Cardiovascular mortality in Peninsular Malaysia: 1950-1989

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Summary

Mortality statistics of Peninsular Malaysia for the period 1950–1989 have been studied in relation to cardiovascular diseases, with particular emphasis on coronary heart disease as an important cause of death. It was observed that among six major disease groups reviewed, cardiovascular diseases which occupied third place as a cause of death in 1950 emerged as the number one killer during the 1970s and has remained so since (with exception in 1980). In contrast, infectious diseases which ranked first in 1950 dropped to fourth position in 1980. Between 1960 and 1980, mortality due to cardiovascular diseases was higher in males than in females. This tendency became less apparent during 1985–1989. With reference to race, the incidence of cardiovascular deaths was highest in Indians followed by Chinese and Malays.

Among the specific cardiovascular diseases, coronary heart and cerebrovascular diseases accounted for the main causes of mortality. Mortality due to coronary heart disease has increased by more than three fold over the last 40 years and is still rising. However, mortality incidence due to rheumatic heart disease and hypertension decreased during the same period. In 1965, mortality due to coronary heart disease was highest in the 55–59 age group. In recent years (1985 to 1989), it shifted to the older age group (i.e. 65–69). There was a tendency for higher mortality due to coronary heart disease in males compared to females. Indians had a higher mortality due to coronary heart disease than Chinese and Malays.

Key words: Cardiovascular diseases, mortality, coronary heart disease, hypertension, rheumatic heart disease.

Introduction

The population of Peninsular Malaysia for 1989 was 14.3 million comprising 57.9% Malays, 31.6% Chinese, 9.9% Indians and 0.6% other ethnic groups. Thirty six point five per cent of the population were under 15 years, 55.0% between 15–54 years, while 8.6% were 55 years and above. An estimated 55% of the population lived in rural areas.

In a study on cardiovascular diseases as a group Khaira[1] analysed 500 cases of cardiovascular diseases admitted to the adult Medical Unit at the General Hospital, Penang during 1958–60.

Hypertensive heart disease (38.8%) and coronary artery disease (20.4%) formed the major groups followed by rheumatic heart disease (14.8%), cor pulmonale (3.8%), thyrotoxicosis (3.4%) and congenital heart disease (2.6%).

Balasundaram[2] in a study of 10,000 subjects attending his general practice in Teluk Anson between 1963–65 found that 4.8% of the subjects had cardiovascular diseases from hypertension (54%), rheumatic heart disease (16%), congenital heart disease (14%) and others (16%).

Ong et al[3] in a study of 151 patients with heart disease and pregnancy at the General Hospital, Kuala Lumpur, observed that 66% of the cases were attributed to rheumatic heart disease, 25% to congenital heart disease and 3% to other forms of heart disease. Among studies on specific cardiovascular diseases, coronary artery disease is the one that has been best documented in Malaysia. Pallister[4] described 89 cases in the Penang General Hospital between 1952–1955 and observed that it was more common in Indians than other races.

With the setting up of Coronary Care Units in various hospitals, experiences with acute myocardial infarction in such units at the various hospitals have been documented.[5–10]

Burns-Cox et al[11] associated the absence of coronary heart disease in Orang Asli with their low levels of serum cholesterol. In contrast a very high incidence of coronary heart disease was described by Khoo[12] in 117 families with genetic hyperlipidaemia.

Quek et al[13,14] attributed cigarette smoking as a risk factor in myocardial infarction among patients admitted to the Coronary Care Unit at the General Hospital, Kuala Lumpur. Teo et al[15] documented the prevalence of hypercholesterolemia, hypertension and smoking as coronary risk factors in Malaysian male executives. Kandiah et al[16] and Arokiasamy and Gan[17] described blood pressure profiles and the prevalence of hypertension among various communities in Peninsular Malaysia.

With reference to rheumatic heart disease, Balasundaram[18] reported his observations on 74 cases of rheumatic heart disease in his general practice in Teluk Anson during 1963–1965.

