

Blood Pressure, Body Mass Index, Heart Rate and Levels of Blood Cholesterol and Glucose of Volunteers during National Heart Weeks, 1995-1997

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Summary

The paper presents the results of a health screening programme conducted in 10 major centers in Malaysia - Kuala Lumpur, Penang, Ipoh, Johor Bahru, Alor Star, Kuala Terengganu, Malacca, Kota Bahru, Kuching and Kota Kinabalu during the National Heart Weeks, 1995-1997. There were 6,858 participants of both sexes aged between 6 years to 81 years old. The parameters involved in the screening programme were body mass index, blood pressure, heart rate, cholesterol and glucose. The following are the results of the study :-

1. The mean and standard deviation for the body mass index (BMI), systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate (HR), total cholesterol (TC) and non fasting (random) blood glucose (GL) of the volunteers studied were 24.3 ± 4.0 kg/m², 128.3 ± 21.1 mmHg, 79.6 ± 11.9 mmHg, 77.2 ± 12.1 bpm, 5.33 ± 1.37 mmol/l and 5.11 ± 1.97 mmol/l respectively.
2. There was a rising trend for BMI, SBP, DBP, TC and GL with age. The HR was higher in the younger age group of those below 20 years. Males tended to have higher mean values than females except for HR which was similar in both sexes.
3. The Malays, Chinese and Indians seemed to have closely similar mean values for SBP, DBP and HR but the Indians possessed the highest BMI (25.62 ± 3.90 kg/m²), TC (5.61 ± 1.48 mmol/l) and GL (5.41 ± 2.43 mmol/l) among the three major ethnic groups. While the Ibans had highest TC (6.07 ± 1.09 mmol/l), their GL level was the lowest (4.76 ± 1.15 mmol/l). The Kadazans had the lowest TC level (4.94 ± 1.39 mmol/l) among all the ethnic groups.
4. Among the participants screened, 31.9% were overweight (BMI ≥ 25), 7.6% were obese (BMI ≥ 30), 26.8% had raised SBP (≥ 140 mmHg) and 19.3% had raised DBP (≥ 90 mmHg); 13.6% of the participants had increased HR (≥ 90 bpm), 22% had raised TC (≥ 6.20 mmol/l) and 2% had raised GL (≥ 11.00 mmol/l). There was a higher prevalence for abnormal values with increasing age until between the ages of 60 or 70 years, when the values began to fall.
5. Age was positively correlated with SBP ($r=0.41^{***}$, $df=4351$), DBP ($r=0.27^{***}$, $df=4351$), TC ($r=0.22^{***}$, $df=3303$) and GL ($r=0.16^{***}$, $df=2442$) but negatively correlated with HR ($r=-0.13^{***}$, $df=4351$). The BMI was positively correlated with SBP ($r=0.29^{***}$, $df=2769$), DBP ($r=0.31^{***}$, $df=2769$), TC ($r=0.16^{***}$, $df=2137$) and GL ($r=0.11^{**}$, $df=1637$) but there was no correlation with HR ($r=0.03^{ns}$, $df=2771$). The SBP and DBP were highly correlated with each other ($r=0.75^{***}$, $df=4351$) and they also showed highly significant

positive correlation ($r=0.08^{***}-0.13^{***}$, $df=2441-3301$) with TC and GL. TC was positively correlated with GL ($r=0.05^*$, $df=2319$) but only at the 5% probability level.

Key Words: Body mass index, Blood pressure, Heart rate, Hypercholesterolaemia, Diabetes, Hypertension

Introduction

The National Heart Foundation of Malaysia was founded in 1984 with the objective of promoting awareness and knowledge on cardiovascular risk factors and their reduction in the Malaysian public. In fulfilment of the objective, an annual Heart Week was conducted throughout the country. The activities during the annual Heart Week included a health screening programme, in addition to other awareness and education programmes. During the initial years (1992-1994) the health screening programmes were conducted only in Kuala Lumpur, Kuantan and Penang with measurement of blood pressure, cholesterol and glucose levels of the participants. The results of this preliminary study (1992-1994) were reported by Khoo et al¹.

The health screening programmes continued annually throughout the National Heart Weeks in subsequent years i.e. 1995-1997 and expanded to the other states of Malaysia to include Ipoh, Malacca, Johor Bahru, Alor Setar, Kuala Terengganu, Kota Bahru, Kuching and Kota Kinabalu. Kuala Lumpur, being the national capital, held a Heart Week every year and an additional Heart Week was held in Penang in 1995. In these subsequent screening programmes, body mass index and heart rate were included.

This paper presents the findings of the health screening programme held during the National Heart Weeks during 1995-1997.

Materials and Methods

Members of the public who came to witness the activities of the National Heart Weeks and participated in the health screening programmes in the various states during 1995-1997 were the subjects (volunteers) of this

study. These volunteers were screened for coronary risk factors which included the body mass index, blood pressure, heart rate, total cholesterol, glucose and resting electrocardiogram (ECG). The volunteers were also requested to provide their personal and family histories related to illnesses such as heart disease, hypertension and diabetes including their treatment if any and their smoking habits.

