

## PREVALENCE OF HYPERTENSION AND ITS TREATMENT IN AN AUSTRALIAN COMMUNITY: IMPLICATIONS FOR SCREENING

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### INTRODUCTION

Mass public screening programmes for hypertension have been considered by a number of authors in recent years<sup>1,2</sup>. Before recommendations can be made as to what sections of the population should be screened and how they should be screened, the disease frequency, fatality and success of treatment and prevention need to be known.

Because in the majority of cases found to have hypertension no cause can be found<sup>3</sup>, there are few primary preventive measures that can be advocated at the present time. Elevated blood pressure in asymptomatic patients without apparent organ damage has been shown to carry an excess morbidity and mortality at levels that are not considered for treatment<sup>4</sup>. Trials of treatment have so far shown that prognosis is markedly improved by careful hospital clinic treatment in cooperative middle-aged men who are asymptomatic and have resting diastolic blood pressures of 90 to 114 mms. Hg with more notable success in patients with higher than lower average diastolic pressure<sup>5</sup>.

### Albury Blood Pressure Survey

#### (a) MEASUREMENTS

In order to examine the frequency of the disease and its mode of treatment in an Australian population, a whole town (Albury) sample of men and women aged 50-59 years was examined. Details of this study are reported elsewhere<sup>6</sup>. Of 2001 subjects from a defined base population of 2198 who returned questionnaires relating to past and present diagnosis and treatment of hypertension, 1744 were in the acceptable age group and place of residence at the time of the survey (September, 1971). Of these, 1515 (87 per cent.) were examined.

Blood pressure measurements were made by a team of trained observers during a period of one week. Measurements were made using 4 London School of Hygiene (LSH) Mark IV Sphygmomanometers and 4 standard models. Cuffs were at least 12 x 22 cms. and were applied to the left arm resting on a table. Subjects had been instructed not to eat or smoke for at least half an hour before their examination appointments. On arrival, by appointment, subjects had their names checked and then sat down. After waiting for 2-3 minutes they were directed to a chair beside a sphygmomanometer table where they sat down and had their questionnaires checked. This took 1-2 minutes. Their blood pressure was recorded twice (to the nearest mm. on the LSH instruments and to the nearest 2 mms. on the standard sphygmomanometers). Systolic pressure was recorded at the first perception of sounds, diastolic fourth phase level at muffling of sounds, and fifth phase level at disappearance of sounds.

A random sample of 142 subjects (67 men, 75 women) who attended on the first day of examinations were given second appointments and had their blood pressures measured under identically arranged conditions 4 days later.

#### (b) COMPARISON OF ELEVATED BLOOD PRESSURE IN OTHER STUDIES

Analysis of blood pressure measurements and questionnaire responses showed that elevated blood pressure was very common in this decade of people. Tables I and II compare the results of the Albury Study with other population studies. All these studies (except for Tibblin et al., 1967) reported casual diastolic blood pressures defined as disappearance of sounds. The rates shown in the table were calculated from tables published by the respective authors. The differences in prevalence rates of elevated blood pressure will depend not only on the level of blood pressure chosen but also on the method of measurement, the number of observers, the number of observations and the circumstances under which the measurements are made<sup>11</sup>. Because all of these factors are not matched in each of the studies considered here, it is not possible to make definitive comparisons one country with another. However, these tables show that whatever arbitrary cut-off point is chosen for elevated blood pressure, it is a very common condition in populations in developed countries in this decade of people. These studies were chosen for comparison because they were population studies that included examination of people in the 50 to 59 year age group and did not exclude subjects with disease related to elevated blood pressure.

#### (c) TREATMENT

Table III shows that in a U.S. population aged 18-79 years and in the 50-59 year olds in Albury, the majority of people with elevated blood pressure were not receiving treatment for this condition and that the level of control (if defined as maintaining a casual blood pressure below 160 or + systolic and or 95 or + diastolic) was inadequate in the majority of people under treatment. This finding agrees with the discrepancy between falling stroke mortality and prescriptions of hypotensive drugs in Australia estimated by Lovell and Prineas<sup>13</sup>.

