CANCER REGISTRATION IN SINGAPORE

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History of Cancer Registration in the City-State

Singapore is a tiny city-state of 660 km2, with a total population of 3.9 million. The resident population (3.2 million) is predominantly Chinese (77%), with 14% Malays and 8% Indians. The life expectancy is 75.6 years for males, 79.6 years for females with a low infant mortality rate of 3.2 per 1,000 live births. Cancer is the commonest cause of death (26.6%) followed closely by ischaemic and other heart diseases (25.3%).

The Singapore Cancer Registry (SCR) was founded in 1968 as a population-based registry covering the entire national population. The registry collects notifications from medical practitioners of all cancer patients in Singapore. Reports of cancer cases from pathology laboratories and hospital discharges are also routinely sent to the SCR. Singapore has a unique national registration number (NRIC) for all Singaporeans and permanent residents. For foreigners working in Singapore, a unique foreign identification number (FIN) is also available. These unique numbers have helped in identifying duplicate registrations and record linkages.The SCR has electronic record linkage with the Death Register to ascertain the proportion of death certificate only notifications (DCOs). Over the 30-year period, the DCOs have declined from 5% to 1%, and the proportion of cases with microscopic confirmation has increased from 72.3% to 88.9%

The SCR has published five monographs describing the trends of cancer incidence rates among the resident population (Singaporeans and permanent residents). In the latest monograph covering 1993-1997, cancer incidence among non-residents was also described. Recently, in conjunction with the International Agency of Research on Cancer, a population-based survival analysis was conducted. Several publications and a monograph are currently being prepared. Selected results of the incidence and survival will be presented.

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Incidence of Cancer

Incidence rates for the period 1993-1997, for the Chinese, Malay, and Indian populations, are shown in the Tables 1-3. Lung cancer continues to be the commonest cancer in males, although the rates have been declining since a high point in 1983-1987. Cancer of the colo-rectum is increasing in importance and has become the second commonest cancer in '93-'97. Cancers of the stomach and liver are progressively declining in percentage contribution. The incidence of nasopharynx cancer has remained fairly constant over time.

In females, breast cancer continues to be the commonest cancer in females and the proportion have been increasingly sharply. Cancer of the colo-rectum is also increasing in importance.Cancers of the stomach and cervix are progressively declining in percentage contribution.

Variation by ethnic group.

Study of incidence by ethnic group have been particularly valuable in Singapore, in suggesting aetiological hypotheses (Figs 1 & 2). In both sexes, Malays and Indians are at significantly lower risk of developing cancers than Chinese. This

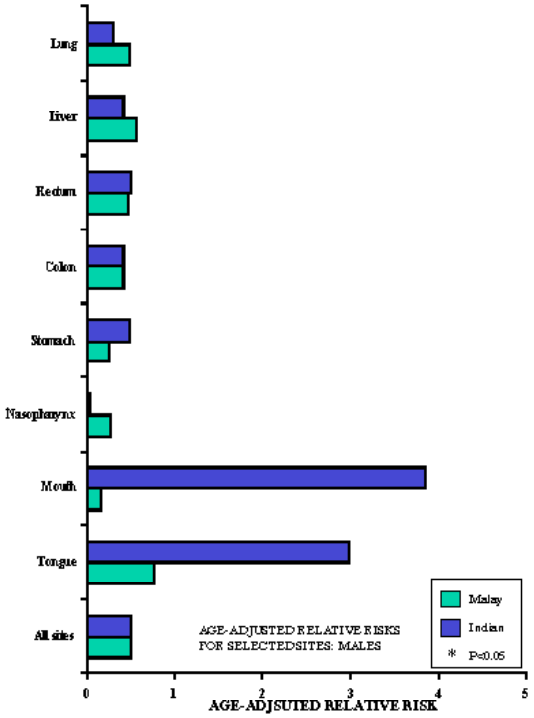

Figure 1. Ethnic Group Variation (Males)

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Table 1. Age-specific Annual Cancer Incidences, Chinese, 1993-1997

