

Distribution of Blood Pressure in a National Sample of Malaysian Adults.

Authors:

Lim TO MRCP
Ding LM MHA
Clinical Research Centre, Hospital Kuala Lumpur

Goh BL. MRCP
Zaki M. FRCP
Suleiman AB. FRACP
Department of Nephrology, Hospital Kuala Lumpur

Maimunah AH. MPH
Rozita H. MPH
Institut Kesihatan Umum, Kuala Lumpur

Rashid A. MRCP
Universiti Sains Malaysia

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Correspondence to :
Dr. Lim Teck Onn
Clinical Research Centre
Hospital Kuala Lumpur
Jalan Pahang, 50586
Kuala Lumpur

SUMMARY

We describe the distribution of blood pressure (BP) by age, sex and ethnicity in Malaysian adults. A national sample of 21391 individuals aged 30 or older had usable data. They were selected by stratified 2-stage cluster sampling. BP was measured using an automated oscillometric device, Visomat®. Percentile tables and curves by age, sex and ethnicity are presented. The systolic and diastolic BP distribution was right skewed and showed the expected increase with age. This was markedly so in Malay and other indigenous women; as a result they had most severe hypertension.

Keywords : blood pressure, hypertension, population survey, percentile, distribution

INTRODUCTION

The distribution of blood pressure(BP) in a representative national sample of Malaysian adults has not previously been described. Such information is of epidemiological interest, and is also useful in public health practice. High levels of BP are associated with increase risk of cardiovascular morbidity¹. While prevalence estimates of hypertension are convenient and simple to interpret, it suffers from dependence on choice of arbitrary cut-off level on a continuous distribution to define hypertension. It is well known that health risk increases progressively throughout the entire range of BP with no evidence of a threshold in risk². Information on the population distribution of BP is therefore useful for describing BP related health burden as well as for planning prevention strategy.

We present here the distribution of systolic and diastolic BP by age, sex and ethnicity using the data from the National Health and Morbidity survey (NHMS) completed in 1996.

METHODS

Sampling design and sample :

The NHMS was a multi-purpose health survey designed to describe the health status, health related behaviour and health services utilisation for a representative sample of the population of Malaysia. An up to date and representative sampling frame for this population was provided by the frame used by the annual Labour Force survey conducted by the Department of Statistics³. The sampling frame was stratified by state and urban/rural residence. A stratified two stage cluster sampling design with self-weighting sample was used to draw a sample of 17995 private dwellings. However, only 13025(87%) dwellings were contactable or responded. All residents of sampled dwellings were included yielding a sample size of 59903 individuals. For NHMS component on blood pressure, 23007 individuals aged 30 years or older were eligible. 21391 (93%) of them agreed to have their measurements taken or had evaluable measurements. Table I and II show the composition of the sample.

Blood pressure measurement :

Respondent's BP was measured by a trained nurse. The procedure was explained and verbal permission obtained from the respondent prior to the examination. Blood pressure was measured with the respondent in the sitting position and his/her arm supported at the same level as his heart. One of two calibrated electronic devices (Visomat® OZ 30 or OZ 2) was used to measure blood pressure according to the manufacturer's guideline. Visomat® OZ 30 was used for patients with arm size 22-32cm and Visomat® OZ 2 for obese patients with arm size more than 32cm. The cuff was placed on respondent's right arm 2-3 cm above the antecubital fossa. Two BP measurements were taken with an interval of 3 minutes apart. Respondents were informed of their BP measurements. All nurses attended centralised training on standardised protocol for BP measurement. During field survey, supervisors conduct weekly check on compliance with BP measurement protocol.

The decision to use electronic device instead of mercury sphygmomanometer was based on the assumption that electronic device ought to be more robust. Survey field work can be difficult especially in outlying parts of the country. A previous national health survey in 1986 had encountered problem with mercury leaking rendering the device unusable or measurements unreliable. Method comparison study between measurements taken with Visomat® and those taken with mercury sphygmomanometer simultaneously was carried out in a clinic patient population⁴. The intra-class correlation coefficient between measurements obtained by the 2 methods was 0.89 and 0.58 for systolic and diastolic BP respectively. Overall, systolic BP measurement taken with Visomat® was 3% lower than that of mercury sphygmomanometer. For diastolic BP, it was 6% lower. The 95% limits of agreement was 83%-114% and 72%-123% for systolic and diastolic BP respectively. The agreement was judged satisfactory for survey use.

Definitions :

The mean of the two BP measurements are used for analysis. If only one is available, then only that single measurement is used. For purpose of analysis, blood pressure levels were categorised as optimal, normal, high normal, stage 1,2, 3 and 4 hypertension according to the classification system recommended by the Joint National Committee on Detection, Evaluation and Treatment of High Blood Pressure⁵.

Statistical methods :

Probability weighted estimation was used to obtain all estimates as appropriate for the sampling design⁶⁻⁸. The sampling weights were adjusted for household non-response using adjustment cells formed by state and urban/rural residence. Post stratification⁹ was used to adjust the weighted sample totals to known population totals for age, gender and ethnicity based on 1996 census population projection. Mean and percentage distribution were standardised by the direct method to the age distribution of the 1996 adult Malaysian population. S-PLUS¹⁰ and STATA¹¹ software packages were used for analysis.

RESULTS

Percentiles distribution

The percentiles of systolic and diastolic blood pressure (BP) by age, gender and ethnicity are shown in Tables III to XVIII. In all ethnic-gender groups, systolic BP rose with increasing age, and likewise its standard deviation. In contrast, the magnitude of the skew to the right tended to decrease with age. In men, the rise in systolic BP was less steep and tended to flatten in the older age groups compared to that of women. This was particularly obvious for the lower percentiles. As a result, while younger and middle aged men in all ethnic groups had higher systolic BP than women, the centile curves of the 2 sexes begun to cross at age 40 to 65 so that in the older age groups, systolic BP of women exceeded that of men.

Similarly for diastolic BP, the level increased with age, though much less steep than that observed in systolic BP. However, beyond the sixth decade, diastolic BP began to decline especially in men. This was more obvious for the lower percentiles. As for systolic BP, young and middle aged men had higher diastolic BP than women, that then converged or reversed at older age.

Mean BP

Tables XVIII and XX show the mean blood pressure(BP) values by gender and ethnicity. Malay and other indigenous women had the highest age-adjusted mean systolic BP (SBP), Chinese and Indian men had the highest diastolic BP (DBP) while Chinese and Indian women had the lowest DBP as well as SBP. In all groups, mean SBP rose with increasing age but DBP tended to decline beyond the age 50-55. Younger women had lower SBP than men but the rise in mean SBP with age was steeper for women than men such that eventually the mean curves of the 2 sexes crossed. The cross occurred at the young age of 35-40 in Malay and other indigenous women. As a result, they had higher mean SBP than their Chinese and Indian counterparts throughout the entire age range.

