

Screening for mild hypertension: costs and benefits

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SUMMARY It is important to understand the full implications of introducing a new screening and treatment programme into the National Health Service. In this paper, we calculate, for mild hypertension, the cost of community-based screening and the cost of case-finding in general practice. We show that case-finding in general practice is both less expensive and more efficient. We calculate the cost of running a programme in general practice for five years and divide that cost by an estimate of the number of deaths that might be prevented as a result of introducing such a programme. This calculation gives a minimum cost for extending a life by the programme.

At present the Medical Research Council is engaged in a randomised controlled trial to determine the effectiveness of treatment for mild hypertension (diastolic—Phase V—blood pressure of 90-109 mmHg) in adults aged 35 to 64 years (Medical Research Council, 1977). Mild hypertension is generally symptomless (Beever *et al.*, 1975). If the results of the trial show that treatment should be offered to this group, health examinations of the population will therefore be needed to identify cases for treatment (Hawthorne *et al.*, 1974). Because such a programme would involve large numbers of people and a substantial cost to the National Health Service, it is important to consider its full implications. A comprehensive analysis has already been completed in the United States (Weinstein and Stason, 1976) but sufficient data to carry out a comparable study in the United Kingdom are not at present available. In this paper, we consider the costs of screening for mild hypertension and estimate some of the benefits.

Method

Two methods of identifying cases of mild hypertension are considered. Firstly, we calculate costs for community-based screening, in which a special clinic is established to screen the population of a particular area. Secondly, we consider case-finding by general practitioners, in which GPs take the opportunity to measure blood pressure whenever people attend the practice centre. Costs are calculated for a population of 100 000 men in which

all men aged 35 to 64 years would be at risk, and for a population of 100 000 women in which all women aged 35 to 64 years would be at risk. All costs are adjusted to 1976 prices. A technical appendix explaining costing in more detail is available from the authors.

The costs of community-based screening are calculated as follows. About 75% of the population are likely to attend a special screening clinic (Hawthorne *et al.*, 1976). Of these, between 5.6% and 40.2%, the proportion depending on age and sex (Paisley Midspan Survey), will register an initial diastolic blood pressure reading of 90 mmHg or higher. These people will be asked to make two visits to their GP for further readings. About 40% of those who initially register a high reading will have this confirmed after three sets of readings (Tudor Hart, 1970; Pedersen and Nielsen, 1975). Of the new hypertensive patients identified after three sets of measurements, 92% will have diastolic blood pressure between 90 and 109 mmHg and the remaining 8% will have diastolic blood pressure of 110 mmHg or higher (Paisley Midspan Survey; Stamler *et al.*, 1976).

The cost of initial screening (£1.31) is calculated from the Paisley Midspan Survey. This includes the cost of identifying the population to be screened, fees for the measurement of blood pressure, the cost of renting halls, and other expenses. Visits to the practice centre for repeat blood pressure readings are assumed to involve 10 minutes of a nurse's time (or three to four minutes of a doctor's time) together with overheads—a total cost of £0.58. It is

assumed that participants would incur no cost for the initial screening because this would take place out of working time. However, extra visits to the general practitioner are valued at two hours of working time, plus a travelling cost. This cost is included for all men and women whether working or not, as an indication of the disruption caused by the extra visits.

Costs for case-finding in general practice are calculated similarly. If the population is to be screened every five years, general practitioners might expect to screen 20% of their patients each year. Those registering an initial high diastolic blood pressure reading would be asked to return for two further sets of readings. The initial visit incurs only the cost of the doctor's or nurse's time to measure the blood pressure. Return visits incur this cost, together with a cost to the health service for overheads, and to the patient of lost working time, if the visit would not otherwise have been made—that is, those visits in excess of the average number of consultations per episode of illness (Office of Population Censuses and Surveys, 1974).

Costs are calculated for running a programme for five years. A high lapse rate is often associated with the treatment of hypertension (Abernethy *et al.*, 1976; Hawthorne, 1977; Medical Research Council, 1977). We have assumed a lapse rate of 10% per year. This includes those who leave treatment of their own accord, or because of drug reactions, and those who die. This is higher than the rate of 18% over three years recorded in the MRC trial (Medical Research Council, 1977), but it may be a more realistic rate for a programme offered to the whole community, where motivation to continue treatment may be lower.