Males

	Number	0-	5-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	65-	70-	75-	80-	ASR (World)
Lip & oral cavity	202	-	-	-	-	1.0	0.4	0.4	0.9	3.4	5.8	6.6	8.4	18.2	21.8	22.5	23.6	27.1	3.7 [3.2,4.3]
Nasopharynx	1043	-	-	0.3	0.7	1.0	2.9	8.1	19.3	29.1	61.3	45.1	52.6	53.3	54	33.2	24.9	19.9	16.7 [15.6,17.8]
Other pharynx	143	-	-	-	-	-	-	0.1	0.3	0.7	3.2	6.6	5.4	15.8	23.7	21.4	14.4	18.5	2.9 [2.4,3.4]
Oesophagus	357	-	-	-	-	-	-	-	-	1.3	5.8	6.9	19.2	24.0	57.8	73.5	56.3	84.0	7.1 [6.3,7.9]
Stomach	1306	-	-	-	0.2	0.5	0.4	1.3	2.3	5.2	14.9	23.9	59.3	99.1	210.	234	220	331	25.6 [24.1,27.0]
Colon	1289	-	-	-	0.2	0.3	0.7	1.7	2.4	9.5	26.3	24.6	50.6	108	201	231	212	248	25.3 [23.9,26.8]
Rectum & anus	1010	-	-	-	-	0.3	0.9	1.1	3.2	9.0	21.4	29.5	57.7	79.1	131	178	114	175	19.5 [18.2,20.7]
Liver	1116	0.7	0.5	0.5	0.2	0.4	0.5	1.6	3.6	11.2	25.3	27.4	55.6	93.2	169	166	159	162	21.7 [20.4,23.0]
Pancreas	268	0.2	-	-	-	-	-	0.1	0.3	1.4	8.1	6.2	7.5	24.6	40.7	52.2	52.4	37.0	5.4 [4.7,6.1]
Larynx	293	-	-	-	-	-	-	-	0.1	0.5	3.6	7.3	16.3	27.6	51.2	52.2	45.9	54.1	6.0 [5.2,6.7]
Lung	2807	-	-	-	-	-	0.7	0.6	4.7	10.8	25.9	50.3	107	233	536	571	482	584	56.8 [54.7,59.0]
Prostate	717	-	-	-	-	-	-	-	0.1	0.5	-	2.4	10.9	36.9	114	178	190	288	13.8 [12.8,14.9]
Bladder	391	-	-	-	-	-	0.2	0.3	0.8	2.2	5.8	8.0	16.7	28.7	58.7	65.2	76.0	92.6	7.5 [6.8,8.3]
Brain, central nervous system	135	1.7	3.3	1.8	1.2	2.0	1.2	1.3	1.5	1.4	2.6	2.4	3.8	6.5	6.6	9.5	9.2	5.7	2.5 [2.1,3.0]
Thyroid	116	-	-	0.3	0.2	1.0	0.9	1.6	1.6	2.7	3.6	2.8	5.4	6.5	9.5	4.8	6.6	7.1	1.9 [1.5,2.3]
Non-Hodgkin lymphoma	425	0.9	0.8	1.0	1.0	1.7	2.4	3.5	3.4	5.8	12.0	9.4	17.6	25.2	34.1	52.2	38.0	69.8	7.5 [6.8,8.3]
Hodgkin's disease	30	-	0.3	0.5	0.7	1.2	0.4	0.1	0.1	-	2.3	0.7	0.8	-	1.9	-	2.6	-	0.6 [0.4,0.8]
Leukaemia	328	8.0	4.6	2.3	3.6	2.0	2.2	3.0	3.2	3.2	6.8	5.9	6.3	12.3	24.6	35.6	21.0	32.8	6.3 [5.6,7.0]
All sites but skin	13326	17.2	10.9	8.0	11.0	17.6	16.1	31.8	54.3	112	266	300	556	987	1928	2161	1876	2459	257 [252,261]