Percentage distribution of BP

Tables XXI to XXIII show the percentage distribution of BP according to the classification recommended by the Joint National Committee on Detection, Evaluation and Treatment of High Blood Pressure⁵. Overall, about a third of the adult population had BP in the optimal range, a fifth in the normal range and as much as 4% had stage 3-4 hypertension. Even in the youngest age group (age 30-39), only Indian women had a majority with BP in the optimal range. Among Malay women, Chinese men and other indigenous men and women, more than half of the adult population had BP beyond the normal range. Malay and other indigenous women had the most severe hypertension, and getting worse with advancing age. 14% and 13% respectively had hypertension at stage 2 through 4 overall, and beyond 70 years of age, the percentage was 41% for both.

DISCUSSION

We advise caution in interpreting the results. Firstly, the stability of the centile estimates is assured only if based on large sample sizes. This was clearly the case for Malay, Chinese and other indigenous ethnic group's estimates. However sample sizes for Indian in the older age groups (age 60-70+) were small though they all exceeded 30. Secondly, BP was measured by Visomat® in this survey and its measurements of both systolic and diastolic BP were systematically lower than conventional mercury sphygmomanometer. Thus the results would have been higher than those reported here had mercury sphygmomanometer been used in the survey. This also renders comparison with other surveys' findings difficult. Finally, one should be cautious in interpreting cross sectional data longitudinally. The observed age trends in both systolic and diastolic BP may not be due to ageing effect alone. One alternative explanation is selective survival. People with lower BP tend to survive with increasing age thus shifting the BP distribution of survivors downwards. Another explanation is the so call cohort effect. The people who were 70 years or older were born before 1926 while the younger people (age 30-40) were born between 1956 and 1966. The vast socio-economic changes this country has witnessed in the last few decades will have greater impact on the younger than the older cohorts. Socio-economic changes are known to be associated with increasing BP¹⁰. Nevertheless, the above caveats aside, the rise and flattening of BP with age is likely to be genuine. This has been confirmed by the longitudinal Framingham study¹¹. While no doubt selective survival and cohort effects may contribute partially to the observed trends, cross sectional data however cannot differentiate the individual contribution of each.

Characteristics of the BP distribution of the Malaysian population, as shown here, largely resemble those observed in other substantial population surveys in 'westernised' countries^{10,12}. The unimodal right skewed distribution, the decussation of the centile curves of the 2 sexes, the rise in systolic BP with age while that of diastolic BP decline with resulting higher prevalence of isolated systolic hypertension in the elderly are all well described characteristics of 'westernised' population BP distribution. The tendency of men's BP to flatten and decline with age compares to that of women is usually attributed to the relative susceptibility of men to succumb to hypertension related cardiovascular morbidity¹⁰. However, the most striking finding in this survey was the upward shift in the systolic BP distribution observed in Malay and other indigenous women. This was already apparent as young as age 30-40. Further research is required to elucidate the determinants of this unusual BP distribution in these two sub-populations.

The BP distribution of Malaysian adults described here is not merely of epidemiological interest. It is useful in its own right. In public health practice, the planning of any prevention strategy must take into account the burden of illness due to any risk factor in the community. Population BP distribution can help in estimating the burden of illness due to BP related cardiovascular morbidity in the population. For example, the risk of death from coronary heart disease (CHD) increases steadily with increasing levels of systolic BP. Using published rates of hypertension related CHD deaths¹³, one can easily estimate the expected number of CHD deaths a year given our population BP distribution. Similarly we could also estimate the number of excess CHD deaths avoided had we been successful in shifting the BP distribution downwards. In the planning of hypertension screening programme, the choice of a BP

cut-off level to initiate follow-up, investigation or treatment must partly be informed by BP distribution in the population. This is necessary for resource planning. The available resources must match the number of individuals in the population targeted for intervention, the number in turn depends on the population distribution for any choice of cut-off level. Current guideline on screening practices is of little help if the resulting number of people above recommended cut-off level would completely overwhelm the health service. For example, a common recommendation is to follow up people with BP above 140/90 on first screen. Based on our population BP distribution, 2.1 million (30%) adult Malaysians can be expected to have BP above such a level.

To our knowledge, this is the first detailed description of BP distribution in a representative national sample of Malaysian adults. The distribution can serve as a baseline for comparison with future repeat survey to determine the effectiveness of intervention programme in shifting the population BP distribution in a favourable direction. The population BP distribution described here can also serve as a yardstick for assessing the representativeness of sample in small scale survey. The BP distribution of a representative sample should closely match that described here.

In clinical practice, population reference centile charts are widely used for interpreting clinical measurements on individual patients. This is particularly so for blood pressure and body weight which are strongly dependent on age and other covariates like sex and ethnicity. In paediatric practice, this is already standard practice¹⁴. Conventional criteria for defining and treating hypertension is not always appropriate. For example, many young people with say diabetic nephropathy would not be regarded as hypertensive by current criteria as published by various authoritative bodies^{5,15}. In such patient population, it may be more appropriate to use population age and sex specific reference centile charts both to define the BP level to commence treatment as well as to define the target BP level to achieve on treatment. A reasonable strategy would be to initiate treatment at BP above 95th percentile and to achieve target BP below 75th percentile on treatment.

In conclusion, we found the distribution of BP of Malaysian adults was largely similar to those in other 'westernised' populations except for Malay and indigenous women's distributions that were shifted upward. Detailed description of BP distribution in our population is useful for both public health and clinical practice.

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Table I : Characteristics of respondents compared with total population of Malaysia age 20 or older in 1996.

	% respondents (unweighted) n=21391 No. (%)	% Malaysia population aged 30 or older n=7.84 million %
Sex		
Male	10004 (47%)	50%
Female	11387 (53%)	50%
Age		
30-34	4252 (20%)	21%
35-39	3944 (18%)	19%
40-44	3344 (16%)	16%
45-49	2638 (12%)	12%
50-54	1935 (9%)	9%
55-59	1651 (8%)	7%
60-64	1360 (6%)	6%
65-69	951 (4%)	4%
>=70	1316 (6%)	6%
Ethnic		
Malay	9656 (45%)	43%
Chinese	5978 (28%)	31%
Indian	1467 (7%)	8%
Other indigenous	3194 (15%)	9%
Others	1096 (5%)	10%

Table II : Sample size by age, sex and ethnicity in the survey

	Malay	Chinese	Indian	Other indigenous
Men, age in years				
30-34	821	433	130	322
35-39	799	420	155	278
40-44	705	422	120	233
45-49	592	406	82	145
50-54	420	304	49	155
55-59	399	243	39	91
60-64	282	195	36	101
65-69	212	150	31	55
>=70	273	173	37	102
Women, age in years				
30-34	1002	556	165	433
35-39	971	543	172	343
40-44	854	532	124	210
45-49	599	421	101	199
50-54	453	316	46	123
55-59	400	264	57	112
60-64	325	217	56	105
65-69	221	161	29	72
>=70	329	222	38	115

Table III : Empirical percentiles of systolic blood pressure for Malay males,by age

