PAPERS AND ORIGINALS

Screening for Hypertension: Some Epidemiological Observations

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Summary

Data obtained in long-term epidemiological studies of arterial blood pressure in the general population in South Wales were analysed to provide background information for the rational planning of screening programmes for hypertension.

The incidence rates for cardiovascular complications emphasize the much greater prognostic value of blood pressure measurements in men than in women. Proportionately fewer men are treated for hypertension at all ages and blood pressure levels; in the survey areas treatment for hypertension is less than satisfactory in both sexes but particularly inadequate among men.

The data suggest that once a screening programme has been carried out rescreening can be made more efficient by allowing the intervals before re-examination to be determined by the initial findings rather than by age.

Introduction

Treatment for severe hypertension is known to be both effective and tolerable, and more attention is now being paid to the increased detection of cases and the possibilities of earlier therapy. Screening programmes have to be based on knowledge of the relation between blood pressure levels and morbidity and mortality in the general population, the extent to which hypertensive subjects are currently under effective treatment, and the rate at which people, once screened and found normal, attain levels of pressure at which they should be under careful surveillance.

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In this paper we report data from a long-term epidemiological study which relate to these questions and suggest screening procedures which might reduce the burden of cardiovascular complications without overloading the general practitioners on whom the main responsibility for screening and treatment will continue to fall.

Populations and Surveys

People aged 5 years and over were randomly selected from the populations of a Welsh mining valley, the Rhondda Fach, and a neighbouring agricultural area, the Vale of Glamorgan, which had previously been defined by private censuses. They were used as index cases for family studies in which all first-degree relatives living within 25 miles of the centre of each area were included. Over 95% of index cases and relatives co-operated in the initial surveys and were taken as representative samples of the population of each area.

The first examinations in the Rhondda were carried out in 1954 and repeated in 1958, 1964, and 1971. The first survey in the Vale of Glamorgan was undertaken in 1956 and repeated in 1960, 1964, and 1971. The intersurvey intervals therefore differed in the two studies, whose total durations were, respectively, 17½ and 15½ years.

Of 1,216 subjects seen in the first Rhondda survey 762 (62·7%) were re-examined in 1971, 231 (19·0%) had died, and 188 (15·5%) had left the district. Thus in 1971 measurements were repeated for 762 (95·6%) of the 797 still living in the area. Of 1,464 seen in the first Vale of Glamorgan survey 899 (61·4%) were re-examined in 1971, 268 (18·3%) had died, and 242 (16·5%) had left the area. Thus 94·2% of those still available were followed up.

Methods

The survey techniques have been described previously (Miall and Oldham, 1955, 1958). Casual blood pressure measurements (systolic and diastolic IV—muffling) were made by one observer throughout using an orthodox mercury manometer. Apart from 10% of readings in the 1971 surveys which were

made at a central clinic after electrocardiography all were carried out in the subjects' own home surroundings. On each occasion measurements were noted without reference to the previous findings, which were only later transferred to the new record cards.

A brief medical history was obtained at each examination. Causes of hospital attendance and admission were noted, and information provided by patients was corroborated by hospitals. At each interview subjects were asked whether they had received treatment for hypertension, and this information was checked by consulting with general practitioners. In 1971, but not at previous examinations, 12-lead E.C.G.s were recorded and read according to the revised criteria of the Minnesota Code (Rose and Blackburn, 1968).

The certified cause of death was determined for all but one of the 499 deaths. People aged 35 or over accounted for 486 deaths (298 men and 188 women). Deaths were classified as due to either cardiovascular-renal, or other causes. Cardiovascular-renal deaths were subdivided into coronary deaths (where myocardial infarction, coronary thrombosis, or angina pectoris were given as immediate or underlying causes), cerebrovascular deaths (where cerebral thrombosis, haemorrhage, embolism, or cerebral atheromatosis were so mentioned), or other cardiovascular-renal deaths (where death was certified as due to congestive cardiac failure of unspecified cause, renal failure, hypertensive heart disease, rheumatic or congenital heart disease, myocardial degeneration, cardiomyopathy, aneurysm, etc.). Cor pulmonale and congestive failure secondary to respiratory disease were classified as respiratory rather than cardiovascular deaths. Cardiovascular deaths and events in people under 35 were too few for analysis.