Females

	Number	0-	5-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	65-	70-	75-	80-	ASR (World)
Lip & oral cavity	114	-	-	0.3	0.3	0.5	0.2	1.0	2.1	1.1	2.3	1.8	4.6	6.6	3.0	8.9	11.9	15.1	1.6 [1.3,1.9]
Nasopharynx	375	-	-	-	0.3	0.5	1.9	3.7	8.3	11.6	18.3	15.6	18.4	11.2	13.5	8.1	13.7	7.1	5.5 [4.9,6.1]
Other pharynx	15	-	-	-	-	-	-	-	0.3	0.2	-	-	-	1.5	0.8	1.6	2.7	2.7	0.2 [0.1,0.3]
Oesophagus	103	-	-	-	-	-	-	-	-	-	-	2.2	2.9	2.5	7.5	18.6	21.9	24.9	1.4 [1.1,1.7]

is especially so for cancers of the nasopharynx, liver, lung, stomach, colon and rectum. Indians are at higher risk for oral cavity cancers Chinese females are at significantly higher risk for cancers of the lung, nasopharynx, liver, stomach, colon and rectum. As in the case of males, Indian females are at higher risk for developing oral cancers. Interestingly, Malay females had higher risk of developing ovarian and mouth cancers compared to Chinese.

Table 2. Age-specific Annual Cancer Incidences, Malay, 1993-1997

Males

	Number	0-	5-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	65-	70-	75-	80-	ASR (World)	
Lip & oral cavity	44	-	-	-	-	-	-	-	1.7	6.7	8.9	10.9	15.4	22.2	13	38.4	92.4	119.4	6.4 [4.3,8.4]	
Nasopharynx	8	-	-	-	-	-	-	1.3	-	2.2	-	10.9	-	5.5	3.2	-	-	23.9	1.3 [0.3,2.3]	
Other pharynx	15	-	-	-	-	-	-	-	-	-	4.4	10.9	7.7	5.5	6.5	16.5	23.1	23.9	2.3 [1.1,3.6]	
Oesophagus	20	-	-	-	-	-	-	-	1.7	-	-	10.9	-	11.1	16.2	16.5	23.1	71.6	2.9 [1.5,4.2]	
Stomach	57	-	-	-	-	-	1.5	2.7	-	4.5	13.3	21.8	11.5	22.2	32.4	32.9	127	167.1	8.4 [6.,10.7]	
Colon	30	-	-	-	-	-	-	-	-	6.7	-	16.4	19.2	11.1	19.5	27.5	34.6	23.9	4.6 [2.6,5.7]	
Rectum & anus	28	-	-	-	-	-	-	-	1.7	6.7	-	10.9	7.7	13.9	9.7	27.5	57.7	47.7	3.8 [2.3,5.3]	
Liver	50	1.6	-	-	-	-	1.5	-	3.3	2.2	13.3	5.5	15.4	16.6	26	43.9	104	143.2	7.1 [5.0,9.3]	
Pancreas	16	-	-	-	-	-	-	-	1.7	-	-	10.9	3.8	11.9	9.7	16.5	23.1	-	2.1 [1.0,3.2]	
Larynx	33	-	-	-	-	2.3		-	-	-	4.5	4.4	16.4	7.7	11.1	16.2	49.4	46.2	47.7	4.7 [3.0,6.4]
Lung	68	-	-	-	-	-	-	-	1.7	9.0	13.3	21.8	15.4	16.6	61.6	65.9	127	95.5	9.2 [6.8,11.6]	
Prostate	65	-	-	-	-	-	-	-	-	-	-	-	11.5	24.9	48.7	76.9	173.2	214.9	8.3 [6.2,10.5]	
Bladder	33	-	-	-	-	-	-	1.3	-	9.0	13.3	-	7.7	13.9	29.2	22.0	-	119.4	4.9 [3.0,6.6]	
Brain, central nervous system	14	1.6	6.8	-	-	2.3	-	1.3	-	-	4.4	10.9	7.7	-	3.2	-	-	47.7	2.8 [1.3,4.4]	
Thyroid	8	-	-	-	-	2.3	-	1.3	-	4.5	4.4	10.9	-	-	-	-	11.5	-	1.5 [0.4,2.6]	
Non-Hodgkin lymphoma	19	-	-	3.4	3.1	-	4.5	1.3	-	6.7	4.4	10.9	-	5.5	9.7	-	11.5	23.9	3.1 [1.6,4.7]	
Hodgkin's disease		11	-	-	-	3.1	4.6	1.5	2.7	-	2.2	-	-	3.8	-	6.5	5.5	-	-	1.5 [0.6,2.5]
Leukaemia	29	3.3	4.5	6.9	6.1	2.3	4.5	1.3	3.3	-	-	10.9	-	-	9.7	32.9	-	71.6	5.1 [3.0,7.1]	
All sites but skin	629	8.2	15.8	13.7	18.4	16.1	15.1	14.7	18.1	85.3	115	223.7	161.4	210.5	353.5	548.9	946.7	1289	92 [84.1,99.7]	