Weights and heights were measured and the body mass index (BMI) was calculated as weight (in kg) divided by the height (in meters²).

Blood pressure that included systolic blood pressure (SBP) and diastolic blood pressure (DBP) and heart rate (HR) were obtained with the volunteers seated after approximately 10 minutes of rest. An OMRON fuzzy controlled oscillometric blood pressure pulse monitor (model Hem - 706 Fuzzy, OMRON CORPORATION, JAPAN) was used to obtain the blood pressure and heart rate readings. Normally, the two readings were recorded and their mean values were used. In doubtful cases, additional readings were carried out for confirmation.

Serum total cholesterol (TC) and blood glucose (GL) were measured in the non-fasting stage. The Reflotron and Accutrend (Boehringer Mennhein UK Ltd) were used for serum cholesterol and glucose measurements respectively according to the procedures described in the instrument manuals. In both cases, whole blood was collected through finger pricks and placed in appropriate reagent test strips for cholesterol and blood glucose estimations.

The prevalence of abnormality in BMI, SBP, DBP, HR, TC and GL were based on the following cut-off values and criteria:

Parameter	Unit	Abnormality Status	
		[AI]	[All]
BMI	kg/m ²	≥25	≥30
SBP	mmHg	≥140	≥150
DBP	mmHg	≥90	≥100
HR	beat/min (bpm)	≥ 90	-
TC	mmol/l	≥5.2	≥6.2
GL	mmol/l	≥11.0	-

Volunteers who were known hypertensive, hypercholesterolaemic, or diabetic as revealed in their medical history were included in their respective abnormal status.

Statistical Analysis

Statistical analysis was done with SAS Statistic Software^{2,3} (SAS Institute Inc, USA). Summary statistics (mean, standard deviation, minimum, maximum) of parameters measured for volunteers by sex, age and ethnic groups were estimated. Tests of significance among groups were carried out using analysis of variance. Significant means were obtained using Duncan multiple range test or Student t-test as applicable. Chi-square tests were used to compare groups with normal and abnormal status. Pearson correlation was used to reflect the relationship between the parameters studied.

Results

Sample studied

A total of 6858 subjects participated in the 1995-1997 National Heart Week Screening Programme. Table I shows the demographic profile of the participants by race, sex, age and location. Majority (87.9%) of the volunteers studied came from West Malaysia with the highest number in Kuala Lumpur (31.2%) followed by Penang (13.3%), Kota Bahru (9.4%), Alor Star (9.1%), Johore Bahru (8.0%), Kuala Terengganu (7.4%), Malacca (5.5%) and Ipoh (4.1%). In East Malaysia, Kuching and Kota Kinabalu representing major towns of Sarawak and Sabah, constituted respectively 7.7% and 4.4% of the total sample studied.

The majority of the volunteers was Chinese (56.4%),

Table I
Demographic Profile of Volunteers Involved in 1995-1997 Heart Week Health Screening Programme

	Frequency	Percent
By Race		
Malay	2340	34.1
Chinese	3868	56.4
Indian	482	7.0
Iban	102	1.5
Kadazan	66	1.0
By Sex		
Male	4138	60.4
Female	2714	39.6
By Age		
19 and Below	144	2.2
20-29	1074	16.5
30-39	2010	30.9
40-49	1835	28.2
50-59	947	14.5
60-69	381	5.9
70 and Above	118	1.8
By Location		
Kuala Lumpur	2140	31.2
Penang	914	13.3
Ipoh	278	4.1
Malacca	376	5.5
Johor Bahru	549	8.0
Alor Star	623	9.1
Kuala Terengganu	505	7.4
Kota Bahru	645	9.4
Kuching	527	7.7
Kota Kinabalu	301	4.4

followed by Malays (34.1%), Indians (7.0%), Ibans (1.5%) and Kadazans (1.0%). There were more males (60.4%) than females (39.6%).

The mean age of the volunteers studied was 40 year-old (range = 6-81). The male volunteers had a mean age of 40.5 year-old (range = 10-80) while the female

Table II
Simple Statistics of Clinical Parameters for Participants Measured
During 1995-1997 National Heart Weeks

Parameter	Unit	Sample Size	Mean	Standard Deviation	Minimum	Maximum
BMI	kg/m ²	4137	24.34	4.00	12.00	47.67
SBP	mmHg	5422	128.31	21.14	66.00	230.00
DBP	mmHg	5422	79.64	11.92	40.00	133.00
HR	beat/min	4587	77.21	12.10	36.00	139.00
TC	mmol/l	5192	5.33	1.37	2.10	16.48
GL	mmol/l	3861	5.11	1.97	3.00	24.80