The number of person-years of observation for each population and each sex was calculated for all aged 35 years and over. For every group defined by decade of age and 10 mm Hg interval of systolic or diastolic pressure level the number of person-years of observation was computed using, for each intersurvey period, the blood pressure readings at the start of the period. If a subject's age fell in different age groups at the two surveys the years in between were distributed accordingly to the two different groups. Cardiovascular deaths and morbid events were then related to these denominators at the relevant age and blood pressure levels.

Results

The total number of deaths and the cardiovascular morbidity and mortality in those aged 35 and over are shown in table I. From these data mortality rates have been calculated for deaths from all causes, from cardiovascular-renal causes (ICD 330-334, 400-468), from vascular lesions of the central nervous system (330-334), and from coronary heart disease and angina (420), and these are compared with the Registrar General's rates for England and Wales for 1965 in table II.

Mortality from all causes and cardiovascular mortality were higher in both sexes in these Welsh survey populations than in England and Wales as a whole. These observations accord with the mortality analyses reported for Wales by the Registrar General for the years 1959-63. For all causes the standardized mortality ratios for Welsh men and women were, respectively, 111 and 107 and for cardiovascular causes 117 and 120 (Registrar General, 1971). Though based on small numbers our data accord with other evidence that the population in South Wales suffers a higher toll from cardiovascular disease than in England and Wales in general (Hart, 1970).

RELATION BETWEEN ARTERIAL PRESSURE AND CARDIOVASCULAR MORBIDITY AND MORTALITY

The incidence of all cardiovascular-renal deaths and events is shown according to systolic pressure and age in fig. 1 and

TABLE I—*Deaths from all Causes and Cardiovascular-Renal Mortality and Morbidity in Rhondda Fach and Vale of Glamorgan (1954-1971)*

	Men					Women				
Age:	35-44	45-54	55-64	65-74	≥75	35-44	45-54	55-64	65-74	≥75
Person-years of observation:	2,959	3,315	2,348	1,327	652	3,093	3,052	2,521	1,654	857
No. of deaths from all causes	10	32	67	85	104	6	10	30	50	92
Rate/1,000 person-years	3·4	9·7	28·5	64·1	159·5	1·9	3·3	11·9	30·2	107·4
No. of cerebrovascular accidents	1	10	7	24	23	5	3	16	19	18
Fatal		5	4	15	20			8	13	16
Non-fatal	1	5	3	9	3	5	3	8	6	2
Rate/1,000 person-years	0·3	3·0	3·0	18·1	35·3	1·6	1·0	6·3	11·5	21·0
No. with myocardial infarction	5	20	37	38	19	1	5	16	20	23
Fatal	3	6	19	27	17	1	1	9	13	18
Non-fatal	2	14	18	11	2		4	7	7	5
Rate/1,000 person-years	1·7	6·0	15·8	28·6	29·1	0·3	1·6	6·3	12·1	26·8
No. with onset of angina	4	11	8	5	3	8	14	10	14	10
Rate/1,000 person-years	1·4	3·3	3·4	3·8	4·6	2·6	4·6	4·0	4·2	11·7
No. of cardiovascular-renal deaths	2	3	5	17	28		4	5	8·5	32
Ra e/2,000person-years	0·7	0·9	2·1	12·8	42·9		1·3	2·0	7	37·3
Total no. of cardiovascular-renal deaths	5	14	28	59	65	1	5	22	33	66
Rate/1,000 person-years	1·7	4·2	11·9	44·5	99·7	0·3	1·6	8·7	20·0	77·0
Total no. of cardiovascular-renal deaths and events	12	44	57	84	73	14	26	47	60	83
Rate/1,000 person-years	4·1	13·3	24·3	63·3	112·0	4·5	8·5	18·6	36·3	96·8