Females

	Number	0-	5-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	65-	70-	75-	80-	ASR (World)
Lip & oral cavity	24	-	-	-	-	-	-	-	-	-	9.3	12.1	28.4	11.4	36.8	65.8	63.9	50.2	6.3[3.7,8.9]
Nasopharynx	1	-	-	-	-	-	-	-	1.61	-	-	-	-	-	-	-	-	-	0.1 [-0.1,0.3]
Other pharynx	5	-	-	-	-	-	-	-	1.6	2.4	-	4.0	4.7	-	-	-	31.9	-	1.0 [0.1,1.8]
Oesophagus	7	-	-	-	-	-	-	-	-	-	-	4.0	4.7	5.7	18.4	32.9	-	-	1.8 [0.5,3.2]
Stomach	23	-	-	-	-	-	1.5	1.5	3.2	2.4	18.6	4.0	4.7	-	46.0	49.3	63.9	101	6.1 [3.4,8.7]
Colon	32	-	-	-	-	-	1.5	-	1.6	-	27.9	-	18.9	17.2	73.5	82.2	-	201	9.2 [5.8,12.6]
Rectum & anus	22	-	-	-	-	-	-	-	-	4.7	14.0	4.0	18.9	17.2	36.8	32.9	63.9	50.3	5.7 [3.2,8.1]
Liver	7	-	-	-	-	-	1.5	-	-	2.4	-	-	-	11.5	9.2	16.4	31.9	-	1.6 [0.4,2.9]

Incidence rates in Singapore Chinese remain among the highest in Asia, after Hong Kong, and are substantially higher than those for Chinese in Hawaii and the US.

The incidence rates of the disease have remained remarkably stable over the last 25 years (Fig 3). Cantonese had signficantly higher risks than other Chinese dialect groups.

Major Sites

Nasopharynx

Colon

The incidence in Singapore, especially among Chinese, has fast been approaching those of Europe and the USA, and our rates are now comparable with the rates for Chinese in Hawaii and Los Angeles.