Table III
Summary (Mean \pm SD) for Parameters by Sex Group
(Results for the 1992-1994 Heart Weeks Included for Reference)

Parameter		Male	Female	t-value
BMI	1995-1997	24.82 \pm 3.81 (2506)	23.60 \pm 4.17 (1628)	9.71 ***
SBP	1995-1997	132.23 \pm 19.59 (3285)	122.27 \pm 22.02 (2132)	17.40 ***
	1992-1994	131.80 \pm 20.50 (157)	122.50 \pm 20.10 (123)	3.78 ***
DBP	1995-1997	81.87 \pm 11.51 (3285)	76.20 \pm 11.74 (2132)	17.57 ***
	1992-1994	81.90 \pm 12.60 (157)	75.80 \pm 13.20 (123)	3.92 ***
HR	1995-1997	77.04 \pm 12.40 (2758)	77.49 \pm 11.65 (1824)	1.23 NS
TC	1995-1997	5.39 \pm 1.38 (3148)	5.24 \pm 1.35 (2040)	3.90 ***
	1992-1994	5.32 \pm 1.11 (1401)	5.18 \pm 1.19 (792)	2.71 **
GL	1995-1997	5.26 \pm 2.14 (2336)	4.89 \pm 1.66 (1523)	5.67 ***
	1992-1994	5.93 \pm 2.32 (347)	5.26 \pm 1.75 (243)	4.05 ***

Note: The t-values give tests for sex difference for each parameter with ** and *** for significance at $P < 0.01$ and 0.001 respectively (sample size in bracket). The above results show highly significant difference between sex for the given parameters in the two periods except for HR (for 1995-1997 only).

volunteers had a mean age of 39.8 year-old (range = 6-81). The majority of the volunteers was in the 30-49 age group.

Mean BMI, SBP, DBP, HR, TC & GL Levels

Table II shows the mean values of the various parameters of the volunteers measured during the 1995-1997 National Heart Week Health Screening Programme. The mean values of the body mass index (BMI), systolic blood pressure (SBP), diastolic blood pressure (DBP),

heart rate (HR), total cholesterol (TC) and glucose (GL) were 24.3 kg/m², 128.3 mmHg, 79.6 mmHg, 77.2 bpm, 5.33 mmol/l and 5.11 mmol/l respectively.

The males tended to have higher values than females except for the heart rate (Table III) which appeared to be the same in both sexes. Table III also indicates that the male and female values for SBP, DBP and TC did not differ between the studies in 1992-1994 and 1995-1997. There appeared to have lower mean GL values of both sexes in 1995-1997 as compared to those of 1992-1994.

There was a rising trend of BMI, SBP, DBP, TC and GL with increasing age. However the HR was higher in the young group, below 20 years and there was no indication of an increase with age (Table IV). On the other hand there appeared to show a declining trend in advancing age group for HR.

Of the five ethnic groups (Table V), the Indians had the highest BMI (25.6 kg/m²) compared to the Malays (25.0) and the Chinese (23.8). The BMI of the Ibans (24.8) and the Kadazans (24.3) were not significantly different from the Malays. The SBP was about the same in all the ethnic groups with a range of 127.5 to 131.4 mmHg. The DBP was also about the same in all the ethnic groups. The Ibans appeared to have a slightly higher blood pressure (131.4/81.1 mmHg) while the

Kadazans had a slightly lower blood pressure of 127.5/77.8 mmHg. The sample sizes however were small compared to the other three ethnic groups.

The HR of all the ethnic groups were about the same except for the Ibans who had a lower HR (73 bpm) (based on a small sample size). The Ibans had the highest cholesterol of 6.07 mmol/l, while the Kadazans had the lowest (4.94 mmol/l).

The Indians possessed a higher random blood glucose of 5.41 mmol/l than the other ethnic groups with the Ibans having the lowest (4.76).

Taken as a whole, the Malays, Chinese and Indians have about the same mean value for SBP (127.6-129.0

Table IV
Summary (Mean ± SD) for Parameters by Age Group

Age Group	BMI	SBP	DBP	HR	TC	GL
19 & Below	20.91±4.11 (84) c	115.95±14.70 (119) e	72.94±10.67 (119) d	83.32±14.24 (108) a	4.41±0.88 (103) e	4.60±1.22 (66) e
20-29	22.96±3.92 (643) b	118.43±16.81 (835) e	74.85±10.63 (835) d	79.52±12.48 (728) b	4.90±1.23 (781) d	4.83±.46 (573) de
30-39	24.48±3.99 (1250) a	132.20±16.90 (1625) d	77.71±10.70 (1625) c	77.68±11.93 (1377) bc	5.21±1.33 (1562) c	4.78±1.48 (1151) de
40-49	25.10±3.90 (1134) a	129.9±19.72 (1472) c	81.05±12.21 (1472) b	76.58±11.66 (1215) cd	5.47±1.33 (1387) b	5.20±2.09 (1060) cd
50-59	25.02±4.00 (547) a	138.86± 22.57 (751) b	84.14±11.98 (751) a	76.03±11.66 (643) cd	5.71±1.40 (710) ab	5.51±2.36 (562) bc
60-69	24.38±3.32 (226) a	148.29±24.71 (279) a	84.44±12.56 (279) a	74.44±11.81 (226) d	5.66±1.38 (286) ab	5.91±2.70 (228) ab
70 & Above	23.26±3.69 (63) b	151.16±27.01 (90) a	81.63±12.33 (90) b	75.01±13.28 (71) d	5.74±1.75 (88) a	5.97±2.71 (67) a

