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 (Beevers 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
incurred 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

<table>
<thead>
<tr>
<th>Age group</th>
<th>Initial diastolic blood pressure reading</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;90mmHg</td>
</tr>
<tr>
<td>35–44</td>
<td>1·24</td>
</tr>
<tr>
<td>45–55</td>
<td>4·10</td>
</tr>
<tr>
<td>55–64</td>
<td>7·88</td>
</tr>
</tbody>
</table>

*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 under-
estimate 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 pro-
gramme, 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
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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

<table>
<thead>
<tr>
<th>Age group</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>35-39</td>
<td>22-16</td>
<td>41-57</td>
</tr>
<tr>
<td>40-44</td>
<td>14-23</td>
<td>35-02</td>
</tr>
<tr>
<td>45-49</td>
<td>14-67</td>
<td>36-61</td>
</tr>
<tr>
<td>50-54</td>
<td>14-05</td>
<td>37-20</td>
</tr>
<tr>
<td>55-59</td>
<td>15-64</td>
<td>39-22</td>
</tr>
<tr>
<td>60-64</td>
<td>17-49</td>
<td>39-89</td>
</tr>
<tr>
<td>All ages</td>
<td>16-07</td>
<td>37-87</td>
</tr>
</tbody>
</table>

*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

<table>
<thead>
<tr>
<th>Age group</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>35-39</td>
<td>7-86</td>
<td>20-45</td>
</tr>
<tr>
<td>40-44</td>
<td>5-73</td>
<td>18-11</td>
</tr>
<tr>
<td>45-49</td>
<td>5-85</td>
<td>17-73</td>
</tr>
<tr>
<td>50-54</td>
<td>6-05</td>
<td>16-86</td>
</tr>
<tr>
<td>55-59</td>
<td>6-24</td>
<td>16-50</td>
</tr>
<tr>
<td>60-64</td>
<td>6-77</td>
<td>15-60</td>
</tr>
<tr>
<td>All ages</td>
<td>6-29</td>
<td>17-44</td>
</tr>
</tbody>
</table>

*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)

<table>
<thead>
<tr>
<th>Age groups</th>
<th>Using cost to health service only</th>
<th>Using total cost*</th>
</tr>
</thead>
<tbody>
<tr>
<td>35-39</td>
<td>16 900</td>
<td>28 500</td>
</tr>
<tr>
<td>40-44</td>
<td>6 200</td>
<td>10 300</td>
</tr>
<tr>
<td>45-49</td>
<td>34 800</td>
<td>55 600</td>
</tr>
<tr>
<td>All ages</td>
<td>11 200</td>
<td>18 400</td>
</tr>
</tbody>
</table>

*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

<table>
<thead>
<tr>
<th>Age group</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>35-39</td>
<td>7.0</td>
<td>2.2</td>
</tr>
<tr>
<td>40-44</td>
<td>12-9</td>
<td>7.2</td>
</tr>
<tr>
<td>45-49</td>
<td>13-3</td>
<td>10-1</td>
</tr>
<tr>
<td>50-54</td>
<td>14-0</td>
<td>12-5</td>
</tr>
<tr>
<td>55-59</td>
<td>14-4</td>
<td>14-4</td>
</tr>
<tr>
<td>60-64</td>
<td>13-6</td>
<td>16-1</td>
</tr>
<tr>
<td>All ages</td>
<td>12-5</td>
<td>10-5</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Prevalence rates</th>
<th>Lapse rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.4%</td>
<td>5%</td>
</tr>
<tr>
<td>12.5%</td>
<td>11 400</td>
</tr>
<tr>
<td>15.6%</td>
<td>11 100</td>
</tr>
<tr>
<td>18.6%</td>
<td>10 900</td>
</tr>
</tbody>
</table>

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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