Abstract

Background Hypertension is a major risk factor for stroke and ischaemic heart disease. Most hypertension is detected opportunistically by general practitioners. Those who rarely use medical services are less likely to have their blood pressure (BP) measured. We hypothesized that open access self-reading BP measurement would detect previously unrecognized hypertension.

Methods Self-reading sphygmomanometers were placed at 13 public sites in Exeter, Devon, United Kingdom. Machine use was determined by users completing a proforma and by direct observation of sites. Users whose BP reading was above an action level of 135/85 mmHg were asked to attend their general practice. General practitioner records were reviewed 6 months after machine use to identify diagnoses of hypertension. A random sample of users was interviewed, and local general practices were asked about effects on their workload.

Results A total of 758 first-time users completed a proforma fully, although direct observations suggested total use was much higher. Of the total, 221 (29.2 per cent) readings were above the action level. Eleven new hypertensives were found, 1.4 per cent (95 per cent confidence interval (CI) 0.7–2.5) of the total users. User acceptability was high. All general practice replies were supportive.

Conclusion Open access sphygmomanometry for detection of hypertension is feasible. This scheme led to the diagnosis of hypertension in 1.4 per cent of users, and allowed many people to measure their BP in a way convenient to them.

Method

We established an open access BP measurement scheme by placing self-reading sphygmomanometers at strategic sites in Exeter, Devon, United Kingdom. Exeter has a population of approximately 111,000 people, with considerable variation in socio-economic circumstances within the city. Some wards have amongst the highest rates of deprivation in the South West of England and Exeter has a large population of homeless people.

The specific objectives of the study were to (1) estimate the detection rate of new cases of hypertension, (2) assess the views of users on this initiative, and (3) review the feasibility of the scheme in terms of machine functioning and accuracy, the effect on primary care workload, and therefore to evaluate the long-term sustainability of the scheme.

Host sites

Criteria for recruitment of sites for possible entry into the study were that they had to have unrestricted public access for most of the day; to have space to allow a small table and to be indoors. We chose possible sites in areas of deprivation, or in facilities...
with a relatively deprived clientele, or facilities with a clientele who may be less likely to use primary care.

Each site was approached three times. First, an initial expression of interest only was sought when the study was being devised. The second and third approaches were after the study was funded. The second approach gave fuller details of the study and invited participation. We established a sphygmomanometer station at participating sites on the third visit.

Table 1 shows the equipment at each site. The machines used were the Omron705CP, which has an arm cuff, and an Omron-Rx, with a wrist cuff. The European Society of Hypertension has assessed both machines and rated them as accurate.7 Both were given the highest recommendation within their category. The wrist machine’s recommendation was qualified on the grounds of possible inaccuracy if the machine was not kept at heart level during measurement. This qualification applies to all wrist machines. Host sites with least space to place the equipment were offered the wrist machine in preference. We asked users to write their date of birth, sex and BP reading on a proforma, which was to be placed in a secure box. If machine users were willing to be contacted for interview they were asked to write their name, address and telephone number. Each proforma had a detachable part at the bottom so that users could take away a copy of their result.

Each site was visited at least once per week throughout the study. At each visit the machine’s functioning was checked, batteries, printing paper and study literature were replaced as necessary, and completed proformas were collected from the secure box. A week before the machines were placed on site, an interview was given to the main local newspaper, which printed a list of participating sites and a photograph of a machine in use.

The instructions advised users to make a routine appointment with their practice nurse to have their BP checked, if it was above a specified action level. This level was 135/85mmHg (both systolic and diastolic raised), or if the systolic pressure was above 160mmHg, irrespective of the diastolic pressure. There is no universal agreement on upper limits of normal for self-recorded home BP,6 let alone casual recordings. A meta-analysis of 17 studies of home recordings9 calculated a mean plus 2 standard deviations figure of 137/89mmHg. We chose a slightly lower figure for convenience.

Usage and acceptability of the machines

This was determined by asking users to complete the proforma after using the machines. Additionally, all sites except two were directly observed by the study team (R.G., C.B.) for two hours to count machine users who did not complete a proforma.

Fifty users were interviewed: 30 randomly selected from those who had given their address and telephone number, and 20 who had recorded a BP above the action level. They were interviewed at their home or by telephone, according to their preference, using structured interviews. These had been piloted on volunteer patients at W.H.’s surgery. Questions for the first group focused on the acceptability of the scheme; in particular, ease of use, quality of the instructions, placement of the machine, information supplied, and preference between self-measurement or conventional measurement. We also enquired about previous BP measurements, any prior diagnosis of hypertension, and about users’ employment. Interviews for the group whose reading was above the action level focused on their plans (if any) for following up their measurement.