Note: ANOVA showed that means of ages with same alphabets (a, b, c, d) are not significantly different but of different alphabets are statistically significant at P < 0.05 (number of volunteers in bracket)..

Table V
Summary (Mean±SD) For Parameters by Race

Parameter	Malay	Chinese	Indian	Iban	Kadazan
BMI	24.98±4.28 (1399) ab	23.81±3.74 (2356) c	25.62±3.90 (259) a	24.78±3.46 (61) abc	24.29±4.51 (62) bc
SBP	128.99±20.42 (1879) a	127.90±21.86 (3039) a	127.62±18.77 (358) a	131.44±21.34 (92) a	127.46±18.70 (54) a
DBP	80.63±11.77 (1879) ab	79.06±12.13 (3039) ab	79.25±10.59 (358) ab	81.11±11.79 (92) a	77.80±11.57 (54) b
HR	78.21±12.85 (1644) a	76.78±11.61 (2562) ab	75.77±12.11 (313) ab	73.00±8.85 (16) b	76.90±9.42 (52) ab
TC	5.46±1.37 (1743) bc	5.20±1.35 (2950) cd	5.61±1.48 (364) b	6.07±1.09 (102) a	4.94±1.39 (33) d
GL	5.04±2.10 (1331) ab	5.15±1.86 (3168) ab	5.41±2.43 (240) a	4.76±1.15 (91) b	5.09±1.53 (31) ab

Note: ANOVA showed that means of different ethnic group with same alphabets (a, b, c, d) are not significantly different but of different alphabets are statistically significant ($P < 0.05$) (number of volunteers in bracket).

mmHg), DBP (79.1-80.6 mmHg) and HR (75.8-78.2 bpm). The Indians however had the highest BMI (25.6 kg/m²), TC (5.61 mmol/l) and GL (5.41 mmol/l) amongst the three major ethnic groups. The Ibans on the other hand have higher SBP (131.4 mmHg), DBP (81.1 mmHg) and TC (6.07 mmol/l) than the Kadazans and their blood glucose was the lowest (4.76 mmol/l) amongst the five ethnic groups. The Kadazans had the lowest TC (4.94 mmol/l).

Prevalence of Abnormality

The prevalence of abnormal values amongst volunteers in the 1995-1997 National Heart Weeks Health Screening Programme (Table VI) shows that:

39.5% of the volunteers were overweight (BMI \geq 25 kg/m²) of which 7.6% were obese (BMI \geq 30 kg/m²);

26.8% had SBP \geq 140 mmHg and 19.3% had DBP \geq 90 mmHg;

13.6% had HR \geq 90 bpm;

53.9% had TC \geq 5.2 mmol/l and 22% had TC \geq 6.2 mmol/l;

2% had GL \geq 11 mmol/l.

The Indian had a higher prevalence of abnormality for BMI (52.5%), TC (62.1%) and glucose (2.9%) than the Chinese and Malays. The Ibans had the highest percentage of raised SBP (34.8%), DBP (22.8%), and TC (76.5%). The abnormal values for males were higher than the females but both sexes had heart rates that were almost equal (Table VII).

The abnormal values in relation to age groups are shown

Table VI
Percent Abnormality for Clinical Parameters of Volunteers by Ethnic Group

Parameter	Status	Malay	Chinese	Indian	Iban	Kadazan	Total	Chi-sq (df = 4)
BMI	N	1399	2356	256	61	62	4134	
	AI	48.11	32.56	52.51	47.54	43.55	39.45	111.8***
	All	10.44	5.69	10.81	6.56	3.23	7.59	34.16***
SBP	N	1879	3039	358	92	54	5422	
	AI	27.78	26.16	24.30	34.78	27.78	26.76	5.97 ^{NS}
	All	13.09	14.25	10.61	13.04	7.41	13.52	5.99 ^{NS}
DBP	N	1879	3039	358	92	54	5422	
	AI	20.11	19.31	13.52	22.82	12.96	19.28	8.18 ^{NS}
	All	5.69	4.77	3.63	5.43	1.85	5.00	4.82 ^{NS}
HR	N	1644	2562	313	16	52	4587	
	AI	16.06	12.37	11.50	6.25	7.69	13.56	15.22 ^{**}
TC	N	17.43	29.50	364	102	33	5192	
	AI	58.87	49.11	62.08	76.47	51.51	53.86	75.22***
	All	25.36	18.64	26.92	46.08	15.15	22.00	71.33***
GL	N	1331	2168	240	91	31	3861	
	AI	2.33	1.80	2.92	0	0	1.99	4.71 ^{NS}