#### (d) LEVEL OF BLOOD PRESSURE CHOSEN FOR TREATMENT

The choice of cut-off point for treatment of hypertension is an individual one. Of the 21 doctors whose patients were examined in Albury, 17 said they would diagnose hypertension at a diastolic blood pressure (disappearance of sounds) in the range 90-110 mms. Hg (average 95) without comment on age or sex. This accords with the most recent trial of treatment in asymptomatic hypertensive men<sup>5</sup>. However, in this latter trial repeated estimates of blood pressure were made before patients were accepted into the trial. Because such a large number of people (42% of men and 40% of women aged 50 to 59 years) had casual diastolic blood pressures of 95mm. Hg or more in the Albury study<sup>6</sup>, it means that if all such people in a community are offered treatment after being found by a screening programme that the current medical services would be severely strained.

However, the exact relationship of repeated resting blood pressure measurements to carefully measured casual blood pressures is not known. In the present study duplicate blood pressure measurements on the day of examination were taken immediately after the first reading. The distribution of the differences between duplicate systolic pressures, shown in Fig. 1 is not centred about zero and the difference was statistically highly significant. A second systolic reading was usually less than the first and a second measurement of the diastolic disappearance of sounds was also

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TABLE I  
PROPORTION OF MEN WITH ELEVATED BLOOD PRESSURE

Characteristics of men examined	Albury Study 1972 (6) N=713	Norway Boe et al. 1957 (7) N=4898	Sweden Tibblin et al.* 1967 (8) N=855	Poland Aleksandrow 1967 (9) N=216	U.S.A. National Health Survey 1960-62 (10) N=?
Age	50 - 59	50 - 59	50 year olds	50 - 59	45 - 54 55 - 64
% with dias. 90 or +	59.6%	50.6%	62.1%		
% with sys. 160 or + and/or dias. 95 or +	47.1%	38.7%**	62.6%	10.0%	18.3% 22.3%
% with dias. 95 or +	42.4%	24.1%	41.3%		
% with sys. 160 or +	27.4%	29.2%	14.5%		
% with dias. 110 or +	13.1%	7.7%	12.5%		

\*used muffing of sounds for diastolic B.P. level; all other studies used disappearance of sounds.

\*\*estimated from group of 3156 men examined in 1950.

TABLE II  
PROPORTION OF WOMEN WITH ELEVATED BLOOD PRESSURE

Characteristics of women examined	Albury Study 1972 (6) N=802	Norway Boe et al. 1957 (7) N=6899	Poland Aleksandrow 1967 (9) N=183	U.S.A. National Health Survey 1960-62 (10) N=?
Age	50 - 59	50 - 59	50 - 59	45 - 54 55 - 64
% with dias. 90 or +	55.5%	58.1%		
% with sys. 160 or + and/or 95 or +	46.8%	50.5%*	19.3%	18.2% 31.2%
% with dias. 95 or +	40.4%	27.6%		
% with sys. 160 or +	28.1%	41.5%		
% with dias. 110 or +	12.4%	9.7%		

\*estimated from a group of 4572 women examined in 1950.

TABLE III  
PROPORTION OF UNDETECTED  
AND UNTREATED MEN AND WOMEN WITH  
ELEVATED\* BLOOD PRESSURE

Characteristics of people examined	National Health Survey—U.S.A. 1960-1962 N = 6672	Albury Blood Pressure Study 1971 N = 1515
Age	18 - 79 years	50 - 59 years
% with elev. B.P. 160 or + sys. OR 95 or + dias.	15.2%	47.0%
% pop. on med. for hypertension	6.5%	12.0%
% with elev. B.P. on med. for hyp.	23.2%	19.24%
Total hyp. pop.*	1214	757
% unknown	42.8%	62.1%
% of total hyp. on med.	35.7%	24.0%
% of total hyp. "under control"	16.3%	5.9%
% of those on med. "under control."	45.6%	24.7%

\*Total hyp. pop. = those with B.P.  $\geq$  160 systolic and/or 95 mm Hg diastolic at the time of the survey plus those on medication for hypertension with survey pressures below those levels.