Age group	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	>=70
n	821	799	705	592	420	398	282	212	273
Percentiles									
2.50th	98	99	101	102	106	102	102	96	98
5.00th	102	101	104	103	109	108	105	102	106
10.00th	106	105	107	108	115	112	112	112	113
15.00th	109	107	109	112	117	115	117	115	118
20.00th	110	110	112	114	120	119	121	119	122
25.00th	113	112	115	117	123	120	125	124	126
30.00th	115	114	117	120	124	124	128	127	128
35.00th	116	116	119	121	126	128	131	129	131
40.00th	118	118	121	123	128	131	132	131	133
45.00th	120	120	123	125	131	133	136	134	137
50.00th	121	122	125	128	133	135	138	137	141
55.00th	123	124	126	129	135	137	140	140	143
60.00th	124	126	129	131	138	140	142	143	146
65.00th	126	127	131	133	140	142	146	145	150
70.00th	128	129	133	136	142	146	149	147	153
75.00th	130	132	135	139	147	152	151	151	159
80.00th	132	135	138	143	152	156	155	155	163
85.00th	136	139	142	148	158	160	159	160	169
90.00th	140	143	147	155	165	168	166	168	176
95.00th	148	149	154	163	175	178	176	177	185
97.50th	152	156	162	174	186	188	187	187	192
mean	122.01	123	125.91	129.24	136.16	137.42	138.67	137.84	142.07
sd*	13.48	15.21	16.14	18.37	19.96	21.71	21.47	22.06	24.54
skew**	0.41	0.71	0.9	0.78	0.81	0.62	0.53	0.3	0.32

* sd means standard deviation, ** skew means skewness

Table IV : Empirical percentiles of systolic blood pressure for Malay females,by age

Age group	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	>=70
n	1002	971	854	599	453	400	325	221	329
Percentiles									
2.50th	91	94	99	96	97	103	100	104	109
5.00th	96	98	102	101	103	108	108	112	116
10.00th	100	102	107	106	112	115	115	119	125
15.00th	103	106	110	111	116	119	122	122	128
20.00th	105	108	112	114	121	123	125	130	133
25.00th	107	110	115	117	124	126	128	134	137
30.00th	109	111	118	121	126	128	131	137	140
35.00th	111	114	120	123	131	131	133	140	144
40.00th	113	116	122	125	133	134	136	142	146
45.00th	115	119	124	128	137	137	139	145	150
50.00th	117	121	126	131	139	141	141	149	152
55.00th	119	122	128	133	142	143	144	151	157
60.00th	120	125	130	137	145	146	147	154	161
65.00th	122	129	133	140	147	151	150	158	164
70.00th	124	132	135	143	151	154	153	163	168
75.00th	127	135	139	147	154	158	158	167	170
80.00th	130	138	143	151	157	161	164	170	176
85.00th	134	142	148	155	161	164	168	179	184
90.00th	139	146	155	162	164	172	174	186	190
95.00th	147	152	162	170	178	181	190	191	201
97.50th	152	158	169	182	193	191	203	198	212
mean	117.96	122.47	128.25	132.56	139.51	141.88	143.74	150	154.77
sd*	16.13	16.79	18.92	21.56	23.25	22.44	23.96	25.67	25.91
skew**	1	0.41	0.9	0.55	0.61	0.43	0.46	0.27	0.22

* sd means standard deviation, ** skew means skewness

Table V : Empirical percentiles of systolic blood pressure for Chinese males,by age

Age group	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	>=70
n	433	420	422	406	304	243	195	150	173
Percentiles									
2.50th	100	99	98	99	100	104	104	107	100
5.00th	102	103	102	103	105	106	109	110	108
10.00th	105	106	106	108	111	111	115	120	113
15.00th	108	110	111	112	113	115	118	124	119
20.00th	110	111	113	115	116	117	122	125	126
25.00th	112	113	115	118	119	121	125	130	129
30.00th	115	115	117	121	121	125	128	134	133
35.00th	117	117	119	123	123	128	130	136	138
40.00th	118	120	120	125	124	131	132	138	140
45.00th	119	121	122	128	127	134	134	140	140
50.00th	121	123	124	130	129	138	137	142	144
55.00th	122	124	126	132	131	141	139	144	147
60.00th	124	126	128	133	134	142	143	145	150
65.00th	127	128	130	137	136	145	145	147	154
70.00th	129	130	132	140	139	147	148	149	157
75.00th	132	134	134	143	144	149	151	153	160
80.00th	133	136	139	145	147	155	155	155	166
85.00th	136	139	142	148	151	159	162	164	171
90.00th	139	143	149	151	156	166	166	169	180
95.00th	147	148	156	163	163	175	190	174	184
97.50th	151	152	164	168	171	184	198	180	192
mean	121.86	123.47	125.77	130.4	131.26	137.25	139.59	141.71	145.19
sd*	13.43	14.4	16.81	18.19	18.25	20.89	22.15	19.02	23.67
skew**	0.45	0.56	0.82	0.55	0.65	0.37	0.83	0.2	0.12

* sd means standard deviation, ** skew means skewness

Table VI : Empirical percentiles of systolic blood pressure for Chinese females,by age

Age group	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	>=70
n	556	543	532	421	316	264	217	161	222
Percentiles									
2.50th	90	90	92	92	95	98	97	102	103
5.00th	94	95	95	99	98	104	105	112	111
10.00th	97	99	100	103	105	113	113	118	117
15.00th	100	101	103	106	110	116	117	123	120
20.00th	101	103	106	109	115	121	123	126	123
25.00th	102	105	109	111	120	125	125	130	129
30.00th	104	108	112	116	122	127	130	132	134
35.00th	105	110	114	118	126	129	133	135	139
40.00th	107	111	116	120	128	131	136	138	140
45.00th	108	113	119	123	131	133	138	139	143
50.00th	111	115	121	125	133	135	141	144	146
55.00th	112	117	123	127	136	137	143	146	148
60.00th	113	119	125	130	141	140	145	149	152
65.00th	115	121	128	133	143	142	148	151	157
70.00th	117	122	132	135	146	147	153	153	161
75.00th	120	125	134	139	150	149	156	155	166
80.00th	123	128	137	141	153	153	159	160	169
85.00th	126	131	140	148	156	156	164	165	175
90.00th	130	136	146	152	163	163	171	174	181
95.00th	141	144	155	159	171	168	177	183	186
97.50th	147	155	165	168	176	175	185	196	197
mean	112.05	116.33	121.8	126.3	134.09	135.75	140.43	143.8	147.5
sd*	13.94	15.78	18.06	19.34	22.05	19.28	21.79	21.32	25.14
skew**	0.9	0.89	0.44	0.56	0.1	-0.07	0.09	0.37	0.47

* sd means standard deviation, ** skew means skewness

Table VII : Empirical percentiles of systolic blood pressure for Indian males,by age

