
Sex

Male (Table 4a)

The 5-year relative survival of cancer of the testis is 87%, prostate is 63% and penis is 66%. Cancers of the

hypopharynx, breast, small intestine and urinary bladder have a notably higher survival among males than females.

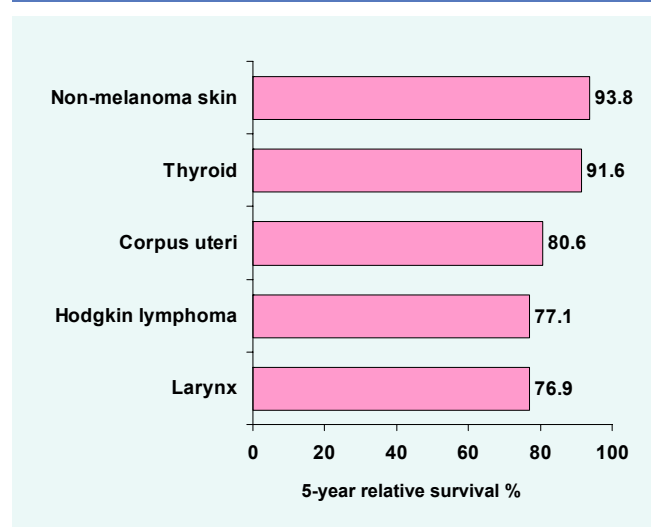
Figure 1b. Top five cancers (ranked by survival), Male, Singapore, 1993–1997



Female (Table 4a)

The 5-year relative survival from cancers of the breast, uterine cervix, ovary and vulva are 76%, 64%, 64% and 62%, respectively. Survival is markedly higher among females than males in most cancers of the head and neck, rectum, anus, other thoracic organs, melanoma and non-melanoma skin, renal pelvis, Hodgkin and non-Hodgkin lymphoma and lymphoid leukaemia.

Figure 1c. Top five cancers (ranked by survival), Female, Singapore, 1993–1997



Age group (Table 4b)

The 5-year relative survival by age group reveals no distinct pattern or trend, and fluctuates with increasing age groups for most cancers. However, an inverse relationship between age group and survival was observed for cancers of the salivary gland, gall bladder, larynx, other thoracic organs, mesothelioma, corpus uteri, ovary, brain, thyroid and myeloid leukaemia.

Extent of disease (Table 5; Figure 2)

The information on the clinical extent of disease is analysed for selected cancer sites. Most of the cancers have been diagnosed at a localized stage ranging between 18–65% for various cancers. Nasopharyngeal cancer is an exception wherein a majority (36%) have regional spread of disease at diagnosis. Distant metastasis at diagnosis vary from 20% for ovarian cancer to 1% in cancer of the oral cavity. The unknown category is substantial, ranging between 24–50%. Survival is the highest among localized cancers, followed by regional and distant metastasis cases among the known categories.

Survival trend (Table 6)

The trend of survival data, estimated by the same method of semi-complete analytic approach as in the previous tables, is available for 34 cancer sites or types spanning 10 years in two time periods, 1988–1992 and 1993–1997. An increasing trend with an absolute difference of 8–10% and more between the two calendar periods is observed in cancers of the colon, rectum, larynx, non-melanoma skin, prostate and urinary bladder. The survival was similar for a majority of other cancers in successive calendar periods.

Trend of survival by period and cohort approaches (Tables 7-9; Figure 3)

The availability of data on registration and follow-up together for both a long (from the calendar year 1968) and up to a recent period (year 1997) of calendar time led to the possibility of estimating up-to-date survival and trend by period approach. Survival is also estimated by cohort approach for comparison.

The 5-, 10- and 15-year relative survival estimates by cohort and period approaches are estimated for the different 5-year calendar periods from 1973–1977 to 1993–1997. A distinct correspondence between the two approaches is forthcoming. The period survival estimates at 5, 10 and 15 years of follow-up in a calendar period are seen to resemble the cohort survival estimates of the succeeding calendar periods after 5, 10 and 15 years respectively for most cancers. Thus, period survival closely predicts the survival experience of cancer cases diagnosed in that period. An increasing trend of period survival estimates over the different calendar periods is an indicator for improved prognosis for cancers diagnosed in those calendar periods.

References

1. Parkin DM, Whelan SL, Ferlay J and Storm H. *Cancer Incidence in Five Continents, Vol I to VIII: IARC Cancerbase No. 7*. IARC Press, Lyon, 2005.
2. Lee HP, Day NE and Shanmugaratnam K. *Cancer incidence in Singapore 1968–1982: IARC Scientific Publications No. 91*. National University of Singapore, Singapore, 1988.
3. Chia KS, Lee JJ, Wong JL, Gao W, Lee HP, Shanmugaratnam K. Cancer incidence in Singapore, 1998 to 1999. *Ann Acad Med Singapore*. 2002; 31(6): 745–750.

Figure 2. Absolute survival (%) from selected cancers by extent of disease, Singapore, 1993–1997