TABLE IV  
PERCENTAGE DISTRIBUTION DIASTOLIC  
BLOOD PRESSURE (DISAPPEARANCE OF  
SOUNDS) MEASURED ON 2 SEPARATE  
OCCASIONS 4 DAYS APART ACCORDING TO  
DIFFERENT PARAMETERS OF HIGH BLOOD  
PRESSURE IN 142 SUBJECTS

Diastolic blood pressure (mms. Hg)	1st reading	2nd reading
110 or +	15.5	5.6
95 or +	38.0	27.5

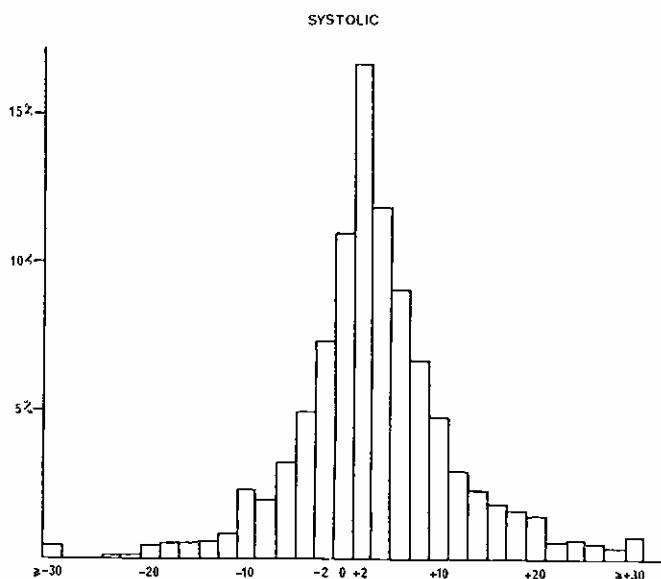


Fig. 1. Distribution of differences between duplicate readings of systolic blood pressure (first reading—second reading).

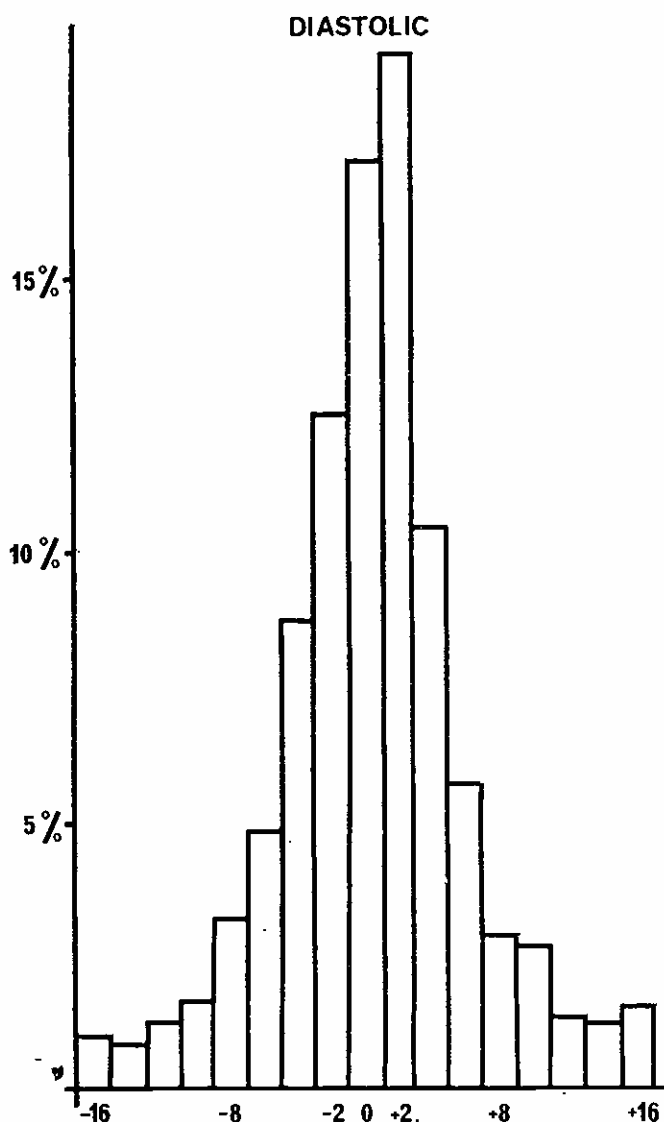


Fig. 2. Distribution of differences between duplicate readings of diastolic blood pressure (first reading—second reading).