The cost of treatment to the health service includes the cost of drugs and the cost of four check-ups with the general practitioner each year. The patients also incur a cost for each visit to the general practitioner. The costs of drug reactions and of anxiety to patients because of their diagnosis have not been included. No cost has been included for diagnostic tests which might be performed on the few patients with complicated hypertension.

Although it is considered obligatory to treat hypertension where diastolic blood pressure is over 110 mmHg, little information is at present available on the outcome when mild hypertension is treated. The Veterans Administration Cooperative Study Group on Antihypertensive Agents (1970) was confined to a small group of men who met a number of strict criteria, and it is not possible to extend their results to the general population. Instead, we use results from a study carried out in Renfrew (Hawthorne *et al.*, 1974). The population has been

followed over a number of years and mortality rates by initial diastolic blood pressure can be calculated. Straight lines are fitted to the cumulative mortality data to give the results shown in Table 1. There is insufficient information to calculate mortality rates for women.

Table 1 Cumulative mortality rates (%) for men after five years

Age group	Initial diastolic blood pressure reading		
	<90mmHg	90-109mmHg	≥110mmHg
35-44*	1.24	2.12	—
45-55	4.10	5.94	16.67
55-64	7.88	7.71	13.58

*The sample was too small to calculate a mortality rate for those with initial diastolic blood pressure ≥110 mmHg in the age group 35-44.

These mortality statistics are based on only one blood pressure reading, so about 60% of those in the high blood pressure groups could be expected to have normal blood pressure after two more sets of readings (Tudor Hart, 1970; Pedersen and Nielsen, 1975). Thus, these mortality rates probably underestimate the true excess mortality in the higher blood pressure groups. On the other hand, we assume in the calculation that treatment of high blood pressure reduces the mortality rate to that of the group with initial blood pressure less than 90 mmHg, an assumption unlikely to be realised.

Applying the differences in mortality rates between high blood pressure and normal blood pressure groups to the numbers on treatment each year gives the number of deaths prevented by treatment. This is discounted at 10% for future years, as for costs. Dividing the cost of the programme by the number of deaths prevented gives a cost per death prevented, or a minimum cost for extending a life by the programme. If we decide to run the programme, we are valuing extending a person's life at at least the amount stated; if we choose not to run the programme, we are valuing extending a person's life at less than the amount stated.

Results

The cost for each new hypertensive person detected is shown in Table 2 for community-based screening and in Table 3 for general practice case-finding. It can be seen that, in most cases, the costs for a community-based screening programme are more than double the costs for general practice case-finding. Because of this, the costs of identifying new patients are based on case-finding by general practitioners in the remainder of the study.

The total cost of running a five-year general practice programme for a population of 100 000

men would be £294 000, of which £178 000 would be incurred by the health service. The total cost for women would be £198 000, including £130 000 incurred by the health service. The minimum cost of extending a life implied by choosing to run the programme is shown in Table 4.

Table 2 *The cost (£) for each new hypertensive patient detected in a community-based screening programme*

Age group	Men		Women	
	Cost to health service	Total cost*	Cost to health service	Total cost*
35-39	22.16	41.57	72.29	89.22
40-44	14.25	35.02	26.40	44.06
45-49	14.67	36.61	21.18	39.96
50-54	15.05	37.20	19.09	38.69
55-59	15.64	39.22	18.20	39.10
60-64	17.49	39.89	18.07	39.57
All ages	16.07	37.87	22.26	42.06

*Total cost = cost to health service plus cost to those participating in the programme.

Table 3 *The cost (£) for each new hypertensive patient detected in a general practice case-finding programme*

Age groups	Men		Women	
	Cost to health service	Total cost*	Cost to health service	Total cost*
35-39	7.86	20.45	21.96	33.33
40-44	5.73	18.11	9.38	20.79
45-49	5.88	17.73	8.11	19.95
50-54	6.05	16.86	7.65	19.57
55-59	6.24	16.50	7.52	19.59
60-64	6.77	15.60	7.58	19.04
All ages	6.29	17.44	8.52	20.27

*Total cost = cost to health service plus cost to those participating in the programme.

Table 4 *The minimum cost (£) of extending a life implied by choosing to run the programme (men)*

Age groups	Using cost to health service only		Using total cost*
	Using cost to health service only	Using total cost*	
35-44	16 900	28 500	
45-54	6 200	10 300	
55-64	34 800	55 600	
All ages	11 200	18 400	

*For definition of total cost, see footnote above.