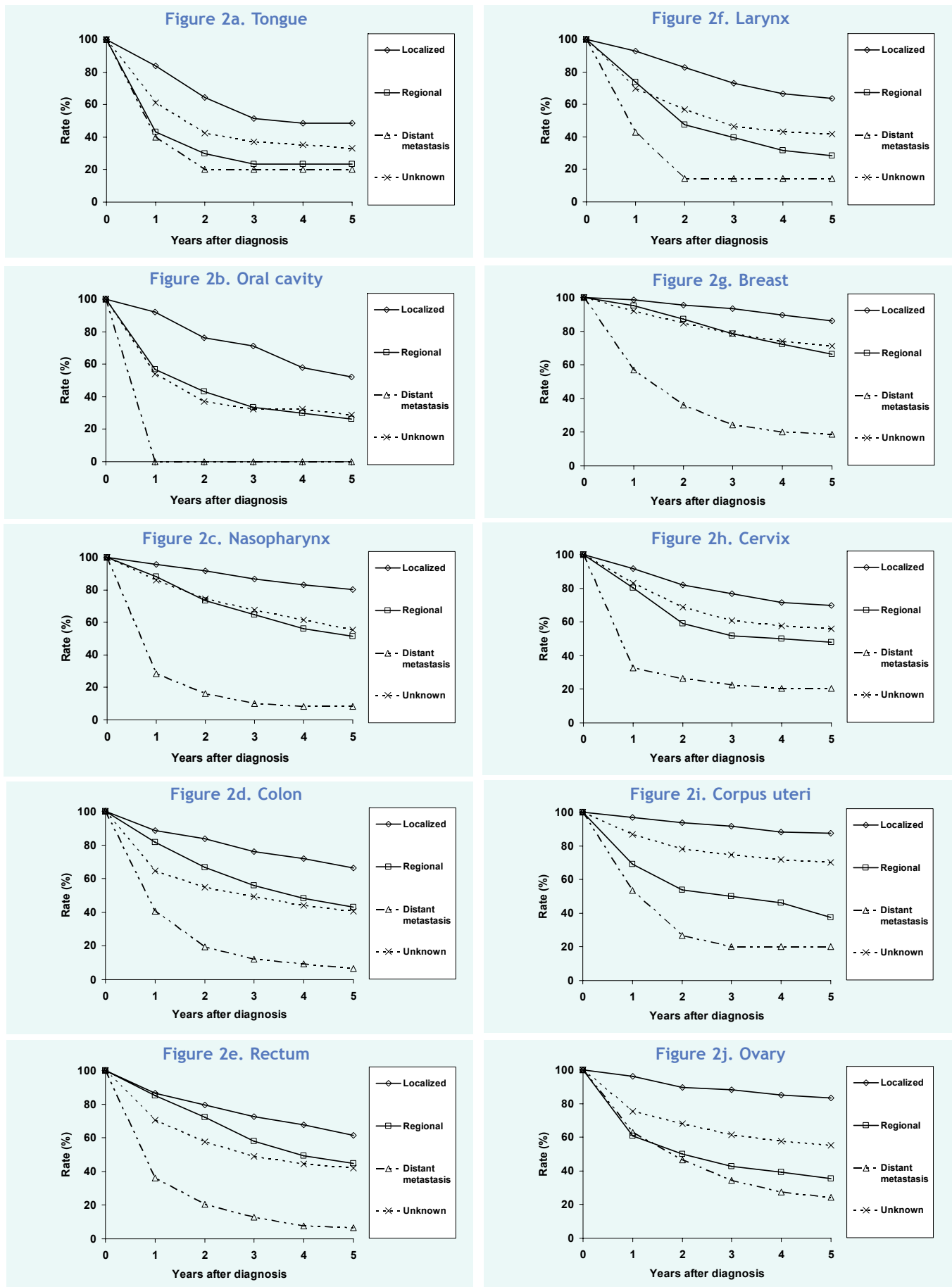


Figure 3. Up-to-date 5-year relative survival of selected cancers by period and cohort approaches, Singapore

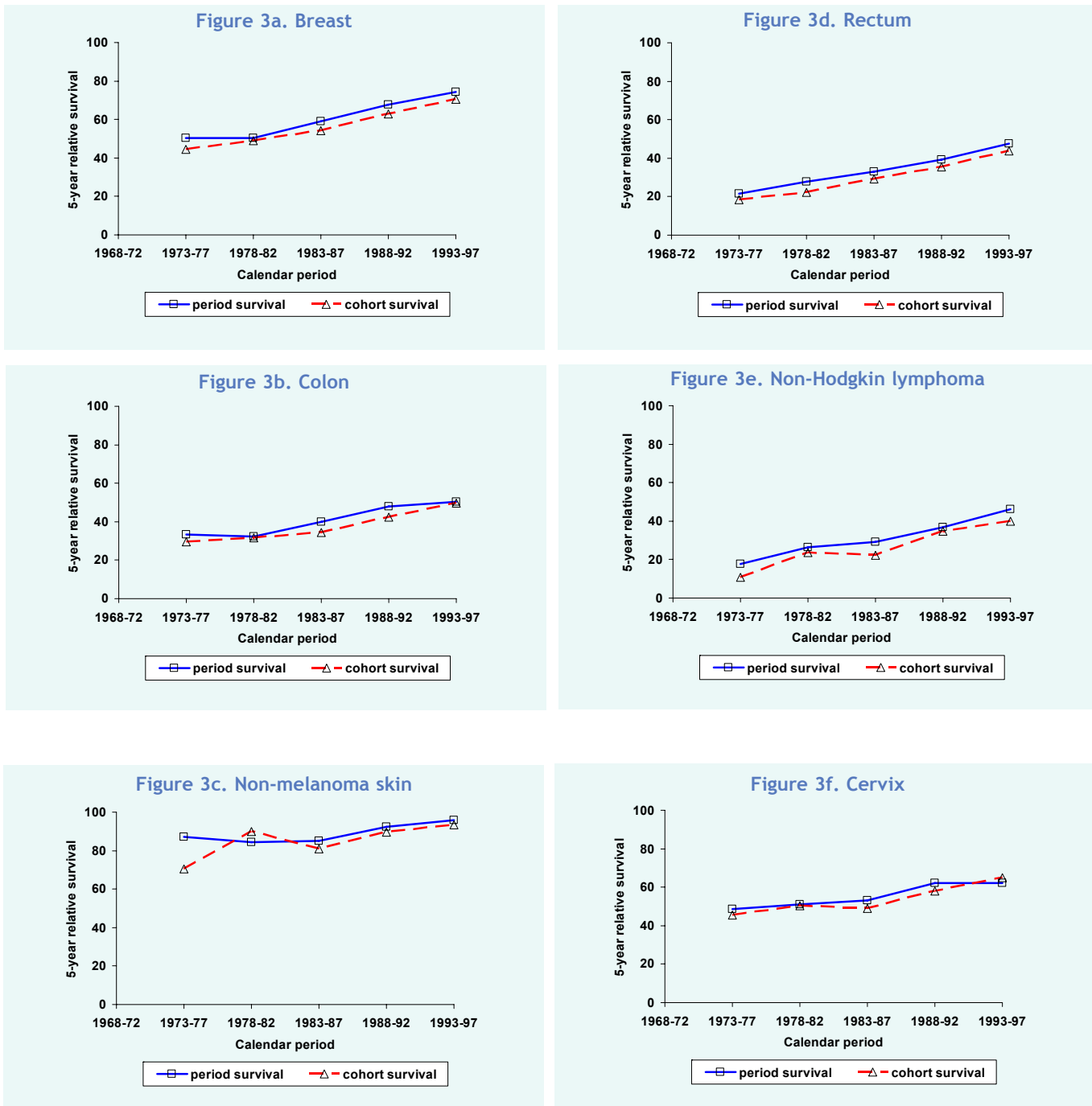


Table 1. Data quality indices - Proportion of histologically verified and death certificate only cases, number and proportion of included and excluded cases by site: Singapore, 1993–1997 cases followed-up until 2001