Note: The statistical significance of the Chi-square values are also marked as: NS for not significant ($P > 0.10$) and ** & *** for significant at $P < 0.01$ & $P < 0.001$ respectively. The above results indicate that BMI is significant in the two groupings (AI, All) but SBP and DBP are not significant for the two groups. HR is shown to be significant in the single group AI. TC is also significant in AI and All. GL shows no significant differences.

in Table VIII. Generally, there is an increasing trend in abnormal values with increasing age till the age 60 or 70 years when the values started to fall. The highest heart rates were found in the younger age groups (< 20 years of age).

Relationship between Parameters

The relationship between the measured parameters are shown in Table IX. There were highly significant positive correlations between age and BMI, SBP, DBP, TC and GL ($r=0.16^{***}$ - 0.41^{***} , $df=2442-4351$) but a negative correlation with HR ($r=-0.13^{***}$, $df=4353$). The BMI was positively correlated with SBP, DBP, TC and GL ($r=0.11^{***}$ - 0.31^{***} , $df=1637-2769$). There was no significant correlation between BMI and HR ($r=0.03$, $df=2771$). The SBP and DBP were highly correlated with each other and they were positively

correlated with all the measured parameters ($r=0.08^{***}$ - 0.14^{***} , $df=2441-4351$). The TC was correlated with GL at the 5% probability level ($r=0.05^*$, $df=2319$).

Discussion

The primary aim of the Heart Foundation of Malaysia is to create public awareness in heart disease and its prevention. The campaign has intensified over the last three years, 1995-1997, compared with the previous campaigns during 1992-1994¹. The campaigns have increased to 12 for the period 1995-1997 compared to 6 for the period 1992-1994. The number of volunteers have also doubled ($n=6858$), compared to 1992-1994 ($n=2670$). The campaigns, which were formerly held only in Peninsular Malaysia, have been extended to Sabah and Sarawak.

Table VII
Percent Abnormality for Clinical Parameters
of Volunteers in 1995-1997
Heart Weeks by Sex Group

Parameter	Status	Male	Female	Chi-sq (df = 1)
BMI	N	2506	1628	
	AI	45.25	29.53	88.94 ***
	All	8.10	6.82	2.133 NS
SBP	N	3285	2132	
	AI	31.39	19.66	90.19 ***
	All	15.01	11.26	15.22 ***
DBP	N	3285	2132	
	AI	22.77	13.93	64.32 ***
	All	6.15	3.24	22.47 ***
HR	N	2758	1824	
	AI	14.00	12.94	0.957 NS
TC	N	3148	2040	
	AI	56.48	49.90	21.29 ***
	All	24.05	18.87	19.01 ***
GL	N	2336	1523	
	AI	2.53	1.18	7.84 **

Note: Chi-square values indicate significantly different percentages between male and female in SBP, DBP and TC for the two abnormality groupings (AI and All). In GL the two percentages are different for the single group AI. In BMI, significant difference is for AI but not All. There is no significant difference between male and female in HR for the single group AI.

The mean values of the parameters for Kuala Lumpur and Penang which consisted three major ethnic groups (Malays, Chinese and Indians) obtained during 1995-1997 and those obtained previously during 1992-1994, which gave: SBP 128.7 mmHg and DBP 79.4 mmHg were essentially similar (Table X). However, there appeared to have a slight increase in TC level from an average of 5.24 mmol/l to 5.39 mmol/l for these two periods (1992-1994 and 1995-1997). In terms of GL level, there was a significant decline from 5.47-5.93 mmol/l in 1992-1994 to 5.10-5.42 mmol/l in 1995-1997. This may imply that the effect of heart week health campaigns to promote awareness and reduction

of cardiovascular risk factors is positive as seen in GL level reduction over the two periods of heart week activities. However, there was a slight increase of TC level during the two periods, suggesting more efforts have to be given and it may need a longer time for the public to adapt and change their life style (e.g. eating habits and exercise) in order to obtain the desirable effect of a reduction in TC level.

In the present Heart Week Campaign (1995-1997) Ibans and Kadazans were represented. Though their sample size was small, a few interesting observations were noted. Among the ethnic groups studied, the Iban had the highest TC level and the lowest GL level. The Kadazan, on the other hand, had the lowest TC level. It is not easy to pin point the reason for this observation. However, their eating habits, life style and genetics could well contribute to these observations.

The SBP, DBP, TC and GL of the three ethnic groups, Malays, Chinese and Indians were almost the same in both the 1992-1994 and the 1995-1997 studies. The mean BMI of all the volunteers was 24.3 kg/m² suggesting the population studied was generally not overweight. The mean HR of 77 bpm was also within normal range.