Age group	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	>=70
n	130	155	120	82	49	39	36	31	37
Percentiles									
2.50th	98	105	100	96	94	117	103	102	100
5.00th	101	108	104	99	98	117	107	102	102
10.00th	104	110	107	108	109	120	112	119	107
15.00th	106	111	112	112	109	122	117	121	118
20.00th	107	113	115	113	113	123	120	126	118
25.00th	110	114	116	118	117	126	123	134	120
30.00th	111	117	117	120	120	131	126	134	126
35.00th	112	119	120	120	120	137	127	137	126
40.00th	115	120	123	122	121	139	128	139	127
45.00th	116	121	126	124	125	140	130	143	133
50.00th	118	123	127	126	129	143	136	144	134
55.00th	121	126	128	128	132	147	142	145	134
60.00th	123	127	130	131	134	149	142	147	141
65.00th	125	129	131	135	137	152	144	149	141
70.00th	127	132	133	139	140	154	148	156	153
75.00th	130	136	138	140	143	165	153	158	156
80.00th	132	138	139	144	148	168	156	174	162
85.00th	134	140	141	149	150	172	161	174	174
90.00th	144	145	145	153	158	179	164	175	177
95.00th	161	151	156	162	169	183	170	185	177
97.50th	165	152	157	168	184	187	172	185	200
mean	120.95	125.41	126.9	129.36	130.45	145.42	137.02	145.78	138.96
sd*	16.37	14.65	15.42	20.54	20.95	21.9	19.14	22.91	25.52
skew**	1.06	1.12	0.47	1.55	0.5	0.25	0.13	0.15	0.75

* sd means standard deviation, ** skew means skewness

Table VIII : Empirical percentiles of systolic blood pressure for Indian females,by age

Age group	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	>=70
n	165	172	124	101	46	57	56	29	38
Percentiles									
2.50th	83	87	99	93	103	99	90	99	108
5.00th	91	91	101	98	105	99	97	119	113
10.00th	97	95	105	103	109	110	103	125	123
15.00th	99	98	108	106	110	113	107	129	124
20.00th	101	102	111	107	113	116	111	130	128
25.00th	103	104	112	111	115	120	118	132	131
30.00th	106	106	113	113	118	122	121	134	136
35.00th	108	108	115	116	122	124	122	135	138
40.00th	108	109	117	118	124	127	124	137	145
45.00th	110	111	119	121	125	130	131	143	147
50.00th	111	113	122	123	125	131	132	145	147
55.00th	112	115	125	127	129	132	139	151	150
60.00th	114	118	127	129	132	140	140	154	151
65.00th	114	119	129	131	135	142	146	155	154
70.00th	116	122	131	136	136	143	147	158	156
75.00th	120	123	134	138	140	146	151	158	158
80.00th	122	127	137	143	148	148	154	164	164
85.00th	123	130	144	146	155	157	162	175	167
90.00th	126	134	149	155	160	161	166	182	171
95.00th	133	141	165	160	161	172	170	197	186
97.50th	138	149	167	179	179	179	173	214	186
mean	111.1	114.06	124.43	125.57	130.43	133	133.92	148.99	145.73
sd*	12.93	15.29	17.72	20.19	20.54	21.13	23.28	24.53	20.25
skew**	0.13	0.38	0.92	0.72	1.08	0.24	-0.03	0.73	-0.07

* sd means standard deviation, ** skew means skewness

Table IX : Empirical percentiles of systolic blood pressure for Other indigenous males,by age

Age group	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	>=70
n	322	278	233	145	155	91	101	55	102
Percentiles									
2.50th	99	99	99	96	98	103	95	106	106
5.00th	103	101	103	109	104	103	100	110	115
10.00th	108	107	110	114	111	108	110	113	122
15.00th	110	110	113	117	115	110	114	114	124
20.00th	113	114	114	120	121	115	118	128	127
25.00th	116	116	117	124	123	119	122	131	132
30.00th	119	117	119	127	126	124	125	134	134
35.00th	120	120	120	129	127	127	126	135	136
40.00th	122	121	122	131	129	130	128	136	139
45.00th	123	123	123	132	131	132	132	137	143
50.00th	124	125	125	133	134	134	135	137	145
55.00th	126	127	126	136	135	135	138	140	148
60.00th	128	128	128	137	138	139	141	142	152
65.00th	130	130	132	139	141	140	149	150	156
70.00th	132	132	134	141	145	146	156	152	161
75.00th	133	134	138	143	147	150	159	160	164
80.00th	136	136	140	146	155	155	164	164	168
85.00th	138	141	147	151	160	160	168	175	176
90.00th	143	147	150	158	170	170	175	181	186
95.00th	148	156	154	167	183	175	191	192	197
97.50th	154	160	162	171	191	193	208	193	219
mean	124.82	125.62	127.22	134.05	136.95	135.89	140.23	144.3	149.12
sd*	13.64	16.22	15.78	17.38	22.75	24.07	27.48	25.04	26.29
skew**	0.19	0.81	0.55	0.22	0.71	0.46	0.6	0.65	0.7

* sd means standard deviation, ** skew means skewness

Table X : Empirical percentiles of systolic blood pressure for Other indigenous females,by age

Age group	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	>=70
n	433	343	210	199	123	112	105	72	115
Percentiles									
2.50th	95	96	98	97	95	97	95	107	102
5.00th	98	101	100	103	103	99	101	111	106
10.00th	103	103	105	108	112	108	110	118	112
15.00th	106	107	111	113	113	116	116	121	119
20.00th	108	111	112	116	118	120	118	129	125
25.00th	110	113	115	119	119	122	125	131	129
30.00th	112	116	119	122	125	126	127	136	134
35.00th	114	119	122	124	126	131	128	139	137
40.00th	116	121	125	127	128	134	132	142	140
45.00th	118	123	128	129	132	137	133	145	143
50.00th	122	125	130	133	135	141	137	148	150
55.00th	123	127	134	136	136	143	141	152	155
60.00th	125	130	137	139	140	148	145	154	161
65.00th	127	131	140	140	145	151	148	157	163
70.00th	131	133	142	143	150	155	149	164	166
75.00th	132	135	145	150	154	158	152	166	170
80.00th	134	138	148	153	158	165	157	170	176
85.00th	137	143	153	158	163	169	163	177	184
90.00th	140	149	159	162	172	183	172	189	197
95.00th	147	155	167	180	176	191	180	192	203
97.50th	156	163	176	192	183	204	189	218	215
mean	121.43	125.48	131.43	134.79	137.31	142.51	138.73	150.17	151.48
sd*	15.69	17.88	20.9	23.04	23.02	27.25	23.09	26.57	29.92
skew**	0.71	0.73	0.47	0.83	0.39	0.53	0.36	0.53	0.29

* sd means standard deviation, ** skew means skewness

Table XI : Empirical percentiles of diastolic blood pressure for Malay males,by age