Site	ICD-10	Total registered	%		Excluded cases					Included cases	
			HV	DCO	DCO	Follow-up	Others	Total	%	No.	%
Tongue	C01-02	124	100.0	0.0	0	4	0	4	3.2	120	96.8
Oral cavity	C03-06	138	97.8	0.0	0	3	0	3	2.2	135	97.8
Salivary gland	C07-08	95	98.9	0.0	0	2	6	8	8.4	87	91.6
Tonsil	C09	40	97.5	0.0	0	2	0	2	5.0	38	95.0
Nasopharynx	C11	1 459	98.8	0.0	0	53	2	55	3.8	1 404	96.2
Hypopharynx	C12-13	92	98.9	0.0	0	2	0	2	2.2	90	97.8
Oesophagus	C15	459	92.4	1.5	7	5	1	13	2.8	446	97.2
Stomach	C16	2 191	94.0	1.1	25	41	25	91	4.2	2 100	95.8
Small intestine	C17	88	94.3	0.0	0	3	5	8	9.1	80	90.9
Colon	C18	2 628	93.3	0.8	20	79	28	127	4.8	2 501	95.2
Rectum	C19-20	1 831	97.2	0.2	3	66	9	78	4.3	1 753	95.7
Anus	C21	53	98.1	0.0	0	0	0	0	0.0	53	100.0
Liver	C22	1 655	26.8	5.2	86	19	0	105	6.3	1 550	93.7
Gall bladder	C23-24	299	73.9	1.7	5	5	0	10	3.3	289	96.7
Pancreas	C25	536	41.8	3.4	18	3	3	24	4.5	512	95.5
Nose/Sinuses	C30-31	73	98.6	0.0	0	1	1	2	2.7	71	97.3
Larynx	C32	326	96.9	0.0	0	14	1	15	4.6	311	95.4
Lung	C33-34	4 386	82.4	1.7	74	56	3	133	3.0	4 253	97.0
Other thoracic organs	C37-38	65	89.2	1.5	1	1	0	2	3.1	63	96.9
Bone	C40-41	80	96.3	1.3	1	2	16	19	23.8	61	76.3
Melanoma of skin	C43	66	100.0	0.0	0	6	0	6	9.1	60	90.9
Other skin	C44	1 163	99.5	0.1	1	124	1	126	10.8	1 037	89.2
Mesothelioma	C45	34	100.0	0.0	0	0	0	0	0.0	34	100.0
Connective tissue	C47+C49	185	94.6	1.1	2	7	10	19	10.3	166	89.7
Peritoneum	C48	44	86.4	0.0	0	1	3	4	9.1	40	90.9
Breast	C50	3 395	98.9	0.2	7	147	37	191	5.6	3 204	94.4
Vulva	C51	38	100.0	0.0	0	3	0	3	7.9	35	92.1
Cervix	C53	1 037	98.7	0.3	3	50	0	53	5.1	984	94.9
Corpus uteri	C54	532	97.7	1.1	6	32	11	49	9.2	483	90.8
Ovary	C56	787	96.6	0.6	5	35	29	69	8.8	718	91.2
Penis	C60	42	100.0	0.0	0	1	0	1	2.4	41	97.6
Prostate	C61	796	95.1	0.5	4	39	1	44	5.5	752	94.5
Testis	C62	87	95.4	0.0	0	6	6	12	13.8	75	86.2
Kidney	C64	387	81.7	1.3	5	12	1	18	4.7	369	95.3
Renal pelvis	C65	45	95.6	0.0	0	1	0	1	2.2	44	97.8
Urinary bladder	C67	520	96.2	0.0	0	20	4	24	4.6	496	95.4
Brain & nervous system	C70-72	314	81.5	4.1	13	3	8	24	7.6	290	92.4
Thyroid	C73	588	97.6	0.0	0	33	1	34	5.8	554	94.2
Adrenal gland	C74	32	81.3	3.1	1	1	2	4	12.5	28	87.5
Hodgkin lymphoma	C81	79	100.0	0.0	0	6	0	6	7.6	73	92.4
Non-Hodgkin lymphoma	C82-85+C96	834	100.0	0.7	6	38	0	44	5.3	790	94.7
Multiple myeloma	C90	167	100.0	3.6	6	2	0	8	4.8	159	95.2
Lymphoid leukaemia	C91	209	100.0	0.5	1	3	0	4	1.9	205	98.1
Myeloid leukaemia	C92-94	408	100.0	0.7	3	15	0	18	4.4	390	95.6
Leukaemia unspecified	C95	80	100.0	7.5	6	2	0	8	10.0	72	90.0

HV: histologically verified; DCO: death certificate only

Table 2. Number and proportion of cases by vital status and median follow-up (in months) by site: Singapore, 1993–1997 cases followed-up until 2001

Site	ICD-10	Cases included	Dead		Alive		Complete FU		Median FU (in months)
			No.	%	No.	%	No.	%	
Tongue	C01-02	120	81	67.5	39	32.5	120	100.0	18.7
Oral cavity	C03-06	135	93	68.9	42	31.1	135	100.0	17.9
Salivary gland	C07-08	87	30	34.5	57	65.5	87	100.0	62.9
Tonsil	C09	38	25	65.8	13	34.2	38	100.0	34.4
Nasopharynx	C11	1 404	659	46.9	745	53.1	1 404	100.0	56.9
Hypopharynx	C12-13	90	84	93.3	6	6.7	90	100.0	10.0
Oesophagus	C15	446	424	95.1	22	4.9	446	100.0	5.3
Stomach	C16	2 100	1 727	82.2	373	17.8	2 100	100.0	8.5
Small intestine	C17	80	63	78.8	17	21.3	80	100.0	12.9
Colon	C18	2 501	1 540	61.6	961	38.4	2 501	100.0	37.8
Rectum	C19-20	1 753	1 064	60.7	689	39.3	1 753	100.0	41.1
Anus	C21	53	39	73.6	14	26.4	53	100.0	22.6
Liver	C22	1 550	1 490	96.1	60	3.9	1 550	100.0	2.2
Gall bladder	C23-24	289	261	90.3	28	9.7	289	100.0	5.2
Pancreas	C25	512	495	96.7	17	3.3	512	100.0	2.6
Nose/Sinuses	C30-31	71	45	63.4	26	36.6	71	100.0	34.9
Larynx	C32	311	174	55.9	137	44.1	311	100.0	45.9
Lung	C33-34	4 253	4 031	94.8	222	5.2	4 253	100.0	5.4
Other thoracic organs	C37-38	63	37	58.7	26	41.3	63	100.0	39.1
Bone	C40-41	61	39	63.9	22	36.1	61	100.0	29.5
Melanoma of skin	C43	60	41	68.3	19	31.7	60	100.0	31.6
Other skin	C44	1 037	311	30.0	726	70.0	1 037	100.0	67.2
Mesothelioma	C45	34	31	91.2	3	8.8	34	100.0	6.3
Connective tissue	C47+C49	166	84	50.6	82	49.4	166	100.0	49.7
Peritoneum	C48	40	30	75.0	10	25.0	40	100.0	18.9
Breast	C50	3 204	1 018	31.8	2 186	68.2	3 204	100.0	64.1
Vulva	C51	35	16	45.7	19	54.3	35	100.0	56.1
Cervix	C53	984	416	42.3	568	57.7	984	100.0	58.4
Corpus uteri	C54	483	124	25.7	359	74.3	483	100.0	63.6
Ovary	C56	718	293	40.8	425	59.2	718	100.0	59.0
Penis	C60	41	19	46.3	22	53.7	41	100.0	55.0
Prostate	C61	752	459	61.0	293	39.0	752	100.0	48.9
Testis	C62	75	11	14.7	64	85.3	75	100.0	71.8
Kidney	C64	369	211	57.2	158	42.8	369	100.0	34.6
Renal pelvis	C65	44	31	70.5	13	29.5	44	100.0	11.0
Urinary bladder	C67	496	252	50.8	244	49.2	496	100.0	52.2
Brain & nervous system	C70-72	290	211	72.8	79	27.2	290	100.0	15.0
Thyroid	C73	554	83	15.0	471	85.0	554	100.0	72.5
Adrenal gland	C74	28	18	64.3	10	35.7	28	100.0	22.6
Hodgkin lymphoma	C81	73	23	31.5	50	68.5	73	100.0	69.4
Non-Hodgkin lymphoma	C82-85+C96	790	472	59.7	318	40.3	790	100.0	23.3
Multiple myeloma	C90	159	138	86.8	21	13.2	159	100.0	16.1
Lymphoid leukaemia	C91	205	119	58.0	86	42.0	205	100.0	36.4
Myeloid leukaemia	C92-94	390	327	83.8	63	16.2	390	100.0	7.7
Leukaemia unspecified	C95	72	66	91.7	6	8.3	72	100.0	2.3