The Singapore National Heart Week Study showed that TC was 5.6 mmol/l in 1986⁴ and 5.5 mmol/l in 1988⁵. These values were slightly higher than the Malaysian values. The prevalence of hypercholesterolaemia (TC \geq 6.2 mmol/l) was 22% in this study compared to 17.5% in the previous Heart Week programme (1992-1994). The prevalence of hypercholesterolaemia in Singaporeans^{4,5} was 21.1% - 23.1% in 1986-1988. These values were higher than our values of 1992-1994 but about the same as the TC values of 1995-1997 period found in the present study.

The prevalence for hypertension was 26.8% for raised SBP and 19.3% for raised DBP. This appeared to be lower than the prevalence figure found during 1992-1994 where 29.6% had raised SBP and 23.2% had raised DBP. Liew et al⁶ reported the prevalence of hypertension in Malaysia to be 16%, while a higher prevalence of 22% and 14% were reported in Singapore based on cut-off points of 150/90 and 160/95 mmHg respectively⁷.

Table VIII
Percent Abnormality for Clinical Parameters of Volunteers by Age Group

Parameter	Status	19 & below	20-29	30-39	40-49	50-59	60-69	70 & above	Chi-sq (df = 6)
BMI	N	84	643	1250	1134	547	226	63	97.30 *** 18.91 **
	AI	15.5	26.4	40.8	47.0	41.9	40.7	30.2	
	All	1.2.	5.6	8.2	9.1	9.5	4.4	4.8	
SBP	N	119	835	1625	1472	751	279	90	607.7 *** 647.7 ***
	AI	6.7	10.7	16.6	29.8	46.5	60.6	64.5	
	All	0.8	3.1	5.5	13.3	28.4	44.1	48.9	
DBP	N	119	835	1625	1472	751	279	90	270.5 *** 103.3 ***
	AI	6.7	7.7	12.8	24.6	33.2	29.8	26.7	
	All	1.7	1.6	2.4	6.5	8.8	11.5	6.7	
HR	N	108	728	1377	1215	634	226	71	52.64 ***
	AI	27.8	20.5	13.8	11.8	10.3	8.9	9.9	
TC	N	103	781	1562	1387	710	286	88	222.1 *** 132.9 ***
	AI	21.4	39.6	48.8	59.6	68.0	67.1	62.6	
	All	1.9	12.0	19.4	25.0	30.0	32.2	33.0	
GL	N	66	573	1151	1060	562	228	67	58.39 ***
	AI	0	0.5	0.6	2.2	3.4	7.0	4.5	

Note: Chi-square values show significant differences in age for percentages of abnormality for all parameters in the two groupings. ** and *** for significant at $P < 0.01$ and 0.001 respectively.

The prevalence of diabetes mellitus was 2% in this study. Among the various ethnic groups, the highest prevalence was found in the Indian (2.9%) followed by the Malays (2.3%) and the Chinese (1.8%). In our last survey conducted during the National Heart Week 1992-1994, the prevalence of diabetes mellitus was 3.3%.

These findings are closely similar to those reported during the Malaysian National Health and Morbidity Survey II⁸ where the national prevalence of undiagnosed diabetes was 2.5%. Taken together with the national prevalence of known diabetes mellitus (5.7%) the prevalence of diabetes is regarded to be 8.3% in Malaysia. Thus there seems to be an increase in the prevalence of diabetes as the previous National Health and Morbidity Survey⁹ reported a prevalence figure of 6.3% in 1986.

In Singapore the prevalence of diabetes (Singapore Heart

Week Survey) was 2.8% in 1986 which is close to our finding. The Singapore National Health Survey 1992¹⁰ reported a prevalence of 8.6% for diabetes mellitus of whom more than half (58.5%) were new or undetected diabetes. The National University of Singapore Heart Study¹¹ found a prevalence of 19.2% for diabetes mellitus with 65.1% known cases and 34.9% newly diagnosed cases.

The prevalence of diabetes mellitus in both the Malaysian and Singapore National Health Survey showed that the prevalence of diabetes was highest in the Indians, followed by the Malays and Chinese. The survey showed the same ethnic distribution.

In the present study, 39.5% of the subject were deemed overweight and 7.6% were obese. Among the overweight subjects, there were more Indians (52.5%) followed by the Ibans (47.5%), the Kadazans (43.6%), the Malays (48.1%) and the Chinese (32.6%).