Table 3. Age-specific Annual Cancer Incidences, Indian 1993-1997

Males

	Number	0-	5-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	65-	70-	75-	80-	ASR (World)
Lip & oral cavity [0.6,2.2]	12	-	-	-	-	-	-	0.7	0.9	1.6	-	6.5	-	-	3.3	29.0	-	16.6	1.4
Nasopharynx [5.3,9.3]	61	-	-	-	-	1.1	2.0	2.9	6.0	14.5	33.7	13.0	20.9	20.8	10.0	29.0	25.9	16.6	7.3
Other pharynx [0.2,1.5]	6	-	-	-	-	-	-	-	-	-	-	3.3	3.5	3.0	-	11.6	-	16.6	0.8
Oesophagus [0.4,1.9]	9	-	-	-	-	-	-	-	-	-	-	-	3.5	-	3.3	17.4	38.8	16.6	1.1
Stomach [4.6,8.2]	52	-	-	1.6	-	-	0.7	-	1.7	-	7.5	13.0	3.5	20.8	33.3	69.6	116.5	49.8	6.4
Colon [6.9,11.1]	77	-	-	-	-	1.1	-	2.1	3.4	9.6	11.2	13.0	27.8	35.6	46.6	63.8	116.5	33.2	9.0
Rectum & anus [8.2,13]	82	-	-	-	-	-	-	1.4	1.7	4.8	22.5	13.0	48.7	11.9	53.3	98.6	77.7	132.9	10.6
Liver [12.6,18.3]	123	-	-	-	-	2.1	0.7	1.4	3.4	9.6	26.2	39.1	48.7	32.6	103.2	92.8	64.7	199.3	15.5
Pancreas [1.7,4.4]	23	-	-	-	-	-	1.4	0.7	-	1.6	7.5	9.8	10.4	5.9	10.0	5.8	12.9	66.4	3.1
Larynx [1.5,3.7]	21	-	-	-	-	-	-	-	0.9	1.6	-	-	13.9	8.9	10.0	17.4	38.8	49.8	2.6
Lung [26.3,34.1]	240	-	-	-	-	-	0.7	1.4	1.7	16.1	33.7	42.3	100.9	86.0	129.8	330.7	440.0	249.1	30.2
Prostate [9.6,14.7]	91	-	-	-	-	-	-	-	-	-	-	6.5	24.3	17.8	59.9	92.8	168.2	481.7	12.2
Bladder [3.99,7.41]	45	-	-	-	-	-	-	-	1.7	3.2	3.7	6.5	10.4	23.7	13.3	46.4	116.5	99.7	5.7
Brain, central nervous system [1.5,3.8]	24	1.4	5.9	3.3	-	1.1	1.4	-	0.9	1.6	7.5	3.3	-	5.9	6.7	5.8	12.9	-	2.7
Thyroid [1.0,3.0]	16	-	-	-	1.5	-	-	1.4	-	-	-	3.3	13.9	3.0	6.7	11.6	12.9	33.2	2.0
Non-Hodgkin lymphoma [6.6,10.7]	76	0.7	2.0	3.3	1.5	3.2	2.0	3.6	4.3	11.3	15.0	16.3	27.8	32.6	20.0	40.6	64.7	16.6	8.6
Hodgkin's disease [0.4,1.9]	11	-	-	-	-	-	1.1	1.4	-	0.9	3.2	-	6.5	3.5	3.0	-	5.8	-	-	1.1
Leukaemia [5.3,9.0]	65	5.6	5.9	9.9	3.0	1.1	-	2.9	3.4	3.2	7.5	3.3	17.4	20.8	16.6	34.8	77.7	-	7.2
All sites but skin [139,157]	1199	14.6	15.7	21.3	16.3	10.6	12.9	22.1	37.0	98.1	221	247	424	374	596	1091	1592	1677	148

Females

	Number	0-	5-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	65-	70-	75-	80-	ASR (World)
Lip & oral cavity [0.5,2.0]	11	-	-	-	1.6	-	-	1.6	0.9	1.6	3.3	5.8	2.3	-	8.5	-	-	-	1.2
Nasopharynx [1.0,3.0]	18	-	-	-	-	-	-	1.6	2.8	1.6	6.6	8.7	2.3	8.5	8.5	7.1	-	-	2.0
Other pharynx [-0.1,0.8]	3	-	-	-	-	-	-	-	-	-	-	-	-	-	8.5	-	11.9	-	0.4
Oesophagus	6	-	-	-	-	-	-	-	-	-	-	2.9	2.3	2.8	-	-	11.9	35.4	0.8

The magnitude of increase in risk over these 25 years is second only to prostate canc er in males and breast in females (Figure 3).

Rectum

Cancers of the rectum (including 'rectosigmoid junction') constituted 42.5% and 33.9% of cancers of the large bowel among males and females in 1988-92 respectively. The general trend was similar to that of colon cancer, although increases were smaller in magnitude, especially among females (Fig 3).