FU: follow-up

Table 3. Comparison of 1-, 3- and 5-year absolute and relative survival and 5-year age-standardized relative survival by site: Singapore, 1993–1997 cases followed-up until 2001

Site	ICD-10	Cases included	% Absolute survival			% Relative survival			% ASRS at 5-years	
			1-year	3-year	5-year	1-year	3-year	5-year	all ages	0-74 years
Tongue	C01-02	120	61.7	36.7	34.0	63.5	39.8	39.0	40.8	44.3
Oral cavity	C03-06	135	64.4	43.0	34.5	66.9	47.6	40.6	45.4	49.2
Salivary gland	C07-08	87	85.1	75.9	65.0	86.6	79.0	69.2	63.0	70.1
Tonsil	C09	38	65.8	47.4	36.1	67.3	49.9	39.2	38.3	44.7
Nasopharynx	C11	1 404	86.6	68.1	56.7	87.5	70.1	59.5	53.6	59.2
Hypopharynx	C12-13	90	43.3	17.8	8.7	45.1	20.0	10.6	11.0	11.9
Oesophagus	C15	446	25.1	8.3	5.3	26.4	9.2	6.2	9.3	12.1
Stomach	C16	2 100	43.1	24.2	19.4	45.0	27.1	23.3	23.9	27.4
Small intestine	C17	80	51.3	35.0	22.4	52.8	38.1	25.8	25.4	28.5
Colon	C18	2 501	70.3	51.0	41.8	73.0	56.9	50.2	49.5	52.5
Rectum	C19-20	1 753	73.5	52.5	42.7	76.1	58.0	50.4	49.0	52.1
Anus	C21	53	60.4	37.7	31.8	63.9	44.3	41.9	39.5	40.4
Liver	C22	1 550	18.3	6.8	4.4	19.0	7.5	5.1	6.0	6.5
Gall bladder	C23-24	289	34.9	17.0	11.9	36.3	18.8	14.0	15.0	18.3
Pancreas	C25	512	11.5	5.3	3.4	12.0	5.8	4.0	4.1	4.8
Nose/Sinuses	C30-31	71	71.8	49.3	40.8	73.9	53.1	45.9	44.3	50.4
Larynx	C32	311	77.8	54.3	47.3	81.0	61.0	57.1	61.0	65.7
Lung	C33-34	4 253	28.9	9.0	6.0	30.2	10.1	7.2	7.7	9.3
Other thoracic organs	C37-38	63	68.3	50.8	44.2	69.0	52.3	46.2	33.8	41.0
Bone	C40-41	61	67.2	47.5	37.2	67.7	48.7	38.5	41.8	38.5
Melanoma of skin	C43	60	71.7	45.0	34.7	73.9	48.7	39.4	39.9	44.5
Other skin	C44	1 037	93.1	82.7	75.2	97.7	95.6	95.8	95.6	95.2
Mesothelioma	C45	34	23.5	11.8	8.4	24.0	12.2	8.8	8.3	11.4
Connective tissue	C47+C49	166	72.3	54.2	51.2	73.6	56.9	55.1	48.2	57.1
Peritoneum	C48	40	60.0	32.5	24.9	60.8	33.3	25.8	19.2	26.2
Breast	C50	3 204	93.0	80.6	72.1	94.0	83.2	76.2	73.9	76.4
Vulva	C51	35	80.0	57.1	54.3	82.5	61.7	62.0	67.0	66.4
Cervix	C53	984	84.2	65.5	59.9	85.3	67.9	63.5	63.2	65.7
Corpus uteri	C54	483	90.3	81.0	76.4	91.3	83.6	80.6	76.5	79.6
Ovary	C56	718	81.8	67.5	61.2	82.7	69.3	63.7	56.2	62.4
Penis	C60	41	82.9	70.7	55.5	85.7	78.5	66.2	70.3	74.8
Prostate	C61	752	82.4	57.7	44.6	88.2	70.8	63.0	61.3	64.3
Testis	C62	75	92.0	89.3	85.1	92.4	90.3	86.7	88.2	88.2
Kidney	C64	369	66.4	49.9	45.3	68.2	53.4	50.7	47.2	55.0
Renal pelvis	C65	44	47.7	34.1	31.5	49.3	37.0	36.1	32.4	43.9
Urinary bladder	C67	496	76.6	58.9	51.8	80.2	67.0	64.0	62.7	71.9
Brain & nervous system	C70-72	290	56.9	35.2	30.2	57.5	35.8	30.9	27.6	29.6
Thyroid	C73	554	92.1	88.8	86.3	93.2	91.4	90.3	89.5	91.2
Adrenal gland	C74	28	60.7	42.9	39.3	61.4	43.4	39.9	23.5	32.1
Hodgkin lymphoma	C81	73	87.7	76.7	69.6	88.4	78.3	71.9	73.1	75.4
Non-Hodgkin lymphoma	C82-85+C96	790	59.5	45.9	42.5	61.1	49.0	47.1	49.2	52.0
Multiple myeloma	C90	159	54.7	28.3	17.2	56.6	30.8	19.4	22.3	26.0
Lymphoid leukaemia	C91	205	68.3	50.2	44.8	68.8	51.1	45.9	35.9	42.9
Myeloid leukaemia	C92-94	390	42.1	22.6	16.7	43.1	23.6	17.7	19.3	22.6
Leukaemia unspecified	C95	72	22.2	12.5	8.3	22.9	13.4	9.0	10.7	12.9