All general practices in Exeter were invited to join the study before machines were made available to the public. Those agreeing were asked to monitor the number of patients attending with a machine reading. Practice nurses were asked to request consent for W.H. to access the general practitioner (GP) notes 6 months after machine use to determine if hypertension had been diagnosed. Regular checks revealed an apparently very low number of patients attending with a machine printout. Therefore, we wrote to all machine users with a BP above the action level and with an Exeter address, requesting consent to access their GP records. A questionnaire was sent to all Exeter GPs after closure of the study asking for comments on primary care workload.

The local research ethics committee approved the study.

Results

Recruitment of host sites

Twenty host sites were approached and asked if they wished to participate. Sixteen of these were at the beginning of the study, and four at the midway point when it was clear that machines were working satisfactorily. Thirty agreed to participate, of which we declined to use three: one had made participation conditional on being the only local site – this was considered inappropriate; the GP at the pilot surgery ensures the BP is checked on all patients, so he suggested his site would be of low yield; and one had too little space, but was otherwise keen. The seven sites who did not wish to participate gave a variety of reasons: four referred the decision to managers who made no reply, one was uninterested, in one we had insuperable language problems, and one was precluded ‘by health and safety factors’.

The public bodies were: City Council Buildings, housing department; Social Security Offices; Healthy Living Centre; NHS walk-in centre; NHS pilot surgery for the homeless; three...
Post Offices (two in a deprived area, plus the main city centre Post Office). The commercial organizations were: two small supermarkets in a deprived area, and one in a mixed area; one large chain supermarket in a deprived area; a city centre chain store; a chip shop in a deprived area; a Bengali takeaway restaurant in a mixed area. The charities and religious organizations were: three charity shops in shopping streets; a city centre 'drop-in' centre for the homeless; the Islamic Centre.

Usage of the machines

The sites were open for a total of 146 machine-weeks, equating to around 8000 machine hours. During this time 803 proformas were completed. By cross-referencing names and addresses 34 of these were identified as repeat users, leaving 769 first time users. These form the basis of the rest of the results. Figure 1 shows the age and sex breakdown of users. The median (interquartile range) age of female users was 50.5 (34–63) years and of male users 42 (29–56) years.

Monitoring of machine usage is summarized in Table 2. Two sites were not observed: one supermarket ceased participation before observation had begun, and the Islamic Centre machine was in a small room, making unobtrusive observation impossible.

No machine was stolen, and none broke down. Both types were resilient, with two arm machines dropped onto hard floors, and one wrist machine chewed by a dog. All three worked satisfactorily afterwards. All the Omron705CP printers jammed repeatedly and finally became irreparable. The arm machine batteries lasted throughout the study, but wrist machines required 13 battery changes, a mean of 28 days apart (range 16–63). Little time was lost because of low batteries as they were always replaced within a day of the problem being reported to the study team.

Acceptability of the machines

All 30 randomly selected for interview agreed to participate. Twenty-one were female, and nine male. Thirteen were employed, 12 retired, three unable to work because of illness, and two unemployed. The employed had a wide range of jobs.

All had been able to use the machine successfully. Nineteen had found it easy to use, three had some difficulty and a charity shop worker had assisted a further eight so they had not required the instructions. Twenty-eight said they would use the machine again, with one having a home machine, and one who only used the machine because a friend had done so. Eleven preferred to be able to measure their own BP primarily for convenience, five preferred a health care professional to take it, and 14 had no preference. Seven would have preferred more privacy, such as having the machine in a booth, partly for the user’s benefit, and also because some felt they were interrupting other shoppers.

A further 20 randomly selected users whose reading was above the action level agreed to interview. Four of these had already attended their practice. Fourteen were proposing to attend, with the majority of these already on treatment for hypertension and under GP review. The other four had no plans, either because they had not realized their reading was above the action level, or they considered themselves healthy and did not need to pursue the finding.

Detection of hypertension and primary care aspects

The BPs of the first time users are shown in Figure 2. Of the 769 first time users 758 wrote down their BP, with 221 (29.2 per cent)
above the action level; 122 of these had given an Exeter address. The median (interquartile range) age of users above the action level was 53 (38–65) years, and of those below the action level was 44 (31–58). This age difference is significant (p < 0.0001: Wilcoxon test).

Although 19 of Exeter’s 21 practices agreed to participate only two patients were recruited this way. However, we were able to determine the outcome of 58 of the 122 with an Exeter address (six by interview; 51 by written consent to access their GP records, and one who gave sufficient detail in a letter for us to know the outcome). Of these, 36/58 (62 per cent) had a BP measurement recorded in their GP notes in the 6 months after their use of the machine. These fell into three groups.