Table IX
Simple Correlation Coefficients Among Clinical
Parameters of Volunteers

Parameter	BMI	SBP	DBP	HR	TC	GL
AGE	0.16*** (2773)	0.41*** (4353)	0.27*** (4353)	-0.13*** (4353)	0.22*** (3305)	0.16*** (2444)
BMI		0.29*** (2771)	0.31*** (2771)	0.03 ^{NS} (2773)	0.16*** (2139)	0.11*** (1639)
SBP			0.75*** (4353)	0.12*** (4353)	0.13*** (3303)	0.13*** (2443)
DBP				0.14*** (4353)	0.13*** (3303)	0.08*** (2443)
HR					0.01 ^{NS} (3305)	0.10*** (2444)
TC						0.05* (2321)

Note: Significant correlation is marked as: * and *** ($P < 0.05$ and 0.001 respectively) and NS for not significant at $P < 0.05$ (sample size in bracket). The results show significant correlation among all the parameters except that between BMI and HR and also between TC and HR. Negative correlation between HR and age is shown.

Among the obese subjects, again there were more Indians (10.8%) followed by the Malays (10.4%), the Ibans (6.6%), the Chinese (5.7%) and the Kadazans (3.2%).

Liew et al¹² in a survey of senior civil servants of Kuala Lumpur found the mean BMI to be 24.6 kg/m² with 36% being overweight and 6.4% obese. The prevalence of obesity was highest in the Malay (8.5%) followed by the Indians (4.6%) and the Chinese (1.2%). Similarly the prevalence of overweight was highest among the Malays (42.2%) followed by the Indians (24.6%) and the Chinese (22.4%).

In both the Heart Week study and the Senior Civil Servants study, the Chinese were the least overweight and obese compared to the Malays and Indians. Ismail et al¹³ reported 29% males and 26% females were overweight in an urban population, while 5% males and 8% females were obese. Mohd Aminuddin et al¹⁴ reported the prevalence of overweight to be 21.4% and obesity of 6.5% in a rural population.

In the National Health Survey in Singapore 1992¹⁰, 5% adult Singaporean were deemed obese and 21% were overweight. A higher proportion of men (23%) were overweight compared to the women (19%) whereas more women (6%) than men (4%) were obese. In Singapore, there were marked differences in obesity levels of the three ethnic groups. The Indians had the highest proportion of obese persons (10%) followed by the Malays (6%) and the Chinese (3%). Among the women, the Malays had the highest proportion of obese persons (17%) followed by the Indians (13%) and the Chinese (4%) as reported by Raja¹⁵.

The prevalence of obesity was 7% in France, 9% in the United Kingdom and 15% in the United States. In these countries, obesity was related to age, sex, and level of education, marital status, physical exercise and smoking¹⁶.

Among our volunteers studied, 13.6% had a HR of above 90 bpm. The Framingham Study¹⁷ has shown that HR is an important risk factor for cardiovascular

Table X
Comparison of Results (Mean \pm SD) in 1992-1994 & 1995-1997 Heart Weeks in Penang (PG) and Kuala Lumpur (KL) for Some Clinical Parameters

Location	Parameter	1992-1994	1995-1997	t-value
PG	SBP	128.2 \pm 21.1 (247)	128.7 \pm 21.1 (794)	0.33 ^{NS}
	DBP	79.4 \pm 13.5 (247)	79.8 \pm 11.6 (794)	0.63 ^{NS}
	TC	5.19 \pm 1.44 (234)	5.39 \pm 1.61 (671)	1.68 ⁺
	GL	5.47 \pm 2.40 (234)	5.10 \pm 2.15 (354)	2.14 [*]
KL	TC	5.29 \pm 1.36 (1898)	5.39 \pm 1.27 (1758)	2.29 [*]
	GL	5.93 \pm 2.09 (358)	5.42 \pm 2.04 (1112)	4.09 ^{***}

Note: Sample size in bracket. NS: Not significant at $P < 0.05$; +, *, and ***: significant at $P < 0.10$, 0.05 and 0.001 respectively.

mortality. In another analysis of the Framingham Study¹⁸, there was an increased risk for cardiovascular death in hypertensive patients with elevated heart rates. In patients with hypertension, the incidence of death from all causes was doubled for an increase of heart rates of 40 bpm (from 60 bpm to 100 bpm). All causes of death attributed to coronary heart disease and cardiovascular disease were lowest if the heart rate was below 65 bpm.

In this study, heart rate showed positive correlation with SBP, DBP and GL but a negative correlation with age. Our observations are thus similar to those made by other researchers^{19, 20}.

Although resting ECG measurement, medical history and lifestyle (smoking, alcohol consumption and exercise) questionnaires were included in the current Heart Week Campaigns, data collected had been limited, incomplete and unreliable. Thus these data were not included in this study. We hope that more attention and refinement in such data collection will be given in the future Heart Week Campaigns.

Conclusion

The National Heart Week has doubled its activities from 6 campaigns during 1992-1994 to 12 campaigns during 1995-1997. From 1992-1997, the major town of every state in Malaysia has been covered thus bringing awareness and education of cardiovascular risk

factors to the public of these states.

The mean BMI of all volunteers was 24.3 kg/m². The prevalence of obesity was 7.6% and this is higher than Singapore (5%), about the same as in France but lower than the UK (9%) and US (15%).