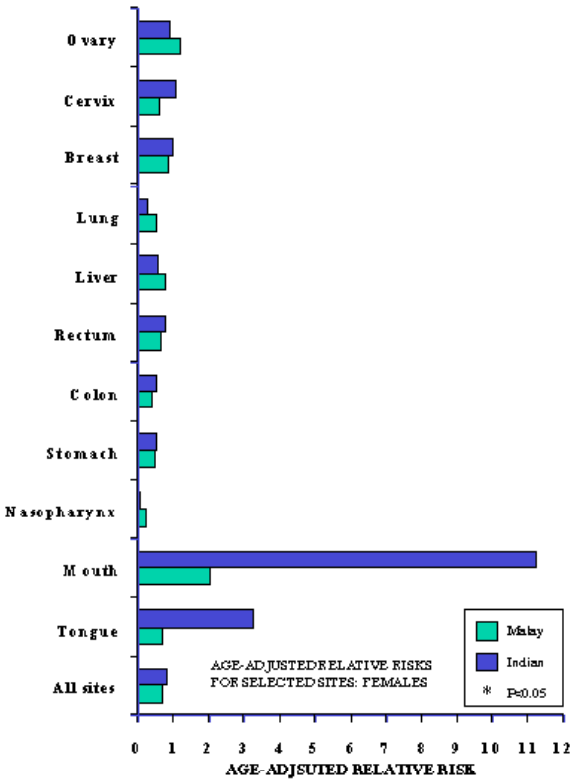

Figure 2. Ethnic Group Variation (Females)

Liver

The incidence continued to show a steady decline for both sexes (Fig 3). This decline is however not attributable to the national immunization programme against hepatitis B. Incidence among Chinese in Singapore during the period 1983-87, although still considerably higher than in the West, was lower than that in several other Asian countries.

Lung

Generally, there were approximately three male cases diagnosed for every female case.

The rates have shown an increase between 1968-82, followed by a slight decrease (Fig 3). The exception to this pattern are the Malay males.