Age group	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	>=70
n	821	799	705	592	420	399	282	212	273
Percentiles									
2.50th	57	58	61	60	62	58	60	56	53
5.00th	60	61	64	64	64	63	62	59	57
10.00th	64	65	67	67	68	67	65	64	61
15.00th	66	67	69	68	70	70	69	66	64
20.00th	68	69	71	70	72	71	70	67	66
25.00th	70	71	72	72	74	74	73	69	67
30.00th	72	72	74	74	76	74	74	70	68
35.00th	73	74	75	75	77	76	75	72	70
40.00th	74	75	76	76	78	77	76	73	73
45.00th	75	76	77	78	80	78	79	75	74
50.00th	77	78	79	79	81	79	80	76	76
55.00th	78	79	80	81	83	81	82	78	78
60.00th	79	80	81	82	84	82	82	79	80
65.00th	81	82	82	84	86	83	84	81	81
70.00th	82	83	83	86	87	85	85	82	85
75.00th	83	85	85	88	90	87	88	84	86
80.00th	85	87	87	90	92	89	90	86	87
85.00th	87	90	90	94	94	92	91	91	90
90.00th	90	93	94	97	102	95	94	94	95
95.00th	94	98	104	104	112	100	102	98	104
97.50th	98	103	108	109	118	108	106	104	111
mean	76.72	78.05	79.52	80.65	82.83	80.3	80.18	77.19	77.11
sd*	10.46	11.07	11.57	12.8	13.28	11.56	12.9	12.07	14.69
skew**	0.28	0.44	0.95	0.86	0.85	0.72	1.37	0.62	0.87

* sd means standard deviation, ** skew means skewness

Table XII : Empirical percentiles of diastolic blood pressure for Malay females,by age

Age group	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	>=70
n	1002	971	854	599	453	400	325	221	329
Percentiles									
2.50th	56	57	60	56	59	59	58	57	56
5.00th	59	60	62	60	62	63	61	61	58
10.00th	62	64	65	64	66	66	64	65	63
15.00th	64	66	68	67	69	69	68	68	66
20.00th	66	69	70	69	70	71	70	70	69
25.00th	68	70	71	70	72	73	72	73	71
30.00th	70	71	73	72	74	75	74	75	72
35.00th	71	72	74	74	76	77	75	76	74
40.00th	72	73	76	76	77	78	77	78	76
45.00th	73	75	78	77	79	79	78	80	77
50.00th	75	77	80	80	80	81	80	81	79
55.00th	76	79	81	81	82	82	81	82	81
60.00th	78	80	82	83	83	84	84	84	83
65.00th	79	81	83	84	84	86	86	85	84
70.00th	81	83	85	86	86	88	88	87	86
75.00th	82	85	87	89	89	90	90	90	89
80.00th	84	87	90	91	91	93	91	93	92
85.00th	86	89	93	93	94	95	95	96	96
90.00th	89	93	97	97	98	100	98	101	100
95.00th	95	98	105	106	105	108	105	107	109
97.50th	100	103	109	112	115	114	111	111	121
mean	75.27	77.54	80.05	80.25	81.1	82.09	80.95	81.88	80.71
sd*	11.54	11.81	12.72	14.76	13.54	13.7	13.45	14.84	15.7
skew**	0.66	0.48	0.67	1.21	0.76	0.7	0.46	0.61	0.95

* sd means standard deviation, ** skew means skewness

Table XIII : Empirical percentiles of diastolic blood pressure for Chinese males,by age

Age group	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	>=70
n	433	420	422	406	304	243	195	150	173
Percentiles									
2.50th	60	61	62	62	63	61	58	61	56
5.00th	61	65	65	66	66	64	64	63	59
10.00th	64	67	68	69	70	69	67	66	62
15.00th	68	69	70	71	72	71	70	68	65
20.00th	70	71	71	73	75	72	73	72	69
25.00th	71	73	73	76	76	74	73	74	72
30.00th	73	74	75	77	77	76	75	76	73
35.00th	74	76	76	79	79	79	77	77	74
40.00th	75	77	78	80	80	81	79	79	76
45.00th	77	79	79	82	81	82	82	81	78
50.00th	78	80	80	83	82	83	83	82	79
55.00th	79	81	81	84	83	84	84	84	80
60.00th	80	82	82	86	85	85	85	86	81
65.00th	81	83	84	88	87	87	86	87	85
70.00th	82	84	86	89	89	89	89	89	86
75.00th	84	87	88	91	91	90	92	92	89
80.00th	85	88	90	93	93	93	94	93	90
85.00th	88	90	92	96	96	97	97	97	93
90.00th	91	93	95	99	101	103	100	99	98
95.00th	95	98	104	105	108	107	106	102	105
97.50th	100	103	111	111	112	115	113	109	109
mean	77.61	79.85	80.97	83.63	83.76	83.54	82.94	82.45	79.46
sd*	9.93	10.6	12.4	12.19	12.27	13.1	12.88	12.65	13.65
skew**	0.27	0.55	1.11	0.56	0.82	0.55	0.3	0.15	0.25

* sd means standard deviation, ** skew means skewness

**Table XIV : Empirical percentiles of diastolic blood pressure for Chinese females,
by age**

Age group	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	>=70
n	556	543	532	421	316	264	217	161	222
Percentiles									
2.50th	52	57	56	58	57	57	56	61	55
5.00th	56	59	58	61	61	61	60	63	58
10.00th	59	61	62	64	65	64	63	66	61
15.00th	62	64	65	66	68	67	67	68	64
20.00th	63	65	67	69	70	70	70	72	67
25.00th	65	67	69	70	72	72	71	73	70
30.00th	66	68	71	71	74	73	74	75	72
35.00th	67	70	73	72	75	75	76	77	75
40.00th	68	71	74	74	78	76	78	78	77
45.00th	70	73	76	75	79	77	80	79	78
50.00th	71	74	77	77	81	78	81	81	80
55.00th	72	75	78	78	82	81	82	82	81
60.00th	73	77	80	80	83	83	83	83	83
65.00th	75	78	81	82	85	85	85	86	84
70.00th	76	80	83	83	87	87	88	89	87
75.00th	78	81	84	85	89	88	91	90	90
80.00th	80	83	86	87	92	91	92	92	94
85.00th	82	84	88	89	95	95	94	95	97
90.00th	84	87	91	92	99	98	97	102	101
95.00th	89	96	96	98	108	103	104	105	106
97.50th	96	100	101	106	116	108	112	114	112
mean	71.31	74.33	76.69	77.61	81.51	80.29	81.17	82.07	80.51
sd*	10.44	10.79	11.59	11.73	14.21	13.07	14.78	13.06	15.34
skew**	0.57	0.57	0.25	0.63	0.75	0.4	1.02	0.57	0.42

* sd means standard deviation, ** skew means skewness

Table XV : Empirical percentiles of diastolic blood pressure for Indian males,by age