TABLE II—*Mortality Rates (per 1,000) from all Causes, Cardiovascular Causes, Vascular Lesions of Central Nervous System, and Coronary Disease in Rhondda and Vale of Glamorgan (1954-71) compared with Rates for England and Wales 1965*

	Men					Women				
	35-44	45-54	55-64	65-74	≥75	35-44	45-54	55-64	65-74	≥75
All causes:										
Rhondda and Vale	3·4	9·7	28·5	64·1	159·5	1·9	3·3	11·9	30·2	107·4
England and Wales	2·5	7·4	21·4	53·0	136·0	1·8	4·4	10·3	28·4	100·4
Cardiovascular causes:										
Rhondda and Vale	1·7	4·2	11·9	44·5	99·7	0·3	1·6	8·7	20·0	77·0
England and Wales	1·0	3·5	10·3	27·1	78·3	0·4	1·3	4·4	16·1	65·3
Vascular lesions of C.N.S.:										
Rhondda and Vale	0·0	1·5	1·7	11·3	30·7	0·0	0·0	3·2	7·9	18·7
England and Wales	0·1	0·6	1·7	6·4	21·9	0·1	0·4	1·3	5·0	21·1
Coronary disease and angina:										
Rhondda and Vale	1·0	1·8	8·1	20·3	26·1	0·3	0·3	3·6	7·9	21·0
England and Wales	0·7	2·4	6·8	14·7	27·3	0·1	0·4	1·8	6·4	16·3

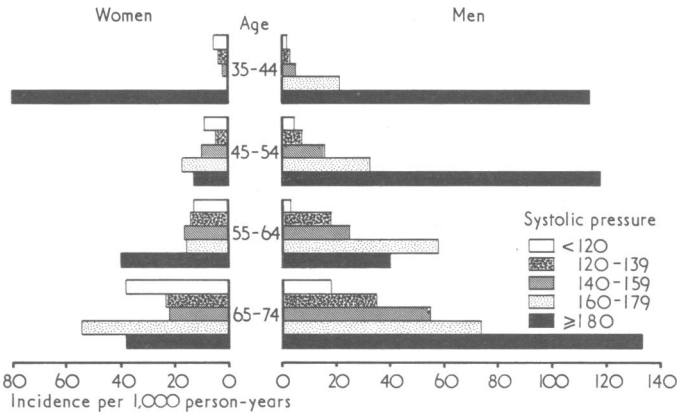

FIG. 1—Incidence of all cardiovascular-renal deaths, myocardial infarctions, angina pectoris, and cerebrovascular accidents according to systolic pressure, age, and sex in Rhondda Fach and Vale of Glamorgan 1971.

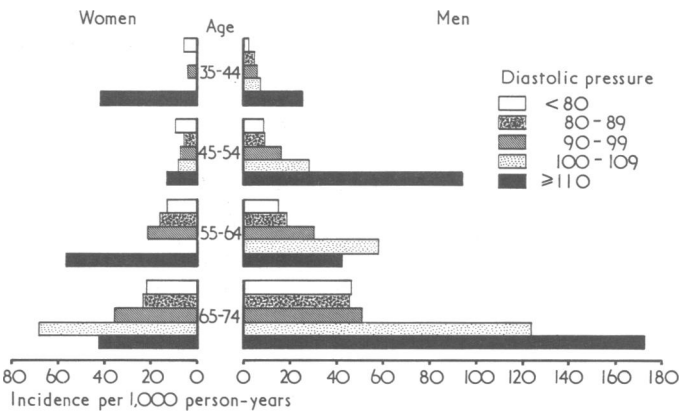

FIG. 2—Incidence of all cardiovascular-renal deaths, myocardial infarctions, angina pectoris, and cerebrovascular accidents according to diastolic pressure, age, and sex in Rhondda Fach and Vale of Glamorgan 1971.

according to diastolic IV pressure and age in fig. 2. Within each sex the similar prognostic value of systolic and diastolic pressure measurements is clearly shown. The data also confirm the greater prognostic significance of a casual blood pressure measurement in men than in women, as indicated by the almost regular step up in the incidence of cardiovascular events with each increment of pressure in men, and the less regular pattern shown among women.