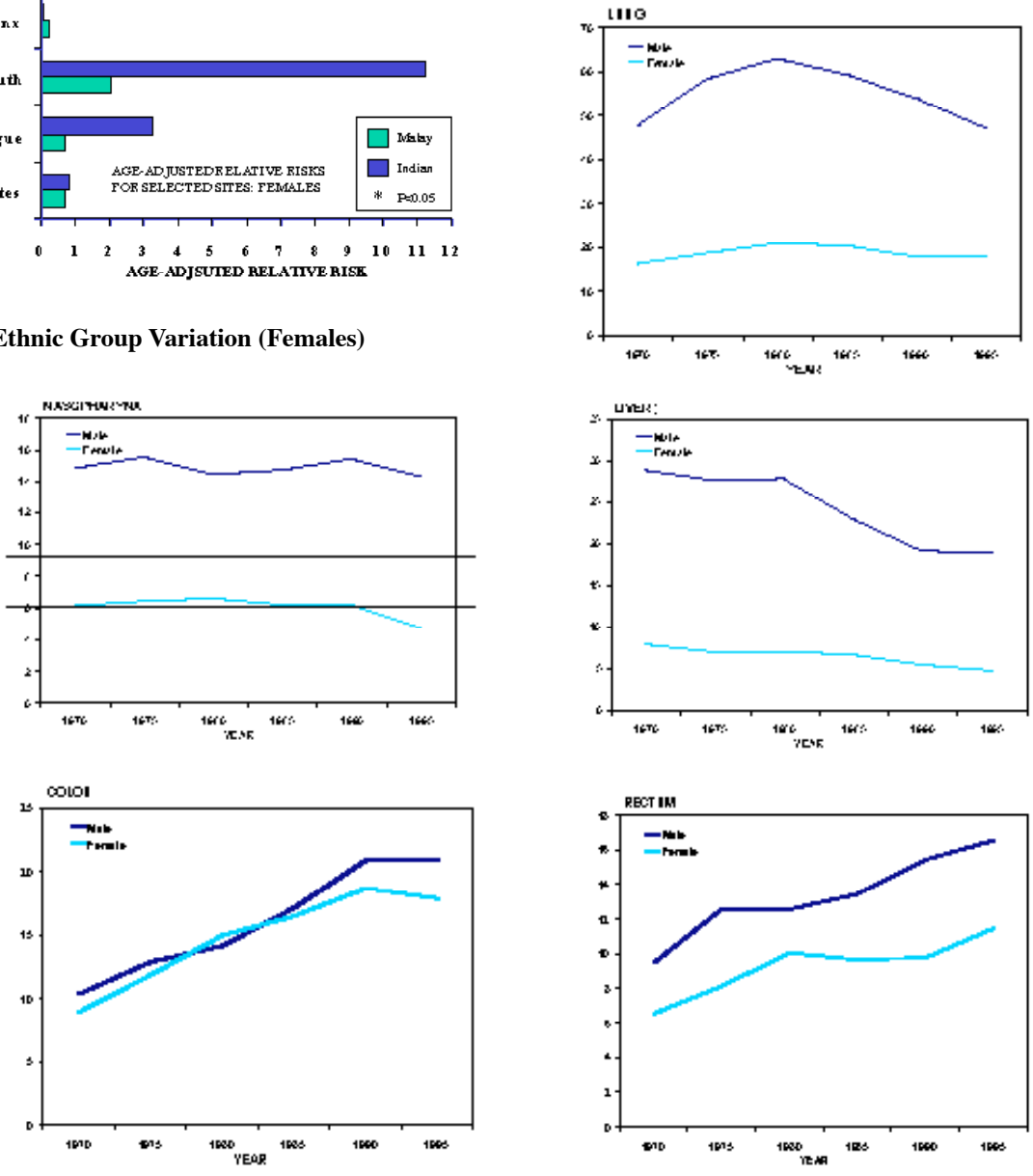

Figure 3. Time-dependent Change in Cancer Incidence Rates

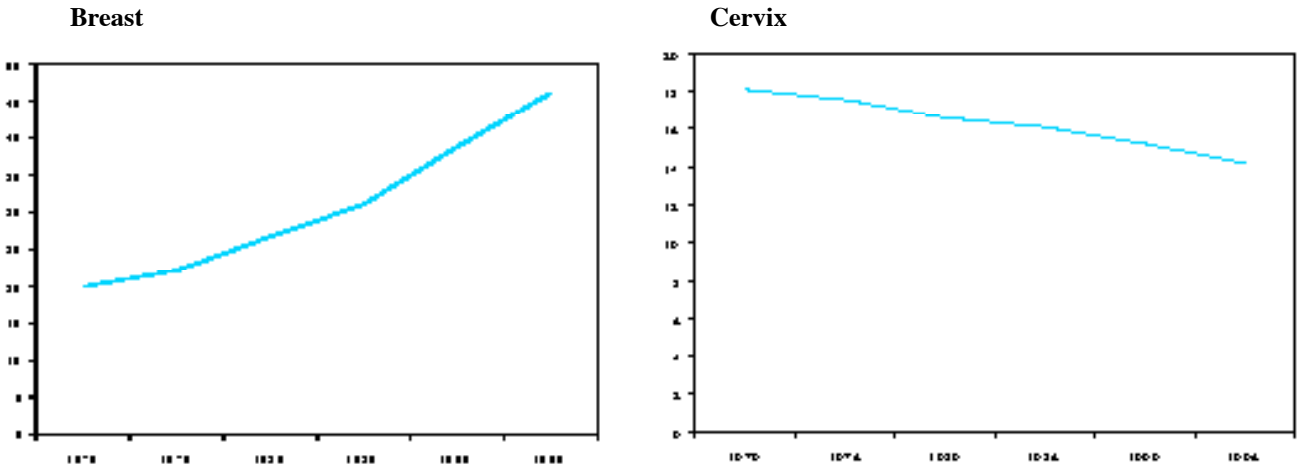

Figure 4. Time-dependent Change in Cancer Incidence Rates

Histologically, it is worth noting that the proportion of adenocarcinomas among females has increased from 18.8% in 1968-72 to 24.9% in 1978-82 and 48.1% in 1988-92.

Breast

Cancer of the breast has remained the most frequent cancer among females over the last 25 years, and there is a clear increase in the incidence rate over time for all three ethnic groups, the increasing trend was attributed to a strong cohort effect (Fig 4).

Singapore still maintains its position between the high rates of the USA and Europe, and the much lower rates experienced in other parts of Asia.

Cervix Uteri

The incidence rate of cancer for cervix has continued to decline marginally over time (Fig 4), although it still maintains its ranking as the fourth most common female cancer. The rates in Singapore continue to be higher than most of Europe and the USA, and lower than those in the developing world.

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