There have been several reports on congenital heart disease in this country. Krishnan and Snelling[19] described their experience with 194 cases of patent ductus arteriosus in the Lady Templer Hospital in Kuala Lumpur. Johnson et al[20] documented his experiences with 1,037 children at the University of Malaya Hospital, while Anuar and Singham[21] documented 10 cases of Ebstein's Anomaly of the tricuspid valve.

As for stroke, Ghee[22] described the ethnic and clinical features of female stroke patients admitted to the Penang General Hospital during a one year period.

Most of the above studies were mainly hospital based, community based or case studies conducted in localised areas in Peninsular Malaysia. Thus, the information available cannot be used to reflect the status of cardiovascular diseases in the entire country.

This paper presents a general study on cardiovascular diseases in the population of Peninsular Malaysia using mortality data between 1950 and 1989. It highlights the relative importance of cardiovascular diseases particularly coronary heart disease, in relation to other major diseases over the past 40 years. Mortality incidence among age groups, sex and ethnic groups caused by

cardiovascular diseases is discussed. Possible reasons for the changing trend in mortality incidence due to cardiovascular diseases in relation to other diseases over time are offered.

Material and Methods

Mortality data from 1950 to 1989 were obtained from the Registrar of Births and Deaths and the Department of Statistics, Malaysia. These were computed and summarised at five yearly intervals except the last entry in 1989 which accounted for data of the previous four years.

The source of information for the period 1950–1960 was the Registrar of Births and Deaths, Federation of Malaya.[23–25] The publication only recorded total mortality – without distinction between medically and non-medically certified cases. In 1950, the classification of causes of death was divided into only a few groups. While 72.4% were known to be non-medically certified in 1955, in 1960, 89.3% was non-medically certified. The data from these periods, though less satisfactory, were used for comparative purposes.

From 1965 onwards, the source of data was obtained from the Department of Statistics.[26–31] Mortality was separated into "medically certified and inspected" and "non-medically certified". Only the "medically certified and inspected" deaths were used for the period 1965–1989. For the initial part of the study on the trend of cardiovascular mortality, all the available data from the combined medically and non-medically certified deaths for the period 1950–1960 as well as the medically certified deaths from 1965–1989 were used.

Depending on the availability of data, mortality in relation to sex and age groups was analysed using data from 1965–1989 whereas for ethnic distribution, data from 1970–1989 was used.

Data for life expectancy,[32–35] per capita income[36–38] and population[34] were obtained from the publications of Department of Statistics, Malaysia. Information on urbanisation was obtained from United Nations Economic and Social Commission For Asia and the Pacific.[39]

Results

Mortality caused by some major diseases: In order to illustrate the importance of cardiovascular disease in the population under study, comparisons were made between six major disease groups viz. cardiovascular diseases, respisratory diseases, neoplasms, infectious diseases, metabolic diseases (i.e. diabetes mellitus) and blood diseases (i.e. anaemias) over the past 40 years. Table 1 shows the percentage mortality in relation to the total mortality for selected diseases between 1950 to 1989 and their ranking.

Cardiovascular diseases ranked third in the 1950s gradually creeping up to take first position in 1970 and continued to do so in 1989 with an increase of 16.5 times from 1.8% in 1950 to 29.6% in 1989. This means that cardiovascular diseases have become the number one killer among the six disease groups. On the other hand, infectious diseases which ranked first in the 1950s had fallen to fourth position in 1989.

The other disease groups – respiratory diseases, neoplasms, metabolic diseases and blood diseases have not changed their ranks over the same period.

It is noted that although the ranking position for diabetes mellitus has not changed, the percentage

Table 1
Percentage and relative ranking of mortality due to various disease groups in Peninsular Malaysia