Cardiac morbidity was also measured in terms of E.C.G. abnormalities for those examined at the final survey. All except 15 elderly housebound individuals were asked to attend for E.C.G. examinations and 1,631 (99·1%) of the remaining 1,646 did so. The prevalence of the main types of E.C.G. changes compatible with myocardial damage due to hypertensive or ischaemic heart disease is shown for those aged 35 and over in table III, and the prevalence of these abnormalities combined is shown in relation to the highest diastolic pressure recorded for each subject during the course of the study in fig. 3. The similarity between the sexes in the prevalence of E.C.G. abnormalities at different levels of pressure contrasts strongly with the sex difference in deaths and morbid events. It is probably partly explained by sex differences in survival after cardiac complications have occurred.

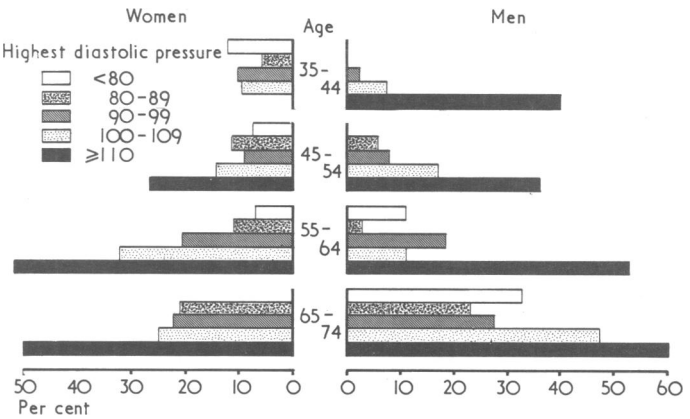

FIG. 3—Prevalence of E.C.G. abnormalities (Q/QS abnormalities, S-T depression, T-wave inversion or flattening, left bundle-branch block) compatible with myocardial ischaemia or hypertensive heart disease according to highest diastolic pressure recorded, age, and sex in Rhondda Fach and Vale of Glamorgan 1971.

RELATION BETWEEN ARTERIAL PRESSURE AND TREATMENT FOR HYPERTENSION

People were considered to have had treatment for hypertension if they had taken specific hypotensive agents or diuretics for a period of at least one month; sedatives, tranquillisers, and dietary modifications were not included as specific treatment.

Thirty two (5·4%) of the men over age 35 and 100 (13·1%) of the women had received hypotensive drugs. The proportion of patients treated, which is shown in relation to their highest values of diastolic pressure recorded in fig. 4, was greater at all ages and at almost every level of pressure in women than in men.

In subjects aged 35-64 who at the final survey were found with diastolic pressures of 110 mm Hg and more, six (25%) out of 24 men and 13 (45%) out of 29 women had been treated for hypertension. Six (27%) out of 22 men and 13 (24%) out of 54 women who had received treatment

TABLE III—*Prevalence of E.C.G. Abnormalities compatible with Myocardial Damage due to Hypertensive or Ischaemic Heart Disease in Rhondda Fach and Vale of Glamorgan 1971. Results expressed as Proportion of Patients*

Age at Final Survey	No. Examined	Major Q/QS Items, Minor Q/QS Items with T-wave Changes, and L.B.B.B. (1)*	S-T Depression with T-wave Changes (2)*	T-wave Changes alone (3)*	Minor Q/QS Items alone (4)*	Total	
						No.	%
			Men				
35-44	111	—	1	3	—	4	3·6
45-54	182	8	2	5	3	18	9·9
55-64	165	5	10	9	2	26	15·8
65-74	90	10	7	9	3	29	32·2
≥75	24	3	4	1	—	8	33·3
			Women				
35-44	136	3	4	4	—	11	8·1
45-54	173	2	10	8	—	20	11·6
55-64	182	12	19	7	4	42	23·1
65-74	108	6	17	4	2	29	26·9
≥75	56	8	14	3	1	26	46·4