Discussion

Community-based screening programmes are expensive because they involve the identification of the target population and the establishment of special screening clinics. However, such programmes also provide an opportunity to screen for a number of other conditions. Attendance rates at clinics are usually about 75% (Hawthorne *et al.*, 1976) and it is unlikely that higher rates could be achieved without a substantial increase in cost. On the other hand, 60% of men and 67% of women aged 45 to 64 years consult their general practitioner in a year (Office of Population Censuses and Surveys, 1974) and in

Scotland 85% of men and women aged 40 to 49 years consult their general practitioner at least once in three years (Hawthorne, 1977). Thus in five years there is an opportunity to screen at least 85% and possibly more of the population. A general practitioner with 2500 patients might expect to screen 338 people in a year (six or seven a week). Using the prevalence rate described, he might eventually expect to be treating a total of 194 patients.

During the first five years of the programme a new section of the population is being screened each year, so a large number of new hypertensive patients is being detected each year. Costs for the second five-year span are perhaps more representative of those likely to arise once the programme is running. Case-finding costs to the health service would rise to £9.89 for men and £12.55 for women. Total case-finding costs would rise to £26.04 for men and £27.79 for women.

It is disappointing to realise how little is known of the prevalence of a condition as apparently common as hypertension. The assumptions made in this study lead to the prevalence rates shown in Table 5. There is, however, no firm basis for these values. In consequence, calculations have been repeated for two different situations: one in which the proportion of people having an initial high blood pressure reading confirmed is 30% (instead of 40%), and one in which it is 50%. These lead to prevalence in men of 9.4% and 15.6% respectively.

Table 5 *The prevalence rates (%) of hypertension (diastolic blood pressure ≥ 90 mmHg) used in this study*

Age group	Men	Women
35-39	7.0	2.2
40-44	12.9	7.2
45-49	13.3	10.1
50-54	14.0	12.5
55-59	14.4	14.4
60-64	13.6	16.1
All ages	12.5	10.5

Table 6 *The implicit costs (£) of extending a life for different prevalence rates and lapse rates*

Prevalence rates	Lapse rates		
	5%	10%	20%
9.4%	11 400	11 500	11 600
12.5%	11 100	11 200	11 100
15.6%	10 800	10 900	10 900

The lapse rate, assumed to be 10%, may also vary, depending on the patients' perceptions of the consequences of stopping treatment. Calculations were made for lapse rates of 5% and 20% per year. The results for the implicit costs of extending a life for the different situations are shown in Table 6. It can be seen that although the implicit cost of

extending a life falls slightly as prevalence rates increase, it is largely independent of changes in both prevalence and lapse rates. This is because the costs of identifying new cases of hypertension are small compared with the costs of treatment, so that both costs and benefits are approximately proportional to numbers undergoing treatment. Altering either the prevalence rates or the lapse rates therefore affects both costs and benefits to the same extent.

The implied cost of extending a life is, however, dependent on the number of deaths prevented: that is, on the effectiveness of treatment of mild hypertension. So the absolute cost of extending a life implied by choosing to run the programme could alter dramatically once the results of the MRC trial are known. The implicit costs calculated are based on unsatisfactory data on the benefits of treatment, so no undue importance should be placed, at this stage, on the actual costs.

The benefits of treating mild hypertension, if they are confirmed by the MRC trial, are unlikely to be confined only to extending lives. There is also likely to be some prevention of morbidity. When data become available, it should be possible to calculate the cash values of savings on items like hospital care and time lost from work. The economic benefits of extending a life are more difficult to assess (Mooney, 1977). The implicit value method used here is incomplete, if there is also a substantial saving in morbidity. Weinstein and Stason (1976) overcome this problem by using 'quality-adjusted life years' as a measure of the benefit of treatment, and a similar concept could be employed in a British study.

The MRC trial should provide information on prevalence, lapse rates, and side effects of drugs, as well as on morbidity and mortality prevented by treatment. A more detailed and accurate analysis will then be possible. In particular, the analysis should show which groups in the community are most likely to benefit, and thus where selective screening or case-finding should begin.

Although an analysis of costs and benefits does not provide a definite answer to whether a programme should be introduced or not, it aims to help the decision-maker by removing uncertainty from as many areas as possible, thus contributing to the process of more rational policy-making in the National Health Service.

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