Disease Group	1950	1955	1960	1965	1970	1975	1980	1985	1989
Cardiovascular Diseases	1.8	2.5	1.2	9.2	11.1	20.0	22.6	28.5	29.6
	(3)	(3)	(4)	(2)	(1)	(1)	(2)	(1)	(1)
Respiratory Diseases	3.9	3.3	4.5	7.2	6.0	6.4	24.5	13.5	12.6
	(2)	(2)	(1)	(3)	(4)	(4)	(1)	(2)	(2)
Neoplasms	0.7	1.3	1.4	6.7	7.8	9.0	10.2	10.2	11.8
	(4)	(4)	(3)	(4)	(3)	(4)	(3)	(3)	(3)
Infectious Diseases	8.2	5.5	2.7	10.4	8.8	10.0	9.3	7.2	5.5
	(1)	(1)	(2)	(1)	(2)	(2)	(4)	(4)	(4)
Metabolic Diseases	–	0.1	0.1	0.8	1.2	1.4	1.8	1.9	1.9
(e.g. Diabetes)		(6)	(6)	(6)	(5)	(5)	(5)	(5)	(5)
Blood Diseases	–	0.3	0.3	1.1	1.2	0.9	0.5	0.4	0.3
(Anaemia)		(5)	(5)	(5)	(5)	(6)	(6)	(6)	(6)

Bracketed figures refer to relative ranking.
Source: Fletcher;[23] Ibrahim bin Ali;[24] McDonald;[25] Department of Statistics[26–31]

of its incidence increased from 0.1% in 1955 to 1.9% in 1989 – an overall increase of close to 20 times. Similarly, neoplasms increased from 0.7% in 1955 to 11.8% in 1989, an increase of 17 times. Respiratory diseases increased from 3.9% in 1950 to 12.6% in 1989. Blood diseases however have not changed very much in their ranking or percentage mortality.

Mortality of cardiovascular diseases: Table 2 shows the mortality caused by cardiovascular diseases in males and females. It is observed that there was a slightly higher proportion of males dying from cardiovascular diseases compared to females between 1960 and 1980. This difference however was not apparent in the 1985–1989 data. In both males and females, there was an increase in mortality due to cardiovascular diseases from 1.8% to close to 30% as reflected in the total population described earlier.

Table 3 shows the distribution of cardiovascular deaths in relation to the various ethnic groups from 1970 to 1989 with the highest proportion of death in Indians followed by Chinese and Malays.

Mortality of various cardiovascular diseases: The mortality incidence of specific cardiovascular diseases occurred during the years 1965–1989 is presented in Table 4. The following observations were made:

(i) Cardiovascular disease mortality had increased from 9.2% in 1965 to 29.6% in 1989, while mortality from non-cardiovascular diseases dropped from 90.8% in 1965 to 70.4% in 1989.

Table 2
Mortality caused by Cardiovascular Diseases among males and females in Peninsular Malaysia

Year	Males		Females		Total	
	N	%	N	%	N	%
1950	–	–	–	–	1,458 (82,554)	1.8
1955	–	–	–	–	1,765 (69,447)	2.5
1960	578 (35,942)	1.6	227 (29,100)	0.8	805 (65,042)	1.2
1965	1,343 (13,321)	10.1	631 (8,192)	7.7	1,974 (21,513)	9.2
1970	1,555 (13,049)	11.9	731 (7,637)	9.6	2,286 (20,686)	11.1
1975	3,070 (14,657)	20.9	1,602 (8,682)	18.5	4,672 (23,339)	20.0
1980	3,470 (14,957)	23.2	1,963 (9,118)	21.5	5,433 (24,075)	22.6
1985	4,605 (16,191)	28.4	2,824 (9,843)	28.7	7,429 (26,034)	28.5
1989	4,809 (16,316)	29.5	3,080 (10,323)	29.8	7,889 (26,639)	29.6

Bracketed figures refer to total number of deaths in corresponding year.
Source: Fletcher;[23] Ibrahim bin Ali;[24] McDonald;[25] Department of Statistics[26–31]

(ii) Among the four specific cardiovascular diseases (excluding other cardiovascular diseases), the ranking order with reference to total deaths from 1975–1989 was as follows:–

No. 1: Coronary Heart Disease	(35.6%)
No. 2: Cerebrovascular Disease	(30.9%)
No. 3: Hypertension	(3.7%)
No. 4: Rheumatic Heart Disease	(2.6%)

(iii) There was a rising trend in coronary deaths during 1965–1989. When compared with all cases of cardiovascular deaths, there was an increase from 32.7% in 1965 to 38.2% in 1989. Similarly, an increase of 3.0% to 11.3% was noted during the same period when compared with the total mortality of all causes.