ASRS: age-standardized relative survival

Table 4a. Site-wise number of cases, 5-year absolute and relative survival by sex: Singapore, 1993–1997 cases followed-up until 2001

Site	ICD-10	Cases included	Male			Female		
			% 5-year survival			% 5-year survival		
			No.	Abs	Rel	No.	Abs	Rel
Tongue	C01-02	120	73	24.4	28.2	47	48.9	55.8
Oral cavity	C03-06	135	91	31.3	37.7	44	40.9	46.3
Salivary gland	C07-08	87	50	61.4	66.7	37	69.9	72.5
Tonsil	C09	38	27	32.6	35.4	11	45.5	49.4
Nasopharynx	C11	1 404	1 046	54.1	56.9	358	64.6	67.1
Hypopharynx	C12-13	90	84	9.4	11.4	6	0.0	0.0
Oesophagus	C15	446	342	4.9	5.8	104	6.5	7.7
Stomach	C16	2 100	1 289	19.0	23.3	811	20.0	23.2
Small intestine	C17	80	43	25.4	30.1	37	18.9	21.3
Colon	C18	2 501	1 270	41.9	51.3	1 231	41.6	49.2
Rectum	C19-20	1 753	1 006	40.3	48.2	747	46.0	53.4
Anus	C21	53	22	22.7	31.3	31	38.6	49.9
Liver	C22	1 550	1 204	4.6	5.4	346	3.6	4.2
Gall bladder	C23-24	289	132	12.8	15.3	157	11.2	13.0
Pancreas	C25	512	290	3.2	3.8	222	3.6	4.1
Nose/Sinuses	C30-31	71	49	30.5	34.9	22	63.6	69.6
Larynx	C32	311	284	45.5	55.2	27	66.7	76.9
Lung	C33-34	4 253	2 941	5.8	7.1	1 312	6.3	7.2
Other thoracic organs	C37-38	63	42	40.3	42.5	21	52.4	53.8
Bone	C40-41	61	33	36.4	36.9	28	37.6	39.8
Melanoma of skin	C43	60	28	28.6	34.1	32	40.3	44.1
Other skin	C44	1 037	490	76.5	98.0	547	74.1	93.8
Mesothelioma	C45	34	26	6.9	7.3	8	12.5	13.1
Connective tissue	C47+C49	166	96	53.1	57.2	70	48.6	52.1
Peritoneum	C48	40	12	16.7	17.6	28	28.4	29.3
Breast	C50	3 204	13	76.2	88.4	3 191	72.1	76.1
Vulva	C51	35				35	54.3	62.0
Cervix	C53	984				984	59.9	63.5
Corpus uteri	C54	483				483	76.4	80.6
Ovary	C56	718				718	61.2	63.7
Penis	C60	41	41	55.5	66.2			
Prostate	C61	752	752	44.6	63.0			
Testis	C62	75	75	85.1	86.7			
Kidney	C64	369	253	44.1	50.2	116	48.0	51.5
Renal pelvis	C65	44	31	25.6	29.7	13	46.2	51.8
Urinary bladder	C67	496	390	53.1	65.6	106	47.0	58.2
Brain & nervous system	C70-72	290	163	31.7	32.6	127	28.3	28.8
Thyroid	C73	554	123	79.6	85.7	431	88.2	91.6
Adrenal gland	C74	28	14	35.7	36.3	14	42.9	43.4
Hodgkin lymphoma	C81	73	44	65.7	68.7	29	75.9	77.1
Non-Hodgkin lymphoma	C82-85+C96	790	476	37.9	42.4	314	49.5	54.0
Multiple myeloma	C90	159	82	20.2	22.9	77	14.1	15.7
Lymphoid leukaemia	C91	205	127	41.6	42.8	78	50.0	51.0
Myeloid leukaemia	C92-94	390	224	16.2	17.3	166	17.3	18.2
Leukaemia unspecified	C95	72	37	8.1	8.9	35	8.6	9.0

Abs: absolute survival; Rel: relative survival

Table 4b. Site-wise number of cases and relative survival by age group: Singapore, 1993–1997 cases followed-up until 2001

Site	ICD-10	Cases included	Number of cases by age group					Relative survival by age group				
								% 5-year survival				
			< 45	45-54	55-64	65-74	> 75	< 45	45-54	55-64	65-74	> 75
Tongue	C01-02	120	23	17	34	20	26	30.6	54.3	34.8	56.7	28.2
Oral cavity	C03-06	135	12	16	39	36	32	92.3	44.7	30.1	47.3	21.0
Salivary gland	C07-08	87	33	17	14	14	9	84.7	77.9	67.7	51.7	20.7
Tonsil	C09	38	5	8	13	9	3	80.6	38.7	48.1	13.0	0.0
Nasopharynx	C11	1 404	547	407	281	110	59	67.1	60.7	50.6	51.2	32.7
Hypopharynx	C12-13	90	3	16	20	28	23	12.9	21.5	4.5	6.9	
Oesophagus	C15	446	8	45	97	148	148	38.0	9.1	4.5	9.8	0.7
Stomach	C16	2 100	145	211	450	623	671	28.9	29.0	31.6	21.5	15.3
Small intestine	C17	80	15	12	15	24	14	26.9	42.7	28.5	19.3	13.8
Colon	C18	2 501	196	303	551	747	704	55.4	56.0	54.6	47.8	45.6
Rectum	C19-20	1 753	162	245	433	499	414	54.0	52.4	57.0	47.3	44.5
Anus	C21	53	1	4	11	11	26	0.0	76.3	48.2	32.6	38.8
Liver	C22	1 550	157	191	363	469	370	10.9	6.9	4.3	3.7	4.1
Gall bladder	C23-24	289	20	42	58	91	78	25.2	18.8	16.6	14.3	4.3
Pancreas	C25	512	25	64	115	164	144	8.1	3.2	6.4	2.9	3.0
Nose/Sinuses	C30-31	71	11	10	22	17	11	45.8	71.5	39.6	50.3	27.3
Larynx	C32	311	10	37	88	99	77	80.9	78.2	57.0	56.9	42.7
Lung	C33-34	4 253	195	374	918	1 520	1 246	9.8	13.6	10.0	5.9	3.7
Other thoracic organs	C37-38	63	31	10	16	4	2	54.9	51.0	33.9	29.4	0.0
Bone	C40-41	61	44	6	6	2	3	40.7	11.3	35.5	56.5	50.4
Melanoma of skin	C43	60	19	6	6	13	16	47.6	48.6	35.6	45.1	21.2
Other skin	C44	1 037	113	114	193	230	387	96.3	95.3	92.9	96.4	97.5
Mesothelioma	C45	34	4	6	11	9	4	25.2	17.2	9.5	0.0	0.0
Connective tissue	C47+C49	166	74	21	30	24	17	58.4	53.7	75.3	40.4	20.2
Peritoneum	C48	40	12	9	7	10	2	33.4	34.1	30.5	11.2	0.0
Breast	C50	3 204	936	1 025	645	369	229	77.8	78.9	75.8	72.0	63.0
Vulva	C51	35	3	7	7	6	12	100.6	43.7	60.0	77.7	58.3
Cervix	C53	984	273	273	214	128	96	77.6	61.3	58.7	59.2	43.0
Corpus uteri	C54	483	96	140	142	75	30	87.8	86.8	79.0	68.1	65.5
Ovary	C56	718	270	189	116	89	54	83.6	60.5	52.0	45.9	24.8
Penis	C60	41	2	7	10	16	6	101.3	59.2	76.9	60.6	58.6
Prostate	C61	752	4	7	98	283	360	50.5	42.6	67.0	66.2	59.8
Testis	C62	75	57	9	7	2	0	91.9	91.3	58.9	0.0	
Kidney	C64	369	58	76	87	92	56	60.8	64.5	53.4	45.1	22.3
Renal pelvis	C65	44	2	6	15	14	7	50.5	34.6	21.9	68.8	0.0
Urinary bladder	C67	496	34	52	100	147	163	77.2	81.1	82.8	57.3	47.9
Brain & nervous system	C70-72	290	171	32	36	34	17	43.8	28.8	9.0	3.7	0.0
Thyroid	C73	554	287	93	74	56	44	99.8	95.4	90.1	66.2	41.5
Adrenal gland	C74	28	20	1	3	1	3	50.1	101.9	0.0	0.0	0.0
Hodgkin lymphoma	C81	73	42	15	6	8	2	86.1	54.2	51.4	60.9	0.0
Non-Hodgkin lymphoma	C82-85+C96	790	231	122	159	144	134	54.0	64.0	46.5	39.4	25.5
Multiple myeloma	C90	159	11	29	37	42	40	45.9	49.6	20.3	1.7	3.9
Lymphoid leukaemia	C91	205	155	11	14	18	7	51.6	37.1	23.5	33.5	0.0
Myeloid leukaemia	C92-94	390	152	42	57	75	64	32.2	14.4	10.8	4.4	4.5
Leukaemia unspecified	C95	72	27	4	8	16	17	22.3	0.0	0.0	0.0	0.0