The mean systolic blood pressure was 128.3 mmHg and the diastolic blood pressure 79.6 mmHg. 26.8% of the volunteers have SBP above 140 mmHg and 19.3% have DBP above 90 mmHg. The prevalence of hypertension appeared to have decreased slightly compared to the 1992-1994 survey.

The mean serum cholesterol for all volunteers was 5.33 mmol/l, slightly higher than the 1992-1994 survey (5.27 mmol/l). However 76.5% of the Ibans had serum cholesterol values above 5.2 mmol/l (i.e. 6.07 mmol/l) compared to 53.9% for the whole sample studied.

The prevalence of diabetes mellitus in this study was 2%, compared to 3.3% in the 1992-1994 survey.

It should be noted that the volunteers involved in the Heart Weeks during 1995-1997 differed from those studied during 1992-1994 in that the earlier study did not include the ethnic groups of the Ibans and the Kadazans of East Malaysia. Any comparison in terms of national averages between these two periods would need to take these factors into consideration.

References

1. Khoo K L, Tan H, Sambhi J S, Aljafri A M, Hatijah A. Screening for blood pressure, cholesterol and blood glucose during National Heart Weeks 1992-1994. *Med J Malaysia* 1996; 51(3): 307-16.
2. SAS Institute Inc. SAS Users Guide; Basics Version 5 Edition. Cary, NC: SAS Institute Incorporated 1985; 1290 pp.
3. SAS Institute Inc. SAS/STAT. Guide for Personal Computers, Version 6 Edition. Cary N.C. : SAS Institute Incorporation 1987; 1028 pp.
4. Ng A S H, Chee T S, Wong W M, Aw T C, Quek S S S, Tan A T H, Arulanan S. Coronary risk profile screening during National Heart Week 1986. *Annals Acad. Med.* 1990; 19(1): 30-3.
5. Teo W S, Ng A S H, Chee T S, Chua T S, Tan P. Lipid screening in Singapore. *Ann Acad Med Singapore* 1992; 21 (1): 5-9.
6. Liew Y M, Tan H, Khoo K L. A review of blood pressure profile and hypertension studies in Malaysia. *The Family Physician* 1994; 6(2): 36-45.
7. Lee H P, Seah C S, Yik T K et al. An epidemiological survey of blood pressures in Singapore 1974. *J. Chron. Dis.* 1977; 30: 793-802.
8. Ministry of Health, Malaysia. National Health and Morbidity Survey II. Public Health Institute, Kuala Lumpur 1997.
9. Ministry of Health, Malaysia. National Health and Morbidity Survey 1986-1987. Public Health Institute, Kuala Lumpur 1987.
10. Ministry of Health, Singapore. National Health Survey 1992: Highlights of Main Survey Findings. Research and Evaluation Department, Singapore 1993.
11. Hughes K, Choo M, Kuperan P, Ong C N, Aw T C. Cardiovascular risk factors in non-insulin-dependent diabetes compared to non-diabetic controls: a population based survey among Asians in Singapore. *Atherosclerosis* 1998; 136: 25-31.
12. Liew Y M, Zulkifli A, Tan H, Ho Y N, Khoo K L. Health status of senior civil servants in Kuala Lumpur. *Med J Malaysia* 1997; 54(4): 348-66.
13. Ismail M N, Zakiah H, Chee S S, Ng K K. Prevalence of obesity and chronic energy deficiency (CED) in adult Malaysians. *Mal J Nutr* 1995; 1: 1-9.
14. Mohd Aminuddin M S, Yusoff K, Osman B A, Khalid B A K. Is coronary heart disease potentially a serious public health problem in rural Malaysians? Quarterly Scientific meeting. Academy of Med. Malaysia, Penang 1993.
15. Raja U. Obesity: Is it a problem in the Asia-Pacific region? - Singaporean Perspective. *Proc. MASSO* 1996; 1: 59-70.
16. Laurier D, Guiquet M et al. Prevalence of obesity: A comparative study in France, the United Kingdom and the United States. *Int. J Obesity* 16: 565-72.
17. Kannel W B, Kannel C, Paffenbarber R S Jr, Cupples L A. Heart rate and cardiovascular mortality: The Framingham Study. *Am Heart J* 1987; 113: 1489-94.
18. Gillman M W, Kannel W B, Belanger A, D' Agostino R B. Influence of heart rate on mortality among persons with hypertension: The Framingham Study. *Am Heart J.* 1993; 125 (4): 1148-54.
19. Gillum R F. The epidemiology of resting heart rate in a national sample of men and women: association with hypertension, coronary heart disease, blood pressure, and other cardiovascular risk factors. *American Heart Journal* 1998; 116(1):163-74.
20. Palatini P, Casiglia E, Pualetto P, Staessen J, Kacicroti N, Julius S. Relationship of tachycardia with high blood pressure and metabolic abnormalities. A study with mixture analysis in three populations. *Hypertension* 1997; 30(5): 1267-73.