(iv) Rheumatic heart disease dropped from 4.5% in 1965 to 1.7% in 1989.

Table 3
Mortality caused by Cardiovascular Disease among ethnic groups in Peninsular Malaysia

Year	Malay		Chinese		Indian		Others		Total	
	N	%	N	%	N	%	N	%	N	%
1970	525	9.7	1,143	10.6	553	12.9	65	28.1	2,286	11.1
	(5,391)		(10,773)		(4,291)		(231)		(20,686)	
1975	1,238	17.2	2,315	20.6	1,073	22.6	45	27.3	4,672	20.0
	(7,179)		(11,253)		(4,742)		(165)		(23,339)	
1980	1,553	19.1	2,638.	23.9	1,184	25.3	58	25.7	5,433	22.6
	(8,115)		(11,057)		(4,677)		(226)		(24,075)	
1985	2,414	24.3	3,418	31.0	1,545	31.8	52	25.0	7,429	28.5
	(9,952)		(11,018)		(4,856)		(208)		(26,034)	
1989	2,960	27.5	3,410	30.8	1,470	32.0	49	24.7	7,889	29.6
	(10,763)		(11,079)		(4,599)		(198)		(26,639)	

Bracketed figures refer to total number of deaths.
Department of Statistics[27–31]

(v) Mortality due to hypertension fell markedly from 16.8% in 1965 to 1.4% in 1989.

(vi) With reference to cerebrovascular disease, there was a narrow fluctuation of 33.1% in 1975 to 30.1% in 1989.

(vii) Other forms of heart and cardiovascular diseases declined from 46% in 1965 to 28.6% in 1989.

The percent mortality and relative ranking of specific cardiovascular diseases in male and female groups in relation to total cardiovascular mortality are summarised in Table 5. The results revealed that:–

(i) Coronary mortality was 1.5 times more common in males than in females.

(ii) Rheumatic heart disease was 2.1 times more common in females than in males.

(iii) Cerebrovascular mortality was 1.2 times more common in females than in males.

(iv) Excluding cerebrovascular mortality from consideration, coronary mortality ranked first position in both the male and female groups.

Mortality of coronary heart disease in various age groups: Table 6 summarises the frequency distribution of mortality due to coronary heart disease by age groups in Peninsular Malaysia. The distribution in general is skewed with their mode occurring around 55–69 years of age. The mode of the mortality frequency distribution due to coronary heart disease moved from

Table 4
Mortality due to specific Cardiovascular Diseases in Peninsular Malaysia 1965–1989

Cause of Mortality		1965	1970	1975	1980	1985	1989	1975–89
A. Cardiovascular Diseases	No.	1974	2286	4672	5433	7429	7889	25423
	%C	9.18	11.05	20.02	22.57	28.54	29.61	25.40
	% B	10.10	12.42	25.03	29.14	39.93	42.07	34.05
Coronary heart disease	No.	646	968	1380	1950	2699	3011	9040
	% C	3.00	4.68	5.91	8.10	10.37	11.30	9.03
	% A	32.73	42.34	29.54	35.89	36.33	38.17	35.56
	Rank % A	2	2	2	1	1	1	1
Rheumatic Heart disease	No.	89	99	182	219	122	134	657
	% C	0.41	0.48	0.78	0.91	0.47	0.50	0.66
	% A	4.51	4.33	3.90	4.03	1.64	1.70	2.58
	Rank % A	4	4	5	5	5	4	5
Hypertension	No.	331	226	275	235	316	111	937
	% C	1.54	1.09	1.18	0.98	1.21	0.42	0.94
	% A	16.77	9.89	5.89	4.33	4.25	1.41	3.69
	Rank % A	3	3	4	4	4	5	4
Cerebrovascular Disease	No.	–	–	1548	1792	2147	2376	7863
	% C	–	–	6.63	7.44	8.25	8.92	7.86
	% A	–	–	33.13	32.98	28.90	30.12	30.93
	Rank % A	–	–	1	2	2	2	2
Other Forms of Heart and Cardiovascular Diseases	No.	908	993	1287	1237	2145	2257	6926
	% C	4.22	4.80	5.51	5.14	8.24	8.47	6.92
	% A	46.00	43.44	27.55	22.77	28.87	28.61	27.24
	Rank % A	1	1	3	3	3	3	3
B. Non Cardiovascular Diseases	No.	19539	18400	18667	18642	18605	18750	74664
	% C	90.82	88.95	79.98	77.43	71.46	70.39	74.60
	% A	990	805	400	343	250	238	294
C. All Causes	No.	21513	20686	23339	24075	26034	26639	100087