*Minnesota code items (1) 1_{1-3}, 1_3+5_{1-3}, 7_1. (2) $4_{1-3}+5_{1-3}$. (3) 5_{1-3}. (4) 1_3.
L.B.B.B. = Left bundle-branch block.

still had diastolic pressures of at least 110 mm Hg (table IV). Eleven men and 19 women were being treated for hypertension at the final survey who had previously experienced a serious cardiovascular complication (stroke, myocardial infarction, angina, or intermittent claudication), and in seven (64%) of these men and six (32%) of the women therapy had been started only after the complication had occurred.

As at each survey those considered in need of treatment had been referred to their general practitioners, the extent of treatment in these two populations might have been greater than in similar districts where no screening had been carried out. Nevertheless, these observations show that treatment for hypertension is less than satisfactory for both sexes and particularly inadequate for men.

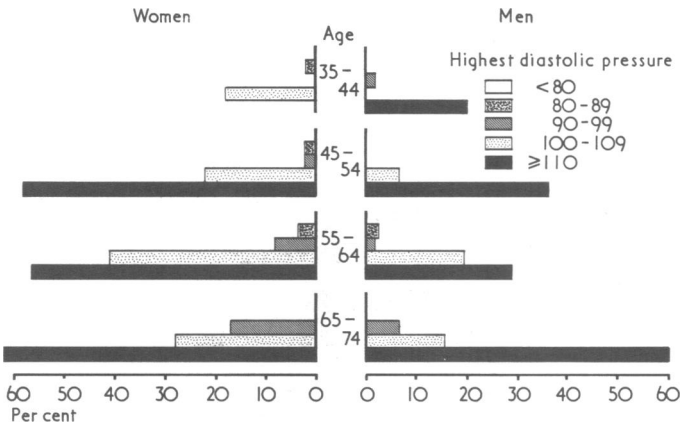

FIG. 4—Proportion of subjects who had received treatment for hypertension according to highest diastolic pressure recorded, age, and sex in Rhondda Fach and Vale of Glamorgan 1971.

TABLE IV—*Treatment for Hypertension in Subjects aged 35-64 according to Diastolic Pressure at Final Survey*

Diastolic Pressure at Final Survey	Ever Treated for Hypertension			Never Treated for Hypertension			Total (a)
	No.	% of (a)	% of (b)	No.	% of (a)	% of (b)	
			Men				
≥110	6	25	27	18	75	4·1	24
<110	16	3·7	73	421	96·3	95·9	437
Total (b)	22	4·8	100	439	95·2	100	461
			Women				
≥110	13	45	24	16	56	3·6	29
<110	41	8·7	76	429	91·3	96·4	470
Total (b)	54	10·8	100	445	89·2	100	499

FREQUENCY OF SCREENING

A successful programme of screening for hypertension would detect all people whose pressures were approaching the level at which the effectiveness of therapy had been established. Currently this is at a diastolic pressure of 110 mm Hg in adults. All those with pressures over this level would be offered treatment, and those with values below 110 but above 100 mm Hg could be kept under close surveillance. Rescreening would also be necessary for those with lower pressures. Some people will inevitably slip through any screening net unless the investigations are repeated at short intervals. The frequency of rescreening for hypertension could be designed to limit the proportion with undetected diastolic hypertension to not more than, say, 10% of any subgroup whose pressures had once been recorded.

We examined these Welsh data to determine the frequency of rescreening which would be necessary to ensure that not more than 10% of any subgroup (defined in terms of age, sex and diastolic pressure) remained undetected with diastolic pressures of 100 mm Hg or more. The percentage of men with casual diastolic pressures over 100 mm Hg, and over 110 mm Hg, at intervals of 4, 8-10, and 15-17 years after first screening is shown in table V, according to their initial diastolic readings and ages.