Age group	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	>=70
n	130	155	120	82	49	39	36	31	37
Percentiles									
2.50th	61	65	65	60	66	66	59	64	56
5.00th	62	66	66	67	69	68	64	64	56
10.00th	64	69	72	68	70	70	69	71	58
15.00th	66	71	72	70	72	74	69	72	58
20.00th	67	72	74	73	74	75	72	73	62
25.00th	70	74	75	74	76	79	72	74	65
30.00th	71	75	76	76	80	81	73	75	68
35.00th	72	78	78	78	80	82	76	76	71
40.00th	73	79	80	79	81	83	80	76	73
45.00th	75	80	81	81	81	85	82	79	74
50.00th	76	81	82	82	81	86	83	80	76
55.00th	78	83	82	84	82	88	84	82	79
60.00th	80	84	85	85	83	93	84	83	82
65.00th	80	85	88	88	85	95	86	87	83
70.00th	82	86	90	89	86	96	90	89	84
75.00th	83	88	91	91	87	96	90	90	85
80.00th	85	89	93	93	91	102	92	91	86
85.00th	91	91	94	95	95	102	97	95	88
90.00th	94	93	98	98	96	105	99	104	90
95.00th	100	102	103	106	109	113	108	113	91
97.50th	105	103	109	111	116	116	118	115	94
mean	77.56	81.57	83.1	82.92	83.32	87.96	82.43	83.14	75.03
sd*	11.81	10.97	10.93	12.76	11.4	13.2	13.22	12.93	12.23
skew**	0.87	1.4	0.34	0.67	0.97	0.28	0.62	0.89	-0.17

* sd means standard deviation, ** skew means skewness

Table XVI : Empirical percentiles of diastolic blood pressure for Indian females,by age

Age group	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	>=70
n	165	172	124	101	46	57	56	29	38
Percentiles									
2.50th	56	53	58	56	66	59	55	58	52
5.00th	58	57	61	59	67	63	61	67	60
10.00th	61	60	64	62	68	68	64	71	67
15.00th	63	62	66	66	69	69	65	74	68
20.00th	65	64	68	69	71	71	67	74	69
25.00th	66	66	70	71	72	74	71	75	72
30.00th	68	68	71	72	72	75	73	75	73
35.00th	69	70	72	73	74	75	75	78	74
40.00th	70	71	74	74	76	76	77	78	76
45.00th	71	71	76	77	77	78	80	81	77
50.00th	72	73	77	78	80	80	81	84	79
55.00th	73	74	79	81	81	81	81	85	80
60.00th	74	76	80	82	83	81	83	91	81
65.00th	76	77	81	84	87	82	84	92	82
70.00th	78	78	83	85	88	83	86	93	85
75.00th	80	80	85	87	88	84	86	96	87
80.00th	81	82	86	90	92	89	89	98	89
85.00th	82	83	89	93	100	93	90	98	92
90.00th	86	88	93	98	101	102	91	105	97
95.00th	90	92	100	105	116	108	101	119	103
97.50th	94	94	104	108	122	109	106	120	130
mean	72.81	73.05	77.61	79.25	82.58	80.78	79.14	86	80.1
sd*	9.61	10.63	11.53	13.39	14.91	12.51	13.29	14.84	14.95
skew**	0.41	0.25	0.6	0.35	1.39	0.76	0.51	0.59	1.14

* sd means standard deviation, ** skew means skewness

Table XVII : Empirical percentiles of diastolic blood pressure for Other indigenous males,by age

Age group	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	>=70
n	322	278	233	145	155	91	101	55	102
Percentiles									
2.50th	59	60	61	59	59	57	54	53	53
5.00th	61	62	64	65	62	63	56	59	57
10.00th	64	65	66	67	64	63	63	65	61
15.00th	67	66	69	70	67	66	67	67	63
20.00th	69	68	71	72	69	69	68	68	66
25.00th	71	71	72	74	72	71	71	71	67
30.00th	72	72	73	76	74	72	73	72	70
35.00th	73	74	75	77	75	73	75	73	72
40.00th	75	76	76	77	78	75	77	78	73
45.00th	76	77	78	80	79	77	78	81	76
50.00th	78	78	79	82	80	78	81	82	79
55.00th	80	79	81	84	82	81	82	83	80
60.00th	81	80	82	85	84	82	84	85	82
65.00th	82	82	83	87	86	84	86	87	84
70.00th	84	83	84	88	87	86	88	87	85
75.00th	85	85	86	89	88	87	91	90	86
80.00th	86	86	88	91	91	88	95	93	89
85.00th	88	88	91	94	93	92	97	95	100
90.00th	90	91	97	97	98	94	100	98	105
95.00th	95	100	102	103	105	101	110	103	118
97.50th	97	107	109	105	114	105	122	107	120
mean	77.55	78.29	80.09	81.88	80.75	79.13	81.14	80.65	79.5
sd*	10.15	11.93	11.93	11.85	13.26	12.05	15.72	13.54	17.22
skew**	0.12	1	0.63	0.29	0.4	0.22	0.42	0.03	0.79

* sd means standard deviation, ** skew means skewness

Table XVIII : Empirical percentiles of diastolic blood pressure for Other indigenous females,by age

Age group	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	>=70
n	433	343	210	199	123	112	105	72	115
Percentiles									
2.50th	57	57	58	58	54	60	56	59	52
5.00th	59	60	61	62	61	61	57	61	56
10.00th	62	64	64	65	65	64	62	64	64
15.00th	64	66	66	67	68	66	64	67	65
20.00th	66	68	69	70	70	68	66	69	67
25.00th	68	70	70	72	71	71	69	71	69
30.00th	70	71	72	73	73	72	71	71	71
35.00th	71	73	74	75	75	74	72	72	73
40.00th	72	74	75	76	77	76	76	73	74
45.00th	74	76	77	78	79	78	77	75	76
50.00th	75	78	80	79	81	80	78	76	77
55.00th	77	78	81	80	82	81	79	79	78
60.00th	78	80	83	82	83	82	80	81	79
65.00th	79	81	84	84	85	84	81	82	83
70.00th	81	83	85	86	87	87	83	85	86
75.00th	82	85	87	87	90	91	85	87	89
80.00th	85	86	88	89	92	94	88	91	91
85.00th	87	89	91	91	94	100	90	94	95
90.00th	90	91	96	96	97	103	95	103	97
95.00th	96	97	102	102	101	109	105	107	99
97.50th	102	101	104	108	105	113	110	112	101
mean	75.79	77.48	79.15	79.92	80.57	81.05	77.94	79.48	78.37
sd*	11.67	12.16	12.48	12.73	13.37	14.57	13.33	14.21	13.7
skew**	0.8	1.02	0.31	0.71	0.31	0.59	0.56	0.67	0.46