usually less but by a smaller amount. There was a mean fall in systolic pressure of 3.19 mms. (S.E. 0.23) from the first to the second reading; and in diastolic (disappearance) blood pressure there was an average fall of 0.56 mms. (S.E. 0.16). These results are remarkably similar to those of Armitage and Rose who carried out 20 duplicate readings on 10 subjects under laboratory conditions.<sup>14</sup>

Further, the change in pressure between occasions was studied by repeating duplicate measurements on 142 subjects randomly chosen from people who attended for examination on the first day of the study at a similar time of day 4 days later. They were all measured by the same 4 observers using LSH sphygmomanometers on each occasion. The change between occasions was much greater for diastolic blood pressure than between duplicate readings. The changes are shown in Figs. 3 and 4 where it can be seen that the higher the blood pressure on the first occasion the more likely it was to be lower on the second occasion. This is an illustration of the regression towards the mean phenomenon. On average, however, the systolic blood pressure rose by 1.95 mms. Hg (S.E. 1.69) from the first to the fifth day and the diastolic pressure fell by 6.91 mms. Hg (S.E. 1.25).

This means that the proportion of subjects diagnosed as hypertensive on the first day will be more than that on a second occasion and that the proportions become more disparate as the level of diastolic blood pressure chosen to diagnose hypertension rises. Such a situation is illustrated in table 4 where it can be seen that the proportion of subjects with levels of diastolic blood pressure above 95 mms. Hg and 110 mms. Hg are both lower on the second time of measurement and that the fall is greater for subjects at or above 110 mms. Hg than for those at or above 95 mms. Hg.

If an arbitrary level of blood pressure requiring treatment, higher levels of casual blood pressure from screening programmes will have to be selected than those obtained from repeated measurement in hospital.

What these actual levels should be will have to be calculated on the basis of treatment expectation and extra patient load on the current medical care system.

That the initial diagnosis in a doctor's office is meaningful in future years is illustrated in Figure 5. There is a gradual increase in mean blood pressure according to previous diagnosis and treatment by which subjects had been characterised by their own doctors. The average time of diagnosis prior to the survey of those known to have elevated blood pressure was 8 years in men and 7 years in women. Therefore future levels of blood pressure are on average well characterised by casual blood pressure readings.

**SUMMARY AND CONCLUSIONS**

Elevated blood pressure is very common in developed countries and its treatment and recognition are inadequate.

If mass detection campaigns are to be used to control the disease operational definitions of elevated blood pressure need to be established. In any screening programme the level chosen for diagnosis will be better characterised by repeated readings on separate occasions than initial duplicate readings. The levels chosen will also depend on the likelihood of treatment having an effect and on the ability of medical services to cope with the extra work load.

Before mass screening programmes are initiated, however, methods of helping doctors in practice outside of hospitals to treat blood pressure adequately should certainly be investigated.

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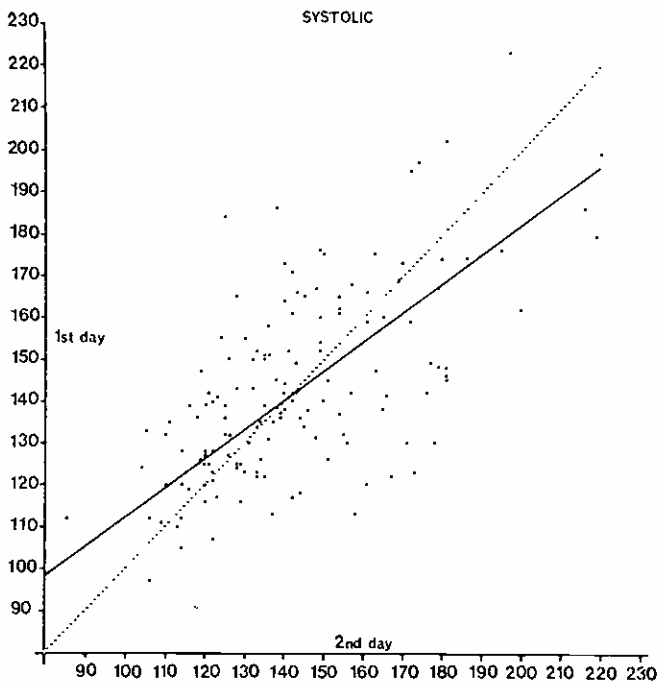


Fig. 3. Change in systolic blood pressure (second of duplicate readings) on 142 subjects on 2 separate occasions, 4 days apart: ... indicates regression line if there was no change; — indicates calculated regression line.