(1) Nineteen had no previous elevated BP measurements. Five had clinic BPs averaging above 160/100mmHg (the level above which treatment is recommended).10 Three had had antihypertensive therapy started.

(2) Six had had an elevated BP some time in the past, but had not been labelled hypertensive, or been added to the GP’s recall system, nor received treatment. All had BPs averaging above 160/100mmHg. Two had antihypertensive therapy started.

(3) Eleven were currently being treated for hypertension. In nine of these the BP at the GP’s surgery was above 150/90mmHg (the audit standard for treated hypertension).10 Five had their treatment increased in the 6 months after machine usage.

All those whose clinic BP was above the recommended levels, plus two with repeat figures between 140/90mmHg and 160/100mmHg, had been entered into the GPs’ review systems. The 11 machine users who had sustained hypertension (as defined by primary care measurements above 160/100mmHg) represent 1.4 per cent (binomial confidence interval 0.7–2.5 per cent) of the 769 first time users.

We received replies to our questionnaire from 49/74 (66 per cent) GPs, representing 16 of the 19 participating practices, and from 13 of 19 nursing teams. Only four doctors and one nursing team could recall patients attending with a readout from a community sphygmomanometer. Many clinicians expressed surprise at the apparent lack of extra attendances, and none considered the additional work onerous.

### Discussion

This was an innovative scheme for detection of hypertension. Before implementation on a wider scale, a scheme must be shown to be feasible in terms of detection of new cases of hypertension, in terms of machine placement, functioning and durability, and user acceptability, and to have a reasonable impact on primary care. This study addressed these issues.

Five new hypertensives were discovered, and a further six who had had previous raised BPs but were not labelled hypertensive were found to have sustained hypertension. All 11 qualify for treatment under the British Hypertension Society guidelines, although by 6 months after the community recording only five had started treatment. These 11 people represent 1.4 per cent of the machine users. However, we were only able to determine the outcome of a quarter of those who had had a BP above the action level, mainly because many users did not live in Exeter. The other three-quarters may yield equivalent numbers. Furthermore, our direct observation suggests that many more people used the machines than completed a proforma. Perhaps this group are less likely to have had a BP above the action level, as they may have chosen to record their result using a proforma had it been raised.

An unexpected finding was the number of users who were already taking treatment for hypertension. It is difficult to know whether the machine measurement led to the treatment alterations in this group, as they were already under review. The preferential use of the machines by those with hypertension also means that the BPs recorded in this study do not represent a true population sample. Furthermore, although the machines were
sited to facilitate use by those less likely to have opportunistic GP measurement, we do not know if we achieved this aim.

Placement of the machines was surprisingly easy. Host sites were largely helpful, although it is hard to know if such support would be sustained in a long-term scheme. Certainly, commercial sites regarded the machines as an attraction that might have increased trade. The machines were remarkably resilient, but required frequent battery changes. Users found it easy to use the machines, and many planned to reuse them. To the yield of new hypertensives, and possible improved treatment of current hypertensives, must be added the issue of empowerment. Users valued the machines, primarily for convenience. This may be of particular importance to those already diagnosed hypertensive. It is noteworthy that the three sites with most usage were non-medical.

The impact on primary care was small. One concern was that
the action level of 135/85mmHg could have led to large increases in primary care attendances. This was not borne out by replies to the questionnaires. It is difficult to equate the number of primary care staff answering that they had not seen patients with a readout, to the number of patients we know were actually seen. The questionnaires were sent at the end of the study, so the simplest explanation is that attendances had been forgotten, which implies they had not been burdensome. Eleven patients previously untreated for hypertension each had a series of BP recordings before being labelled hypertensive. Against this, 12 had normal readings after a community recording above the action level. This is a very favourable ratio when compared with opportunistic GP measurement. However, because we only were able to follow up a quarter of users above the action level, these figures of general practice usage will be an underestimate.

In conclusion, a scheme such as this one is feasible. However, this was a relatively small study, in a single city, and caution needs to be exercised in generalizing from the results. In particular, we do not know if such a scheme reduces inequalities in detection of hypertension, even though this study targeted deprived populations in its selection of sites. Additionally, this study examined only the feasibility of community self-reading sphygmomanometry, and did not address whether the yield of new hypertensives justified the expenditure. We recommend a multi-centre study to examine whether open access sphygmomanometry helps to reduce inequalities and is cost-effective.

Acknowledgements

We wish to thank the sites for hosting the machines and the participants for completing the proformas and questionnaires. We also thank the British Heart Foundation, which supplied all the leaflets for use at the sites. Funding was provided by NHS Executive South West, Grant RS21/10.00. Barnfield Hill Surgery is a research practice, funded under the NHS R&D general practice scheme.

References


Accepted on 24 October 2002