* sd means standard deviation, ** skew means skewness

Table XIX : Crude and age-adjusted mean systolic and diastolic BP

		Diastolic BP, mmHg		Systolic BP, mmHg	
		mean (SE)	Age- (SE) adjusted mean	mean (SE)	Age- (SE) adjusted mean
All		79 (0.1)	79 (0.1)	129 (0.2)	129 (0.2)
	men	80 (0.1)	80 (0.1)	129 (0.2)	130 (0.2)
	women	78 (0.2)	78 (0.1)	129 (0.3)	129 (0.2)
Malay		79 (0.2)	79 (0.1)	130 (0.3)	130 (0.2)
	men	79 (0.2)	79 (0.2)	129 (0.3)	129 (0.3)
	women	79 (0.2)	79 (0.2)	131 (0.4)	131 (0.3)
Chinese		79 (0.2)	79 (0.2)	128 (0.4)	127 (0.3)
	men	81 (0.3)	81 (0.3)	130 (0.4)	129 (0.4)
	women	77 (0.3)	77 (0.2)	126 (0.5)	125 (0.4)
Indian		79 (0.4)	79 (0.4)	126 (0.6)	127 (0.5)
	men	82 (0.5)	82 (0.5)	129 (0.8)	129 (0.8)
	women	77 (0.5)	77 (0.5)	123 (0.8)	124 (0.7)
Other indigenous		79 (0.3)	79 (0.2)	132 (0.5)	132 (0.4)
	men	79 (0.3)	80 (0.3)	131 (0.5)	131 (0.5)
	Women	78 (0.4)	78 (0.3)	132 (0.6)	132 (0.6)

Table XX : Age specific mean systolic and diastolic BP

		Age group	Mean (SE) diastolic BP, mmHg	Mean (SE) systolic BP, mmHg
Malay	men	30-39	77 (0.3)	123 (0.4)
		40-49	80 (0.4)	127 (0.5)
		50-59	82 (0.5)	137 (0.9)
		60-69	79 (0.6)	138 (1.0)
		>=70	77 (1.0)	142 (1.6)
Malay	women	30-39	76 (0.3)	120 (0.4)
		40-49	80 (0.4)	130 (0.6)
		50-59	82 (0.5)	141 (0.9)
		60-69	81 (0.7)	146 (1.2)
		>=70	81 (1.0)	155 (1.6)
Chinese	men	30-39	79 (0.4)	123 (0.5)
		40-49	82 (0.5)	128 (0.7)
		50-59	84 (0.6)	134 (1.0)
		60-69	83 (0.8)	140 (1.3)
		>=70	80 (1.2)	145 (2.0)
Chinese	women	30-39	73 (0.4)	114 (0.5)
		40-49	77 (0.4)	124 (0.7)
		50-59	81 (0.6)	135 (1.0)
		60-69	82 (0.8)	142 (1.2)
		>=70	81 (1.2)	148 (1.8)
Indian	men	30-39	80 (0.7)	123 (1.0)

		40-49	83 (0.9)	128 (1.4)
		50-59	85 (1.6)	137 (2.7)
		60-69	83 (1.7)	141 (2.6)
		>=70	75 (2.1)	139 (4.7)
Indian	women	30-39	73 (0.6)	113 (0.8)
		40-49	78 (0.9)	125 (1.3)
		50-59	82 (1.5)	132 (2.1)
		60-69	82 (1.6)	140 (2.7)
		>=70	80 (2.7)	146 (3.2)
Other indigenous	men	30-39	78 (0.4)	125 (0.6)
		40-49	81 (0.7)	130 (0.9)
		50-59	80 (0.8)	137 (1.7)
		60-69	81 (1.2)	142 (2.1)
		>=70	80 (2.0)	149 (2.7)
Other indigenous	women	30-39	77 (0.5)	123 (0.7)
		40-49	80 (0.7)	133 (1.1)
		50-59	81 (1.0)	140 (1.8)
		60-69	79 (1.0)	144 (2.0)
		>=70	78 (1.2)	152 (2.8)

Table XXI : Crude percentage distribution of BP according to JNC* classification

		% (SE) Optimal	Normotensive % (SE) Normal	% High (SE) normal	%Stage (SE) 1	Hypertensive % Stage (SE) 2	% Stage (SE) 3-4
SBP		<120	120-29	130-39	140-59	160-79	>=180
DBP		<80	80-84	85-89	90-99	100-109	>=110
All		32 (0.5)	20 (0.3)	17 (0.3)	20 (0.3)	8 (0.2)	4 (0.2)
	men	29 (0.5)	23 (0.5)	19 (0.5)	20 (0.5)	7 (0.3)	3 (0.2)
	women	35 (0.6)	18 (0.4)	15 (0.4)	20 (0.4)	8 (0.3)	4 (0.2)
Malay		31 (0.6)	21 (0.5)	17 (0.4)	20 (0.5)	8 (0.3)	4 (0.2)
	men	30 (0.8)	23 (0.7)	18 (0.7)	19 (0.6)	7 (0.4)	3 (0.3)
	women	31 (0.8)	18 (0.6)	15 (0.6)	21 (0.6)	9 (0.4)	5 (0.3)
Chinese		34 (0.8)	19 (0.6)	16 (0.5)	20 (0.6)	7 (0.4)	3 (0.3)
	men	28 (1.0)	21 (0.9)	18 (0.8)	22 (1.0)	7 (0.5)	4 (0.4)
	women	40 (1.1)	18 (0.7)	14 (0.7)	18 (0.7)	7 (0.5)	3 (0.4)
Indian		37 (1.4)	20 (1.0)	15 (1.0)	18 (1.1)	7 (0.8)	3 (0.5)
	men	29 (1.8)	22 (1.6)	17 (1.5)	20 (1.6)	8 (1.1)	4 (0.8)
	women	45 (1.9)	18 (1.3)	13 (1.3)	16 (1.4)	6 (1.0)	3 (0.6)
Other indigenous		28 (0.9)	20 (0.8)	21 (0.8)	19 (0.8)	8 (0.5)	4 (0.4)
	men	26 (1.2)	22 (1.2)	23 (1.2)	19 (1.1)	7 (0.7)	4 (0.5)
	Women	30 (1.2)	18 (1.0)	19 (1.1)	20 (1.0)	9 (0.8)	5 (0.5)

* Joint National Committee on Detection, Evaluation and Treatment of High Blood Pressure⁵.

Table XXII : Age adjusted* percentage distribution of BP according to JNC classification**

		Normotensive			Hypertensive		
		% (SE) Optimal	% (SE) Normal	% High (SE) normal	%Stage (SE) 1	% Stage (SE) 2	% Stage (SE) 3-4
SBP		<120	120-29	130-39	140-59	160-79	>=180
DBP		<80	80-84	85-89	90-99	100-109	>=110
All		32 (0.4)	20 (0.3)	17 (0.3)	20 (0.3)	8 (0.2)	4 (0.1)
	men	28 (0.5)	22 (0.5)	19 (0.5)	20 (0.5)	7 (0.3)	3 (0.2)
	women	36 (0.5)	18 (0.4)	15 (0.4)	19 (0.4)	8 (0.3)	4 (0.2)
Malay		31 (0.5)	21 (0.5)	17 (0.4)	20 (0.4)	8 (0.3)	4 (0.2)
	men	30 (0.7)	23 (0.7)	18 (0.7)	19 (0.6)	7 (0.4)	3 (0.3)
	women	31 (0.7)	18 (0.6)	15 (0.6)	21 (0.6)	9 (0.4)	5 (0.3)
Chinese		36 (0.7)	19 (0.6)	16 (0.5)	19 (0.6)	7 (0.3)	3 (0.2)
	men	29 (1.0)	21 (0.9)	18 (0.8)	22 (0.9)	7 (0.5)	3 (0.4)
	women	42 (0.9)	18 (0.8)	14 (0.7)	17 (0.7)	6 (0.4)	3 (0.3)
Indian		36 (1.3)	20 (1.1)	15 (1.0)	18 (1.1)	7 (0.8)	3 (0.5)
	men	29 (1.8)	22 (1.7)	17 (1.4)	20 (1.6)	8 (1.2)	4 (0.8)
	women	44 (1.7)	18 (1.4)	13 (1.4)	16 (1.4)	6 (0.9)	3 (0.6)
Other indigenous		27 (0.9)	20 (0.7)	21 (0.8)	20 (0.8)	8 (0.5)	4 (0.4)
	men	25 (1.1)	21 (1.1)	23 (1.2)	19 (1.1)	7 (0.7)	4 (0.5)
	Women	29 (1.2)	18 (0.9)	19 (1.1)	20 (1.0)	9 (0.7)	5 (0.5)