For men whose diastolic pressures were originally below 80 mm Hg less than 10% of each age group had attained pressures of 100 mm Hg after an interval of 8-10 years and none had reached 110 mm Hg. After 15-17 years the proportion exceeding 100 mm Hg was around 10% in those initially

TABLE V—*Proportion of Men with Diastolic Pressures over 110 mm Hg and over 100 mm Hg at Various Intervals after Screening according to Initial Diastolic Pressure and Age*

Initial Age	No. of Subjects seen Initially*	% with Diastolic Pressure >100 mm Hg at:			% with Diastolic Pressure >110 mm Hg at:			Recommendation
		4 yr	8-10 yr	15-17 yr	4 yr	8-10 yr	15-17 yr	
				Patients with Initial Diastolic Pressure <80 mm Hg				
15-24	79	0	0	12	0	0	3	Rescreen after 10-15 years but only if initially <45.
25-34	62	0	4	7	0	0	2	
35-44	72	3	5	13	0	0	2	
45-54	39	3	0	5	0	0	0	
55-64	32	9	8	0	0	0	0	
Total	284	2·1	2·9	9·2	0·0	0·0	1·9	
				Patients with Initial Diastolic Pressure 80-89 mm Hg				
15-24	57	2	4	11	0	0	2	Rescreen after 10-15 years at all ages.
25-34	84	1	0	12	0	0	2	
35-44	90	7	4	25	0	2	5	
45-54	76	5	7	18	0	3	8	
55-64	36	8	4	5	0	0	0	
Total	343	4·4	3·5	16·7	0·0	1·3	3·8	
				Patients with Initial Diastolic Pressure 90-99 mm Hg				
15-24	16	13	14	17	0	7	0	Rescreen within 4 years at all ages.
25-34	41	12	20	33	5	3	8	
35-44	42	19	20	21	5	7	3	
45-54	61	30	21	37	13	4	10	
55-64	22	32	24	0	14	12	0	
Total	182	22·0	20·0	27·4	8·2	5·5	5·1	
				Patients with Initial Diastolic Pressure 100-109 mm Hg				
15-24	0							Regular observation required at all ages.
25-34	7	71	57	80	0	17	60	
35-44	12	33	58	40	17	17	10	
45-54	18	39	36	27	11	7	18	
55-64	6	50	60	100	17	40	0	
Total	43	44·2	50·0	44·4	11·6	15·8	22·2	

*Numbers shown refer only to those followed up for four years. Smaller numbers were followed up for 8-10 or 15-17 years.

TABLE VI—*Proportion of Women with Diastolic Pressures over 110 mm Hg and over 100 mm Hg at Various Intervals after Screening according to Initial Diastolic Pressure and Age*

Initial Age	No. of Subjects seen Initially*	% with Diastolic Pressure >100 mm Hg at:			% with Diastolic Pressure >110 mm Hg at:			Recommendation
		4 yr	8-10 yr	15-17 yr	4 yr	8-10 yr	15-17 yr	
Patients with Initial Diastolic Pressure <80 mm Hg								
15-24	103	0	0	0	0	0	0	Rescreening unnecessary within 15 years for all ages.
25-34	115	1	1	5	0	0	1	
35-44	82	0	4	6	0	0	3	
45-54	42	2	3	9	0	3	0	
55-64	21	0	10	17	0	0	0	
Total	363	0·6	2·1	6·0	0·0	0·6	1·0	
Patients with Initial Diastolic Pressure 80-89 mm Hg								
15-24	47	0	4	9	0	0	2	Rescreen at 4 years if initially aged ⩾45. Rescreen at 8 years if initially aged 35-44. Rescreen at 10-15 years if initially <35.
25-34	69	3	5	19	0	3	5	
35-44	75	5	13	24	1	3	9	
45-54	66	12	9	16	2	2	10	
55-64	45	11	16	21	0	0	0	
Total	302	6·3	9·5	17·8	0·7	1·8	5·5	
Patients with Initial Diastolic Pressure 90-99 mm Hg								
15-24	6	17	20	40	0	0	0	Rescreen within 4 years at all ages.
25-34	19	21	44	60	0	17	13	
35-44	41	27	18	25	2	5	8	
45-54	38	16	16	41	3	0	7	
55-64	41	24	32	24	7	9	4	
Total	145	22·1	24·6	34·5	3·4	6·0	7·3	
Patients with Initial Diastolic Pressure 100-109 mm Hg								
15-24	0							Regular observation required at all ages
25-34	5	60	60	60	40	0	20	
35-44	8	63	86	71	50	71	57	
45-54	17	65	56	40	18	31	10	
55-64	15	73	54	38	47	18	25	
Total	45	66·7	61·5	50·0	35·6	30·8	26·7	