Footnote: %C refers to percentage of mortality in relation to total no. of deaths.
%A refers to percentage of mortality in relation to total no. of cardiovascular mortality.
%B refers to percentage of mortality in realtion to total no. of non-cardiovascular mortality.

Source: Department of Statistics[26–31]

Table 5
Percentage of cardiovascular mortality among males and females

Year	Sex	Coronary Heart Disease	Rheumatic Heart Disease	Hypertension	Cerebrovascular Disease
1965	Male	38.20 (1)	2.90 (3)	15.49 (2)	–
	Female	21.08 (1)	7.92 (3)	19.49 (2)	–
1970	Male	47.78 (1)	2.64 (3)	10.42 (2)	–
	Female	30.78 (1)	7.93 (3)	8.76 (2)	–
1975	Male	34.93 (1)	2.64 (4)	5.57 (3)	29.78 (2)
	Female	19.21 (2)	6.30 (4)	6.49 (3)	39.55 (1)
1980	Male	41.04 (1)	3.05 (4)	3.92 (3)	30.34 (2)
	Female	26.80 (2)	5.76 (3)	5.04 (4)	37.65 (1)
1985	Male	41.93 (1)	1.02 (4)	3.76 (3)	26.95 (2)
	Female	27.20 (2)	2.66 (4)	5.08 (3)	32.08 (1)
1989	Male	41.57 (1)	1.27 (4)	1.43 (3)	27.82 (2)
	Female	32.80 (2)	2.37 (3)	1.36 (4)	33.70 (1)
1975 –	Male	40.28 (1)	1.85 (4)	3.44 (3)	28.49 (2)
1989	Female	27.61 (2)	3.82 (4)	4.10 (3)	35.03 (1)

Footnote: Percentage was estimated with reference to total cardiovascular mortality.
Bracketed figures refer to relative ranking among the four specific cardiovascular diseases.
Source: Department of Statistics[23–31]

the 55–59 age group during 1965–1970 to the 60–64 age group during 1975–1980, followed by 65–69 age group during 1985–1989. This shift in the mode of distribution with reference to age group susggests an improved general health and ageging population from 1965 to 1989.

There were similar patterns of skewed distribution for coronary mortality in male and female groups. However, the modes of the distributions were slightly different (Table 7). A higher mode was generally noted in the female group than in the male group by about five to 15 years in most of the years studied. However, the modes of mortality distributions of males and females were similar in the 1970 data.

Mortality due to coronary heart disease by ethnic groups: Table 8 shows mortality due to coronary heart disease in different ethnic groups between 1970–1989. Coronary heart disease mortality was highest among the Indians followed by the Chinese and Malays. Coronary deaths in the Indians were about 1.5–1.8 times greater than the Malays and Chinese. There was however little difference in mortality between the Malays and the Chinese.

For all ethnic groups, coronary heart disease mortality increased steadily from 4.7% in 1970 to 11.3% in 1989 and appears to be still rising. The frequency of coronary heart disease mortality for the Malays increased from 3.7% in 1970 to 10.5% in 1989, while that for the Chinese