* age adjusted to 1996 Malaysian population

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Table XXIII : Age specific percentage distribution of BP according to JNC* classification

		Age group	Normotensive			%Stage (SE) 1	Hypertensive	
			% (SE) Optimal	% (SE) Normal	% High (SE) normal		% Stage (SE) 2	% Stage (SE) 3-4
SBP			<120	120-29	130-39	140-59	160-79	>=180
DBP			<80	80-84	85-89	90-99	100-109	>=110
Malay	men	30-39	39 (1.3)	26 (1.2)	17 (1.1)	14 (0.9)	2 (0.4)	1 (0.3)
		40-49	30 (1.4)	25 (1.3)	19 (1.2)	17 (1.2)	7 (0.8)	2 (0.4)
		50-59	19 (1.6)	18 (1.5)	21 (1.5)	24 (1.6)	11 (1.1)	6 (1.1)
		60-69	17 (1.9)	17 (1.8)	18 (1.9)	31 (2.3)	14 (1.7)	4 (0.9)
		>=70	16 (2.4)	16 (2.3)	15 (2.3)	29 (3.0)	15 (2.3)	9 (2.0)
Malay	women	30-39	47 (1.3)	21 (1.0)	13 (0.9)	14 (0.8)	3 (0.4)	1 (0.3)
		40-49	29 (1.3)	21 (1.2)	17 (1.1)	21 (1.2)	9 (0.8)	4 (0.6)
		50-59	17 (1.5)	15 (1.4)	17 (1.4)	30 (1.7)	14 (1.3)	7 (0.9)
		60-69	10 (1.4)	12 (1.5)	17 (1.8)	31 (2.2)	17 (1.8)	12 (1.5)
		>=70	7 (1.6)	8 (1.6)	13 (2.0)	30 (3.0)	25 (2.6)	17 (2.3)
Chinese	men	30-39	38 (1.9)	25 (1.7)	18 (1.5)	16 (1.4)	2 (0.5)	1 (0.3)
		40-49	30 (1.8)	20 (1.5)	20 (1.5)	21 (1.5)	6 (1.0)	3 (0.7)
		50-59	21 (1.9)	21 (2.1)	17 (1.7)	25 (2.0)	11 (1.5)	6 (1.1)
		60-69	14 (2.0)	15 (2.2)	19 (2.3)	34 (2.8)	12 (1.9)	7 (1.5)
		>=70	16 (3.2)	8 (2.2)	17 (3.2)	33 (4.3)	17 (3.2)	10 (2.4)
Chinese	women	30-39	63 (1.7)	20 (1.3)	8 (0.9)	7 (0.8)	2 (0.4)	1 (0.3)
		40-49	40 (1.8)	20 (1.5)	19 (1.4)	16 (1.3)	4 (0.6)	2 (0.5)
		50-59	22 (1.9)	16 (1.8)	18 (1.8)	28 (2.1)	12 (1.5)	4 (0.9)
		60-69	14 (2.0)	12 (1.8)	19 (2.1)	32 (2.6)	16 (2.0)	7 (1.5)
		>=70	15 (2.6)	8 (1.9)	12 (2.6)	31 (3.4)	21 (2.9)	12 (2.4)

Indian	men	30-39	41 (3.3)	22 (2.4)	17 (2.0)	14 (2.2)	5 (1.4)	1 (0.6)
		40-49	27 (3.3)	22 (3.2)	19 (2.7)	24 (3.0)	6 (1.8)	3 (1.2)
		50-59	14 (3.7)	22 (4.7)	18 (4.3)	23 (4.7)	14 (3.7)	8 (3.3)
		60-69	13 (3.9)	21 (5.2)	14 (4.6)	31 (6.2)	13 (4.5)	9 (3.8)
		>=70	19 (6.8)	19 (7.3)	19 (6.3)	20 (7.1)	19 (8.2)	4 (2.9)
Indian	women	30-39	64 (2.7)	18 (1.9)	8 (1.5)	9 (1.7)	1 (0.4)	0 (0.2)
		40-49	41 (3.5)	18 (2.7)	17 (2.8)	15 (2.4)	7 (2.0)	2 (0.9)
		50-59	25 (4.6)	21 (4.2)	17 (4.6)	18 (4.0)	13 (3.4)	5 (2.1)
		60-69	19 (4.4)	10 (3.6)	16 (4.1)	32 (5.7)	13 (3.6)	9 (3.3)
		>=70	8 (4.7)	15 (6.0)	14 (6.1)	37 (7.9)	17 (5.9)	9 (5.3)
Other indigenous	men	30-39	33 (2.0)	25 (1.9)	23 (1.8)	15 (1.6)	3 (0.7)	1 (0.4)
		40-49	24 (2.1)	22 (2.2)	24 (2.4)	20 (2.3)	7 (1.4)	2 (0.9)
		50-59	20 (2.6)	18 (2.6)	23 (2.9)	25 (2.9)	9 (1.9)	6 (1.5)
		60-69	18 (3.0)	15 (2.8)	21 (3.4)	20 (3.0)	16 (2.9)	10 (2.6)
		>=70	9 (3.1)	11 (3.3)	21 (4.2)	26 (4.4)	19 (4.1)	15 (3.7)
Other indigenous.	women	30-39	40 (2.0)	21 (1.5)	22 (1.8)	13 (1.2)	3 (0.7)	2 (0.6)
		40-49	27 (2.3)	17 (1.9)	18 (1.9)	25 (2.3)	10 (1.6)	4 (1.0)
		50-59	22 (3.0)	14 (2.4)	17 (2.6)	23 (2.9)	16 (2.5)	8 (1.8)
		60-69	15 (2.6)	15 (2.8)	16 (2.9)	31 (3.7)	16 (2.9)	8 (2.0)
		>=70	15 (3.4)	9 (2.7)	15 (3.3)	20 (4.5)	24 (4.2)	17 (3.5)

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