Table 5. Proportion of cases and 5-year absolute survival by extent of disease and site: Singapore, 1993–1997

Site	ICD-10	Cases included	% of cases by extent of disease				% 5-year absolute survival			
			Localized	Regional	Dist. met.	Unknown	Localized	Regional	Dist. met.	Unknown
Tongue	C01-02	120	25.8	25.0	4.2	45.0	48.4	23.3	20.0	33.1
Oral cavity	C03-06	135	28.1	22.2	1.5	48.2	52.2	26.3	0.0	28.9
Nasopharynx	C11	1 404	18.2	36.3	3.5	42.0	80.1	51.3	8.2	55.3
Colon	C18	2 501	27.0	22.4	18.8	31.8	66.5	43.2	6.6	40.6
Rectum	C19-20	1 753	30.3	27.0	16.8	25.9	61.6	44.9	6.6	41.9
Larynx	C32	311	35.7	12.2	2.3	49.8	63.6	28.6	14.3	41.8
Breast	C50	3 204	30.6	22.5	4.8	42.1	85.9	66.3	18.8	71.2
Cervix	C53	984	45.5	5.7	5.0	43.8	69.7	48.0	20.4	55.7
Corpus uteri	C54	483	64.8	5.4	6.2	23.6	87.4	37.4	20.0	70.0
Ovary	C56	718	45.7	3.9	19.8	30.6	83.3	35.4	24.5	55.2

Dis. met.: distant metastasis

Table 6. Comparison of 5-year absolute and relative survival of cases diagnosed between 1988–1992 and 1993–1997, Singapore

Site	ICD-10	% 5-year absolute survival		% 5-year relative survival	
		1988–1992	1993–1997	1988–1992	1993–1997
Tongue	C01-02	35.9	34.0	39.8	39.0
Oral cavity	C03-06	37.7	34.5	43.1	40.6
Salivary gland	C07-08	67.6	65.0	71.9	69.2
Tonsil	C09	21.2	36.1	24.2	39.2
Nasopharynx	C11	50.5	56.7	52.8	59.5
Hypopharynx	C12-13	15.0	8.7	17.7	10.6
Oesophagus	C15	3.3	5.3	4.0	6.2
Stomach	C16	16.6	19.4	19.8	23.3
Colon	C18	41.1	41.8	48.8	50.2
Rectum	C19-20	37.0	42.7	43.4	50.4
Liver	C22	2.3	4.4	2.7	5.1
Gall bladder	C23-24	12.1	11.9	14.5	14.0
Pancreas	C25	5.6	3.4	6.4	4.0
Nose/Sinuses	C30-31	34.7	40.8	37.1	45.9
Larynx	C32	40.0	47.3	47.1	57.1
Lung	C33-34	5.3	6.0	6.2	7.2
Bone	C40-41	52.9	37.2	54.5	38.5
Other skin	C44	76.1	75.2	93.7	95.8
Connective tissue	C47+C49	47.8	51.2	51.3	55.1
Breast	C50	66.3	72.1	70.1	76.2
Cervix	C53	61.2	59.9	64.6	63.5
Corpus uteri	C54	71.3	76.4	74.7	80.6
Ovary	C56	63.4	61.2	66.1	63.7
Prostate	C61	37.3	44.6	52.3	63.0
Testis	C62	83.0	85.1	84.6	86.7
Kidney	C64	38.1	45.3	42.7	50.7
Urinary bladder	C67	48.4	51.8	60.6	64.0
Brain & nervous system	C70-72	22.5	30.2	23.3	30.9
Thyroid	C73	83.5	86.3	86.8	90.3
Hodgkin lymphoma	C81	52.7	69.6	55.0	71.9
Non-Hodgkin lymphoma	C82-85+C96	35.5	42.5	38.6	47.1
Multiple myeloma	C90	16.3	17.2	18.9	19.4
Lymphoid leukaemia	C91	15.6	44.8	16.6	45.9
Myeloid leukaemia	C92-94	15.0	16.7	15.8	17.7

Table 7. Number of cases by cancer site and calendar period, Singapore Cancer Registry, 1968–1997