Table 6
Frequency distribution (%) of coronary mortality in various age groups

Age Groups	1965	1970	1975	1980	1985	1989
0 – 4	0.93	0.93	0.36	0.10	0.26	0.03
5 – 9	0.15	0.10	0.07	0.05	0.07	0.03
10 – 14	0.31	0.41	0.29	0.21	0.03	0.10
15 – 19	00.15	0.52	0.07	0.05	0.26	0.07
20 – 24	0.46	0.93	0.14	0.21	0.44	0.27
25 – 29	1.08	1.03	0.94	0.82	0.33	0.40
30 – 34	1.39	2.27	1.74	1.18	1.00	0.73
35 – 39	2.32	3.31	3.33	2.15	2.41	1.49
40 – 44	6.04	6.30	5.14	4.15	3.59	3.09
45 – 49	9.91	7.95	9.20	7.23	7.26	6.34
50 – 54	18.58	13.33	13.26	11.49	9.37	9.30
55 – 59	19.19	17.46	14.13	14.31	14.86	12.85
60 – 64	15.63	16.94	14.64	15.33	14.30	14.68
65 – 69	10.37	12.40	13.99	14.56	15.23	16.01
70 – 74	13.16	8.16	12.03	13.18	12.45	14.55
75 – 80	0.00	4.24	6.30	8.62	10.52	11.13
80 – 84	0.00	2.69	2.68	4.00	4.85	5.51
> 85	0.00	0.83	1.30	2.05	2.33	3.42
Unknown	0.31	0.21	0.36	0.31	0.41	0.00
Total *	646	968	1380	1950	2699	3011

*Coronary Heart Disease Mortality Cases
Source: Department of Statistics[26–31]

Table 7
Modes of frequency distributions for coronary mortality in males and females

Year	Age group	
	Males	Females
1965	50 – 59	70 – 74
1970	55 – 59	55 – 59
1975	55 – 59	65 – 69
1980	55 – 64	70 – 74
1985	55 – 59	65 – 69
1989	60 – 64	65 – 69

Source: Department of Statistics[26–31]

Table 8
Mortality due to Coronary Heart Disease (CHD) in different ethnic groups

Year		Malays	Chinese	Indians	Others	Total
1970	i)	201	424	301	42	968
	ii)	5391	10773	4291	231	20686
	iii)	3.73	3.94	7.01	18.18	4.68
1975	i)	405	538	415	22	1380
	ii)	7179	11253	4742	165	23339
	iii)	5.64	4.78	8.75	13.33	5.91
1980	i)	529	826	567	28	1950
	ii)	8115	11057	4677	226	24075
	iii)	6.52	7.47	12.12	12.39	8.10
1985	i)	857	1101	714	27	2699
	ii)	9952	11018	4856	208	26034
	iii)	8.61	9.99	14.7	12.98	10.37
1989	i)	1125	1157	707	22	3011
	ii)	10763	11079	4599	198	26639
	iii)	10.45	10.44	15.37	11.11	11.30

i) No. of CHD deaths
ii) No. of total deaths
iii) Percentage of CHD over total deaths

Source: Department of Statistics[26–31]

increased from 3.9% in 1970 to 10.4% in 1989. For the Indians, the frequency of coronary heart disease mortality increased from 7.0% in 1970 to 15.4% in 1989.

Discussion

The possible reasons for the increase of mortality in cardiovascular diseases in relation to other diseases, include:

(1) An ageing population. As a population ages, degenerative diseases increase.
The life expectancy in Peninsular Malaysia has increased from 55.8 years in 1955 to 67.7 years in 1989 for males and from 58.2 years in 1955 to 72.4 years in 1989 for females.[32–35]

(2) The people now live longer because of better health services as reflected by a fall in infectious diseases and infant mortality rates.
With improved socio-economic status, more money is available to buy food. This is reflected by the per capita gross national product rising from 793 ringgit in 1955 to 5,558 ringgit in 1989.[36–38]

Amongst the cardiovascular diseases, coronary heart disease mortality showed a rising trend while rheumatic heart disease, hypertension and other cardiovascular diseases have declined.

Cerebrovascular disease showed a narrow fluctuation with a modest rise of 32.7% to 38.2% from 1965 to 1989. Despite this, cardiovascular diseases remain as the number one killer with a 15 fold increase from 1.8% in 1950 to 29.6% in 1989.

As pointed out earlier, the ageing population is the major cause of coronary heart disease death and of increasing incidence in recent decades.