MEAN PRESSURES BY QUESTIONNAIRE GROUPS

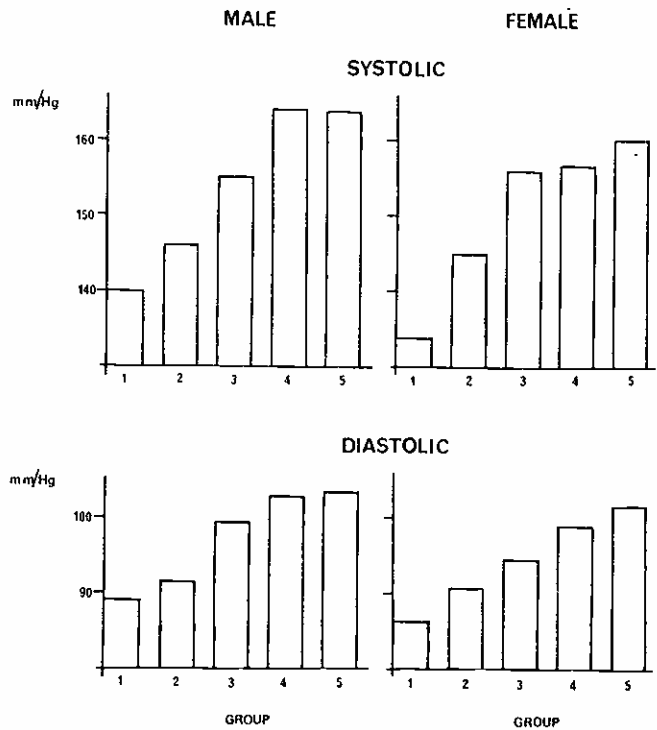


Fig. 5. Mean blood pressures of different questionnaire groups by systolic and diastolic (disappearance of sounds) and sex:  
 Group 1 = subjects once told they had low blood pressure;  
 Group 2 = subjects never told they had high or low blood pressure;  
 Group 3 = subjects once told they had high blood pressure but had never received treatment;  
 Group 4 = subjects once told they had high blood pressure and who had received treatment in the past but were not receiving treatment at the time of the survey;  
 Group 5 = subjects being treated by their own doctors for high blood pressure at the time of the survey.

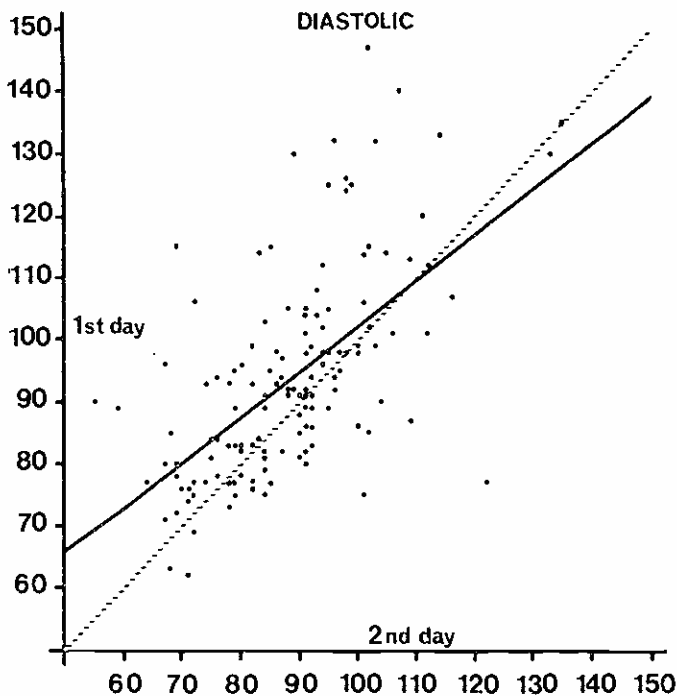


Fig. 4. Change in diastolic blood pressure (second of duplicate readings) on 142 subjects on 2 separate occasions, 4 days apart: ... indicates regression line if there was no change; — indicates calculated regression line.

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