Site	ICD-10	Number of cases						Total 1968-97
		1968-72	1973-77	1978-82	1983-87	1988-92	1993-97	
Tongue	C01-02	69	75	90	103	103	120	560
Oral cavity	C03-06	83	82	106	112	130	135	648
Salivary gland	C07-08	25	45	51	66	74	87	348
Tonsil	C09	34	40	57	36	52	38	257
Nasopharynx	C11	670	850	933	1 118	1 413	1 404	6 388
Hypopharynx	C12-13	30	41	55	49	80	90	345
Oesophagus	C15	505	509	509	469	488	446	2 926
Stomach	C16	1 355	1 551	1 619	1 846	1 966	2 100	10 437
Colon	C18	475	708	1 045	1 474	2 176	2 501	8 379
Rectum	C19-20	392	595	796	999	1 301	1 753	5 836
Liver	C22	886	951	1 125	1 042	1 069	1 550	6 623
Gall bladder	C23-24	47	95	114	143	198	289	886
Pancreas	C25	113	158	218	306	355	512	1 662
Nose/Sinuses	C30-31	37	63	69	66	72	71	378
Larynx	C32	181	200	247	254	295	311	1 488
Lung	C33-34	1 547	2 228	2 841	3 314	3 634	4 253	17 817
Bone	C40-41	51	70	91	89	104	61	466
Other skin	C44	244	338	529	609	848	1 037	3 605
Connective tissue	C47+C49	61	106	94	163	136	166	726
Breast	C50	574	749	1 110	1 550	2 436	3 204	9 623
Cervix	C53	512	599	683	817	920	984	4 515
Corpus uteri	C54	115	115	183	266	376	483	1 538
Ovary	C56	173	215	353	428	604	718	2 491
Prostate	C61	77	112	200	296	459	752	1 896
Testis	C62	31	31	42	53	53	75	285
Kidney	C64	77	85	125	176	244	369	1 076
Urinary bladder	C67	164	217	305	369	444	496	1 995
Brain & nervous system	C70-72	67	87	126	173	213	290	956
Thyroid	C73	149	181	254	431	502	554	2 071
Hodgkin lymphoma	C81	34	46	46	44	55	73	298
Non-Hodgkin lymphoma	C82-85+C96	151	212	329	465	574	790	2 521
Multiple myeloma	C90	30	39	56	111	129	159	524
Lymphoid leukaemia	C91	112	92	106	133	147	205	795
Myeloid leukaemia	C92-94	181	195	228	261	320	390	1 575

Table 8. Up-to-date 5-year relative survival estimates using cohort and period approaches by site and calendar period: Singapore, 1968–1997 cases followed-up until 1997

Site	ICD-10	Period approach					Cohort approach				
		1973–77	1978–82	1983–87	1988–92	1993–97	1973–77	1978–82	1983–87	1988–92	1993–97
Tongue	C01-02	26.3	30.2	22.8	32.6	38.3	24.0	28.2	28.3	20.3	41.0
Oral cavity	C03-06	31.3	25.8	37.2	40.6	40.4	25.9	33.4	27.2	32.6	44.5
Salivary gland	C07-08	57.9	67.6	79.9	63.7	70.2	46.5	59.3	75.3	69.4	73.8
Tonsil	C09	22.6	23.9	28.1	28.4	30.8	21.0	17.8	29.9	30.2	25.4
Nasopharynx	C11	31.4	38.5	39.9	51.2	56.8	28.7	33.6	38.1	46.1	53.2
Hypopharynx	C12-13	6.5	6.3	2.8	11.1	12.7	8.4	5.9	4.5	2.4	18.1
Oesophagus	C15	4.3	5.2	7.3	5.9	5.1	5.1	3.2	5.6	8.0	4.2
Stomach	C16	7.7	11.8	17.2	19.4	21.7	6.8	9.0	13.1	17.4	20.3
Colon	C18	33.2	32.4	40.0	48.0	50.5	29.5	31.5	34.4	42.5	49.5
Rectum	C19-20	21.4	27.8	32.9	39.4	47.6	18.3	22.3	29.0	35.4	43.9
Liver	C22	2.7	3.3	3.0	2.5	4.9	3.8	2.4	2.9	2.4	2.8
Gall bladder	C23-24	8.2	3.8	11.8	13.9	14.9	9.9	5.1	8.4	10.6	14.6
Pancreas	C25	4.5	4.8	9.0	3.9	5.7	7.2	5.2	4.9	6.2	6.7
Nose/Sinuses	C30-31	25.4	25.9	36.4	39.0	40.5	21.9	23.9	28.3	37.6	37.3
Larynx	C32	32.0	30.1	33.2	44.9	49.4	29.0	32.5	29.7	36.7	48.3
Lung	C33-34	5.5	5.9	6.0	6.4	7.7	4.2	4.7	6.2	6.0	6.5
Bone	C40-41	30.9	44.9	56.0	57.7	45.3	30.1	37.0	53.0	54.8	55.0
Other skin	C44	87.1	84.4	85.0	92.3	95.8	70.5	89.8	80.8	89.6	93.3
Connective tissue	C47+C49	54.1	39.2	56.6	51.0	50.2	44.9	48.1	41.6	50.6	51.8
Breast	C50	50.4	50.4	59.0	67.6	74.4	44.5	48.9	54.2	63.0	70.4
Cervix	C53	48.7	51.2	53.2	62.1	62.1	45.4	50.4	48.9	57.9	65.1
Corpus uteri	C54	46.9	64.4	71.7	77.4	79.1	47.7	51.3	65.8	76.2	75.7
Ovary	C56	50.1	48.2	60.2	65.8	65.7	45.6	46.6	54.4	59.1	66.7
Prostate	C61	43.6	38.4	38.8	50.7	57.4	37.3	41.5	35.4	45.6	52.4
Testis	C62	45.7	51.4	73.2	81.1	87.0	53.4	33.3	61.1	73.7	84.9
Kidney	C64	25.7	31.7	36.1	41.8	49.0	23.5	26.7	36.6	37.9	43.7
Urinary bladder	C67	38.3	45.0	50.3	58.7	61.0	35.4	35.7	44.2	55.3	61.3
Brain & nervous system	C70-72	19.3	34.5	25.2	27.3	28.4	13.8	22.6	31.5	25.4	23.9
Thyroid	C73	74.1	75.3	90.4	88.9	91.7	72.0	76.5	79.5	90.4	88.0
Hodgkin lymphoma	C81	42.9	37.5	40.1	52.4	74.0	30.4	38.5	44.3	41.0	56.2
Non-Hodgkin lymphoma	C82-85+C9	17.6	26.4	29.0	36.9	46.2	10.9	23.7	22.3	34.7	39.8
Multiple myeloma	C90	13.4	23.8	22.2	16.8	18.3	19.2	26.7	19.0	17.8	19.4
Lymphoid leukaemia	C91	13.6	18.0	16.1	16.7	33.5	3.7	20.0	13.6	18.0	16.4
Myeloid leukaemia	C92-94	5.9	3.5	9.7	9.5	19.6	4.7	4.9	6.6	10.0	16.3

Table 9. Up-to-date 10- and 15-year relative survival estimates using cohort and period approaches by site and calendar period: Singapore, 1968–1997 cases followed-up until 1997