*Numbers shown refer only to those followed up for four years. Smaller numbers were followed up for 8-10 or 15-17 years.

under 45 years of age and some of these had reached levels of 110 mm Hg or over. For men seen with diastolic pressures below 80 mm Hg it seems, therefore, to be unnecessary to re-screen for hypertension within 10 years and then only to re-examine those who had been under age 45 when first seen.

Likewise less than 10% of men with pressures initially in the 80-89 mm Hg range had attained 100 mm Hg after 8-10 years but by 15-17 years over 10% of all but the oldest age group had done so, and several by then had exceeded 110 mm Hg. Rescreening for all age groups after an interval of 10-15 years would be required.

Over 10% of each age group of men whose initial diastolic pressures lay between 90 and 99 mm Hg had reached levels of 100 mm Hg within four years, and in those over age 45 10% had reached 110 mm Hg or more. Rescreening within four years would be necessary for all age groups. Regular surveillance would have been required for those with casual diastolic pressures of 100-109 mm Hg, a large proportion of whom had reached levels of 110 mm Hg within four years.

The follow up of women (table VI) suggests that a re-screening programme similar to that indicated above for men would, with minor modifications, achieve satisfactory surveillance. In both sexes the frequency of rescreening is determined more by the initial blood pressure findings than it is by age.

Discussion

Few systematic attempts are made by general practitioners to seek out and treat asymptomatic cases of hypertension. Indeed until the recent improvements in therapy most clinicians believed, probably correctly, that an asymptomatic patient was better kept in ignorance of his hypertension despite his increased risk.

Treatment trials have shown clear benefit in men with uncomplicated diastolic hypertension of 110 mm Hg and over (Hamilton *et al.*, 1964) and 115 mm Hg and over (Veterans Administration, 1967). As epidemiological studies have shown that most people with pressures at these levels are unrecognized by the health services, screening for hypertension should be given high priority. Doubt remains about the effectiveness of treating uncomplicated hypertension in women (Hamilton *et al.*, 1964) and in people with diastolic pressures below 110 mm Hg though the results of the Veterans Administration trial for the 90-114 mm Hg range are encouraging (Veterans Administration, 1970). Screening will be needed on a larger scale if evidence favouring earlier intervention is produced by the large scale trials for the treatment of mild hypertension which are currently in progress.

The observations made during the course of these epidemiological studies in South Wales confirm evidence from many sources that small increases in diastolic pressure at levels well below 110 mm Hg are associated with a measurable increase in risk in men. The striking sex difference in the prognostic value of a casual blood pressure measurement accords with other evidence that untreated women tolerate hypertension better than do untreated men (Bechgaard, 1967). Fewer men than women seek the advice of their doctors (Ashford and Pearson, 1970). In these Welsh populations proportionately fewer men than women are treated for hypertension and they seem to be less well treated. Similar observations have been reported recently from Australia (Prineas *et al.*, 1973).

Whether or not the balance would be redressed by providing an improved industrial medical service to give men easier access to medical care, as suggested by Honigsbaum (1972), screening and treatment programmes for hypertension should be designed to increase the proportion of men seen for they are more at risk than women. Once a screening programme had been completed the work involved in re-screening could be made more economical and rational by allowing the intervals between screening tests to be determined by the initial findings. Under such circumstances most hypertensive subjects would be detected before rather than after the onset of symptoms and complications.