A similar rising trend in coronary heart disease has been observed in Singapore by Chen[40] and Emmanuel.[41] The well known risk factors of coronary heart disease include hypertension, diabetes, hyperlipidaemia and smoking. With increasing age, there is an increase in cases of hypertension, diabetes and hyperlipidaemia which naturally will increase the frequency of coronary heart disease death. Teo et al[15] have shown that coronary risk factors such as raised blood cholesterol levels, smoking and hypertension were prevalent amongst Malaysian male executives. The mean cholesterol levels of all age groups exceeded 220mg/dl with 30.8% having blood levels of cholesterol exceeding 250mg/dl; 23.4% smoked more than 10 cigarettes a day and 10.9% were hypertensive. Thirty nine point four percent of all subjects had one risk factor, 10.6% had two risk factors and 1.5% had three risk factors. Fifty one point five percent had one or more of these risk factors.

In contrast, Burns-Cox et al have shown the low prevalence of coronary heart disease in Orang Asli with low blood levels of cholesterol.

The increased urbanisation of 10.7% in 1911 to 37.2% in 1980[39] may also account for more stress resulting in an increase in coronary heart disease.

It is noted that coronary heart disease occurred more often in males than in females. This is in keeping with the general experience that males are more prone to coronary heart disease. However, in the Western countries, the incidence of coronary heart disease in females catch up with the males after menopause. However this was not shown in our data, as coronary heart disease was more common in males even up to the age of 79 years. This may be attributed to different lifestyles, genetics or smoking habits, as post-menopausal Malaysian women despite their lack of protection from oestrogens are rare cigarette smokers compared to their Caucasian counterparts.

The finding that coronary heart disease mortality was 1.5–1.8 times higher in Indians than Malays and Chinese, is consistent with the experience of Pallister[4] who found the incidence higher among Indians than Chinese in Penang General Hospital.

Emmanuel[41] found that mortality in coronary heart disease in Indians was three times that of Chinese and that for Malays was 1.5 times more than that of Chinese. In another study by Chen[40] on mortality and morbidity of cardiovascular diseases in Singapore, the mortality of coronary heart disease was three times more common in Indians compared to other ethnic groups. The reason for the higher mortality among Singaporean Indians (three times that of Chinese and Malays) as compared to Malaysian Indians (1.5–1.8 times that of Chinese and Malays) is not obvious. Genetically, they are the same. The only difference is the environment. While Singapore is considered 100% urbanised, the rate of Peninsular Malaysia in 1989 was estimated to be 45%. Thus the stress of urbanisation could be the cause of the higher incidence of coronary heart disease mortality among Singapore Indians when compared with Malaysian Indians.

The remarkable fall of mortality due to rheumatic heart disease is most liekly due to easy accessibility of health care even in rural areas resulting in early treatment of endocarditis as well as improved management with surgery enabling patients to live longer and die from other causes.

Community surveys on hypertension conducted by Kandiah et al[16] and Arokiasamy and Gan[17] showed prevalence rates of 14% and 21.5% respectively. Kandiah et al[16] showed that there was no sigificant difference in the prevalence rates among the sexes, ethnic groups (Malays, Chinese and Indians) and urban and rural areas. The present data showed that mortality from hypertension has decreased from 1965–1989.

The fall in mortality due to hypertension may be attributed to easier access to hypotensive medication and also more potent anti-hypertensives, resulting in hypertensive patients living longer and dying from other causes. There was no difference in hypertension in rural or urban population. There could be differences in reporting the cause of death, the immediate cause of death being stroke, heart attack or renal failure secondary to hypertension. This would result in under-reporting of death due to hypertension as a cause.

Although cerebrovascular mortality ranked second among the specific cardiovascular disease, it has remained relatively stable. This is in keeping with the experience of Chen[40] in relation to the Singapore population.

In conclusion, this study shows that cardiovascular diseases particularly coronary heart disease is the number one killer in Peninsular Malaysia today and that the trend appear still on the rise and has probably not yet peaked. It behoves the Ministry of Health to provide guideline information for future action aimed at reducing this mortality by health education and reduction of cardiovascular risk factors.

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