Site	ICD-10	% 10-year relative survival							
		Period approach				Cohort approach			
		1978–82	1983–87	1988–92	1993–97	1978–82	1983–87	1988–92	1993–97
Tongue	C01-02	23.0	21.0	33.1	31.9	24.9	22.4	27.5	21.6
Oral cavity	C03-06	18.3	29.9	32.2	33.3	19.1	28.2	23.6	20.8
Salivary gland	C07-08	47.4	74.5	56.4	65.8	38.2	54.4	67.1	58.7
Tonsil	C09	18.1	24.6	23.1	25.1	16.8	17.8	23.3	29.3
Nasopharynx	C11	26.6	30.2	40.1	44.4	20.6	24.5	28.4	37.2
Hypopharynx	C12-13	2.8	0.0	7.0	12.0	5.5	0.0	2.9	3.0
Oesophagus	C15	5.0	7.3	5.4	3.7	4.5	3.5	5.8	6.3
Stomach	C16	7.9	13.3	17.3	18.4	4.2	6.3	11.1	15.5
Colon	C18	29.1	38.7	46.6	47.1	26.0	29.4	33.7	39.9
Rectum	C19-20	20.2	26.0	34.0	40.9	14.9	17.2	22.7	31.4
Liver	C22	2.2	1.8	2.0	3.1	2.2	1.6	2.5	1.5
Gall bladder	C23-24	2.6	9.8	14.4	10.7	6.0	4.8	7.8	8.0
Pancreas	C25	5.8	7.2	4.1	4.8	6.2	5.4	3.4	6.2
Nose/Sinuses	C30-31	13.4	37.9	33.9	24.8	14.9	17.2	29.4	25.6
Larynx	C32	19.8	27.0	39.4	45.4	19.7	22.4	24.8	32.9
Lung	C33-34	4.1	5.3	5.3	5.8	3.2	3.8	5.2	4.7
Bone	C40-41	37.8	48.3	53.4	42.4	30.9	29.1	46.5	51.4
Other skin	C44	77.5	78.4	86.6	92.1	59.8	87.9	73.4	84.3
Connective tissue	C47+C49	33.0	54.1	43.0	47.6	37.9	40.7	37.0	46.1
Breast	C50	39.8	47.8	56.8	63.6	34.6	40.2	43.3	54.3
Cervix	C53	44.9	49.7	56.5	56.5	40.7	44.7	45.8	53.0
Corpus uteri	C54	57.4	66.8	74.3	79.6	47.2	45.5	61.3	75.5
Ovary	C56	43.1	56.8	63.4	60.7	39.5	43.1	51.2	57.1
Prostate	C61	19.7	26.4	24.2	41.5	20.2	22.0	18.5	29.7
Testis	C62	52.9	75.4	78.8	86.3	55.6	34.4	60.4	72.6
Kidney	C64	32.5	24.9	40.8	42.6	22.0	21.5	31.1	36.6
Urinary bladder	C67	39.4	41.2	58.4	59.2	31.2	27.3	42.5	53.2
Brain & nervous system	C70-72	26.6	19.7	22.6	22.8	11.1	17.2	26.1	21.7
Thyroid	C73	66.5	92.4	89.7	92.5	68.4	73.5	80.7	90.5
Hodgkin lymphoma	C81	30.3	40.5	35.2	68.5	22.2	32.0	40.7	31.4
Non-Hodgkin lymphoma	C82-85+C9	16.0	21.9	30.7	42.4	7.3	15.4	17.2	32.2
Multiple myeloma	C90	18.9	15.8	11.4	10.1	13.7	21.2	15.4	10.2
Lymphoid leukaemia	C91	12.1	12.3	9.3	19.5	1.9	12.5	12.1	11.4
Myeloid leukaemia	C92-94	0.7	3.4	4.8	12.0	1.3	1.7	2.0	6.0

Table 9 (Continued).

Site	ICD-10	% 15-year relative survival					
		Period approach			Cohort approach		
		1983-87	1988-92	1993-97	1983-87	1988-92	1993-97
Tongue	C01-02	26.3	20.3	61.4	28.6	22.0	24.4
Oral cavity	C06-03	20.0	62.9	62.6	24.2	14.0	22.9
Salivary gland	C08-00	04.1	18.8	11.1	18.0	44.0	32.3
Tonsil	C09	24.6	24.6	61.8	18.4	20.1	21.1
Nasopharynx	C11	22.1	66.8	69.2	18.9	18.6	23.1
Hypopharynx	C12-16	0.0	8.4	13.2	0.0	0.0	4.0
Esophagus	C15	8.9	4.8	6.9	6.1	4.4	3.2
Stomach	C15	11.0	18.4	10.4	1.0	6.6	11.0
Colon	C18	63.6	41.0	41.0	28.8	24.3	66.4
Rectum	C19-20	24.8	63.2	40.4	18.3	14.0	22.3
Liver	C22	2.1	1.4	6.4	1.6	2.1	2.9
Gallbladder	C23-24	0.6	11.6	9.3	4.2	8.6	0.1
Pancreas	C25	0.9	6.4	1.6	1.3	3.2	6.3
Nose/Sinuses	C60-61	22.6	61.1	19.9	11.4	16.1	23.6
Larynx	C62	28.1	66.0	44.6	18.1	10.0	26.8
Lung	C63-64	4.0	4.3	1.6	6.1	2.1	4.9
Bone	C40-41	60.1	11.9	42.0	21.4	29.8	41.9
Soft tissue	C42	80.2	08.6	90.8	06.1	13.1	86.0
Connective tissue	C48+C49	11.1	42.2	41.6	60.1	68.8	68.6
Breast	C50	69.3	12.0	10.3	64.1	61.6	69.0
Cervix	C53	40.3	14.4	13.3	44.6	40.6	44.1
Corpus uteri	C54	36.2	80.1	89.1	48.1	46.2	18.2
Cervix	C55	11.6	36.1	30.1	40.3	63.1	11.6
Prostate	C61	29.4	13.3	24.2	19.8	14.9	10.8
Testis	C62	80.2	80.1	00.2	62.1	14.3	12.0
Bladder	C63	11.1	48.1	40.0	20.1	16.0	60.1
Urinary bladder	C63	29.2	36.1	19.6	24.3	24.9	41.6
Breast & nervous system	C80-82	19.1	20.0	21.9	13.8	9.9	24.0
Thyroid	C86	92.0	90.1	92.3	86.4	81.6	01.6
Hodgkin lymphoma	C90	66.0	63.4	19.2	29.1	20.0	69.0
Non-Hodgkin lymphoma	C91-C93	24.1	20.0	46.1	14.0	0.2	18.2
Multifocal myeloma	C90	11.3	9.4	8.3	18.3	13.0	12.9
Lymphoid leukaemia	C91	1.1	9.3	18.4	9.6	1.0	12.3
Myeloid leukaemia	C92-94	6.8	6.1	9.1	1.2	0.0	1.8