We thank the 600 families in South Wales who cheerfully tolerated this prolonged study and gratefully acknowledge the help of the epidemiological teams who carried out the field work, particularly Mr. F. Moore, who was involved in all surveys, and Mrs. H. Crook, Mrs. E. James, Mrs. L. Jones, Mrs. G. Thomas, and Mr. B. Wood, who helped in the final one. We also thank practitioners and

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Blood Pressure in a Scottish Town

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Summary

As part of a general health screening survey in the Burgh of Renfrew blood pressure was measured in 3,001 subjects (78·8% of those eligible) aged 45 to 64. In 468 (15·6%) diastolic blood pressure was 100 mm Hg or more. A year later the mean blood pressure for those of the population re-examined showed no change, there being an equal number of subjects with increased and decreased pressures. The prognostic significance of those showing the larger fluctuations remains to be determined through medical-record linkage.

Examination of the general practitioners' medical records of 422 of the 468 subjects with diastolic blood pressure of 100 mm Hg or more showed that 255 had no previous documented hypertension. Of the remainder 73 were receiving antihypertensive therapy. Examination of the records of subjects whose blood pressure was under 100 mm Hg showed that 55 were receiving antihypertensive treatment and that another 113 had previously been recorded as having a diastolic blood pressure of 100 mm Hg or more by their general practitioner. Altogether at least 636 (21·2%) of those who were examined had been considered at some time to have evidence of hypertension.

The prevalence of undetected hypertension in the general population has important implications for the resources of the National Health Service if current trials show benefit to the health of the community from treating "mild" as well as "moderate" hypertension.

Introduction

Because hypertension is common (Wilber *et al.*, 1972; Finnerty *et al.*, 1973; Reid *et al.*, 1974), a hazard to health (Metropolitan Life Insurance Company, 1961; Kannel *et al.*, 1972), often symptomless (Al Bradan *et al.*, 1970; Waters, 1971; Weiss, 1972), and usually treatable (Hamilton *et al.*, 1963; Veterans Administration, 1967, 1970) information on its prevalence in the community is important. There have been numerous surveys and it is apparent that there are differences of blood pressure between countries and between different parts of the same country (Stamler *et al.*, 1967; Hawthorne *et al.*, 1969; Evans and Rose, 1971). There is less information on the number of patients not detected by such surveys because they were being adequately treated for hypertension at the time of the survey (Langfield, 1973).

The study reported here is part of a mass health examination programme for residents aged 45 to 64 years of the town of Renfrew (World Health Organization, 1971; Hawthorne, 1969). One of the objects of the programme other than the detection of tuberculosis was to conduct a random controlled trial of the effect on mortality of stopping smoking in people at high risk from coronary artery disease, lung cancer, and chronic bronchitis (*Report of the Working Group on Epidemiological Studies of Ischaemic Heart Disease*, 1968, 1969) so an estimation of blood pressure was an integral part of the schedule of examinations.

Material and Methods

Renfrew is an urban burgh with a population of about 19,000. A census of all people between the ages of 45 and 64 on January 1972 and resident in the 6,534 households on the burgh assessor's rating list was completed between November 1971 and March 1972. Information on all but 59 (0·9%) households showed that there were 1,788 males and 2,022 females (a total of 3,810 subjects) in this age group.

All were offered a timed appointment to attend a temporary examination centre established in the town hall in Renfrew during 15 days in March and April 1972. Before attending each patient was asked to complete a standard questionnaire* on symptoms of cardiovascular and respiratory disease.

A schematic plan of the accommodation in the town hall is shown in fig. 1. Ten subjects arrived every 10 minutes during each session. Individual questionnaires were checked and standard investigations lasting about 20 minutes were undertaken. Height and weight were measured, and forced expiratory volume in one second was measured using a Garthur Vitalograph with the subject standing, the best of two expirations being recorded. A six-lead electrocardiogram (leads I, II, III, aVR, aVL, and aVF) was made with the subject sitting. Blood pressure was measured seated using the London School of Hygiene and Tropical Medicine sphygmomanometer (Rose *et al.*, 1964) with a cuff of 12 × 22 cm. Diastolic blood pressure was taken at the

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*The questionnaire is available from the authors